# RURAL ARITHMETIC

BY

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STATE SUPERINTENDENT OF PUBLIC INSTRUCTION
FOR NEBRASKA

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RURAL ARITHMETIC
E. P. I

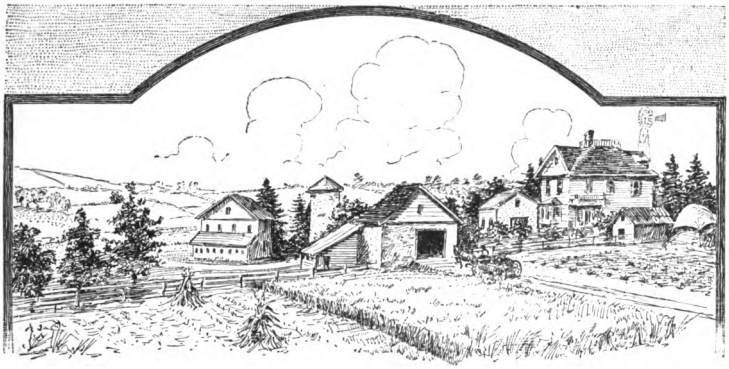
# PREFACE

THE author believes that environmental material provides the most efficient means for building the educational structure. Instead of going into a far country about which the children know nothing, the teacher should make use of conditions found at home. It is the purpose of this text to supply life materials for arithmetical processes. It does not attempt to develop these processes, but to apply the principles of arithmetic to the material with which the rural dweller comes in daily contact. The first pages contain many problems covering fundamentals for drill.

This book may be used as an auxiliary text, either in grammar schools or in high schools, at any time after the fundamental processes are developed. Local color may be added by supplementing the problems of the text with actual data of the same nature presented by the pupils from home life. In the hands of a teacher of proper initiative this text will afford abundant suggestion for research concerning community activities that afford material for additional problems.

As prices vary in different sections of the country and at different times, pupils should be encouraged to ascertain the local prices of various commodities, and, when desirable, to substitute them for prices given in this book.

# CONTENTS



# GENERAL REVIEW

## FUNDAMENTAL OPERATIONS

Add vertically and horizontally. Check by adding results:

| | | | | | |
|---|---|---|---|---|---|
| 1. | 3 | 4 | 5 | 2 | 1 = |
| | 4 | 2 | 7 | 7 | 5 = |
| | 6 | 3 | 4 | 3 | 3 = |
| | 6 | 9 | 3 | 4 | 7 = |
| | 8 | 2 | 6 | 1 | 4 = |
| 2. | 2 | 3 | 4 | 6 | 4 = |
| | 4 | 2 | 3 | 1 | 2 = |
| | 6 | 7 | 5 | 3 | 3 = |
| | 7 | 9 | 2 | 2 | 6 = |
| | 8 | 1 | 8 | 5 | 7 = |
| 3. | 9 | 4 | 2 | 6 | 1 = |
| | 5 | 1 | 7 | 3 | 8 = |
| | 2 | 5 | 4 | 7 | 9 = |
| | 4 | 7 | 6 | 2 | 3 = |
| | 8 | 2 | 1 | 8 | 6 = |

Add. Check by adding in the opposite direction:

| 4. | 5. | 6. | 7. |
|---|---|---|---|
| 34 | 26 | 37 | 82 |
| 52 | 11 | 33 | 72 |
| 42 | 56 | 25 | 14 |
| 12 | 44 | 91 | 54 |
| 76 | 14 | 37 | 81 |
| 27 | 32 | 56 | 19 |
| 48 | 75 | 20 | 16 |
| 60 | 92 | 31 | 35 |
| 45 | 22 | 13 | 60 |
| 15 | 90 | 68 | 22 |

| 8. | 9. | 10. | 11. |
|---|---|---|---|
| 324 | 567 | 842 | 593 |
| 271 | 624 | 111 | 840 |
| 326 | 626 | 397 | 179 |
| 222 | 110 | 670 | 333 |
| 844 | 721 | 214 | 727 |
| 571 | 324 | 613 | 120 |
| 108 | 444 | 933 | 404 |
| 522 | 818 | 356 | 991 |

| 12. | 13. | 14. | 15. |
|---|---|---|---|
| $2678.05 | $9257.10 | $8765.45 | $9786.25 |
| 3467.15 | 1805.20 | 3622.00 | 1281.04 |
| 7133.21 | 5422.08 | 6321.17 | 6542.60 |
| 4922.12 | 6717.50 | 1500.00 | 1370.15 |
| 1800.25 | 7650.40 | 2800.75 | 1825.30 |

Subtract. Check by adding the remainder to the subtrahend:

| 16. | 17. | 18. | 19. |
|---|---|---|---|
| 2567 | 8769 | 7256 | 5781 |
| 1765 | 6530 | 5763 | 2996 |

| 20. | 21. | 22. | 23. |
|---|---|---|---|
| $1267.60 | $823.82 | $3478.10 | $3246.25 |
| 298.75 | 629.95 | 2949.15 | 1657.35 |

Multiply. Check by dividing the product by the multiplier:

| 24. | 25. | 26. | 27. |
|---|---|---|---|
| 248 | 673 | 345 | 4567 |
| 362 | 92 | 24 | 286 |

| 28. | 29. | 30. | 31. |
|---|---|---|---|
| $4.03 | $23.58 | $62.70 | $72.58 |
| 2.97 | 20.09 | 3.00 | 30.69 |

Find the quotients. Check by multiplying the quotient by the divisor, and adding the remainder, if there is any:

| 32. | 33. | 34. | 35. |
|---|---|---|---|
| $29889 \div 41$ | $224730 \div 94$ | $152934 \div 718$ | $80565 \div 615$ |

| 36. | 37. | 38. | 39. |
|---|---|---|---|
| $\$580.81 \div 120$ | $\$688.64 \div 27$ | $\$509.38 \div 31$ | $\$394.59 \div 211$ |

## COMMON FRACTIONS AND MIXED NUMBERS

NOTE. — Reduce all fractions to lowest terms before performing the operations indicated.

Add:

40. $\frac{4}{5}, \frac{2}{3}, \frac{1}{3}, \frac{2}{5}$
41. $\frac{5}{7}, \frac{3}{14}, \frac{1}{2}, \frac{4}{8}$
42. $\frac{3}{10}, \frac{1}{3}, \frac{2}{20}, \frac{2}{3}$
43. $\frac{5}{8}, \frac{2}{16}, \frac{7}{24}$
44. $\frac{3}{5}, \frac{3}{4}, \frac{8}{10}$
45. $14\frac{3}{4}, 28\frac{5}{8}, 17\frac{9}{12}$
46. $125\frac{5}{16}, 73\frac{3}{4}, 141\frac{3}{8}$
47. $41\frac{5}{8}, 18\frac{2}{3}, 142\frac{5}{6}$
48. $129, 213\frac{10}{40}, 93\frac{11}{20}$
49. $63\frac{9}{10}, 78\frac{3}{5}, 94\frac{18}{20}$
50. $125, \frac{6}{18}, 134\frac{11}{15}$
51. $\frac{19}{20}, \frac{15}{25}, 56\frac{3}{4}$

Subtract:

52. $\frac{3}{11}$ from $\frac{5}{11}$
53. $\frac{5}{12}$ from $\frac{7}{12}$
54. $\frac{2}{3}$ from $\frac{3}{4}$
55. $\frac{9}{16}$ from $\frac{7}{8}$
56. $\frac{5}{8}$ from $2\frac{1}{4}$
57. $\frac{3}{4}$ from $\frac{9}{10}$
58. $3\frac{5}{6}$ from $5\frac{2}{3}$
59. $86\frac{1}{4}$ from $127\frac{5}{8}$
60. $287\frac{7}{8}$ from $703\frac{3}{5}$
61. $42\frac{1}{3}$ from $87\frac{9}{10}$
62. $18\frac{5}{12}$ from $94\frac{1}{12}$
63. $121\frac{1}{2}$ from $377\frac{7}{8}$
64. $47\frac{1}{3}$ from $96\frac{5}{12}$
65. $127\frac{11}{15}$ from $156\frac{5}{8}$
66. 75 from $128\frac{11}{20}$
67. 17 from $27\frac{3}{67}$
68. 67 from $93\frac{14}{20}$
69. $16\frac{3}{8}$ from 42
70. $29\frac{5}{16}$ from 263
71. $63\frac{3}{8}$ from $89\frac{2}{5}$

Multiply:

72. 8 by $\frac{5}{8}$
73. 9 by $\frac{5}{9}$
74. 7 by $\frac{7}{16}$
75. 6 by $\frac{5}{6}$
76. 12 by $\frac{7}{10}$
77. $\frac{8}{9}$ by 55
78. $\frac{8}{25}$ by 40
79. $\frac{7}{15}$ by 120
80. $\frac{15}{16}$ by 96
81. $\frac{7}{8}$ by 112
82. $\frac{21}{25}$ by 50
83. $\frac{13}{20}$ by 48
84. $\frac{3}{4}$ by $\frac{7}{9}$
85. $\frac{7}{9}$ by $\frac{7}{10}$
86. $\frac{5}{16}$ by $\frac{7}{8}$
87. $\frac{11}{16}$ by $\frac{14}{15}$
88. $2\frac{5}{8}$ by 14
89. $21\frac{3}{7}$ by 12
90. $16\frac{3}{8}$ by 15
91. $28\frac{2}{7}$ by 21
92. 44 by $20\frac{5}{8}$
93. 75 by $120\frac{8}{10}$
94. $18\frac{3}{4}$ by $15\frac{3}{8}$
95. $27\frac{5}{6}$ by $26\frac{1}{2}$
96. $91\frac{7}{8}$ by $41\frac{3}{5}$
97. $93\frac{2}{3}$ by $86\frac{3}{4}$
98. $88\frac{4}{9}$ by $66\frac{3}{8}$
99. $47\frac{3}{5}$ by $21\frac{4}{5}$
100. $89\frac{5}{8}$ by $16\frac{4}{5}$
101. $74\frac{3}{4}$ by $20\frac{3}{10}$

Divide:

102. $\frac{4}{5}$ by 2
103. $\frac{8}{9}$ by 2
104. $\frac{6}{7}$ by 2
105. $\frac{5}{8}$ by 3
106. $\frac{7}{8}$ by 4
107. $\frac{9}{16}$ by 3
108. $\frac{11}{15}$ by 3
109. $47\frac{5}{9}$ by 8
110. $167\frac{3}{4}$ by 21
111. $472\frac{3}{7}$ by 42
112. $21\frac{2}{5}$ by 12
113. $700\frac{3}{4}$ by 34
114. $502\frac{2}{3}$ by 18
115. 15 by $\frac{3}{4}$
116. 28 by $\frac{4}{9}$
117. 70 by $\frac{10}{11}$
118. 90 by $\frac{5}{16}$
119. 24 by $\frac{8}{11}$

120. 57 by $\frac{8}{10}$
121. $\frac{5}{8}$ by $\frac{4}{7}$
122. $\frac{5}{6}$ by $\frac{8}{9}$
123. $\frac{7}{20}$ by $\frac{7}{20}$
124. $\frac{2}{3}$ by $\frac{5}{11}$
125. $\frac{7}{8}$ by $\frac{5}{6}$
126. $\frac{7}{16}$ by $\frac{4}{15}$
127. $16\frac{2}{3}$ by $14\frac{1}{4}$
128. $12\frac{3}{5}$ by $8\frac{1}{3}$
129. $9\frac{3}{4}$ by $6\frac{2}{3}$
130. $33\frac{1}{3}$ by $12\frac{1}{2}$
131. $62\frac{1}{2}$ by $33\frac{1}{3}$
132. $15\frac{7}{8}$ by $9\frac{1}{4}$
133. $12\frac{7}{11}$ by $8\frac{5}{12}$
134. $11\frac{3}{8}$ by $1\frac{5}{8}$

## DECIMAL FRACTIONS

Change the dissimilar decimals to similar decimals:

135. .4, .65, .175
136. .4, .25, .006
137. .045, .203, .06708
138. .005, .25, .0024
139. .1001, .230, .00001
140. 6.201, 100.001, .000201
141. .9, .01, .246, .00087
142. 2.45, .7501, .010101
143. .202, .10001, .84678
144. 3.27, 1.001, 1.00001

Change to common fractions in their lowest terms:

145. .75
146. .38
147. .64
148. .52
149. .30
150. .48
151. .36
152. .128
153. .16
154. .95
155. .253
156. .002
157. .09
158. .0004
159. .0204
160. .0005
161. .0101
162. .4004
163. .2062
164. .0009
165. .0305

Change to decimals:

166. $\frac{1}{4}$
167. $\frac{3}{5}$
168. $\frac{3}{4}$
169. $\frac{1}{8}$
170. $\frac{2}{5}$
171. $\frac{3}{8}$
172. $\frac{7}{8}$
173. $\frac{4}{25}$
174. $\frac{13}{20}$
175. $1\frac{7}{50}$
176. $3\frac{5}{6}$
177. $\frac{17}{20}$
178. $\frac{3}{16}$
179. $\frac{9}{40}$
180. $\frac{3}{25}$
181. $\frac{21}{50}$
182. $\frac{12}{25}$
183. $\frac{11}{20}$
184. $12\frac{3}{4}$
185. $16\frac{7}{8}$
186. $26\frac{8}{15}$

Add:

**187.**
5.67
24.2
3.246
20.0256

**188.**
7.023
20.12
2.4507
38.027

**189.**
21.2306
8.023
9.2007
10.241

**190.**
2.567
44.25
20.0203
1.102

**191.**
48.22
19.34
16.7207
4.231

**192.**
5.670
23.40
6.7082
3.02

Subtract:

**193.** .3862 from .802.
**194.** 30.75 from 32.633.
**195.** 2.375 from 7.50 .
**196.** 18.8975 from 37.0005.
**197.** 1.2958 from 42.006.
**198.** .4036 from 10.23.
**199.** .23407 from .86.
**200.** 2.4070 from 8.23.
**201.** 104.3 from 124.201.

Multiply:

**202.** .243 by 25
**203.** .005 by .025
**204.** 50.05 by .05
**205.** .4004 by 4
**206.** .367 by .425
**207.** 3.04 by 6.22
**208.** 10.086 by 5.005
**209.** 245.306 by .75
**210.** .367 by .246
**211.** .200102 by .0006
**212.** .502 by .502
**213.** .245 by 2000
**214.** 5.67 by .001
**215.** 35.705 by .242
**216.** .567 by 567
**217.** 2.57 by .203
**218.** 456 by .0008
**219.** 2.252 by 2.34

Divide:

**220.** 2.450 by 9.8

**221.** 105.35 by 3.5

**222.** 6.253 by .37

**223.** 688.5 by .027

**224.** .00255 by 51

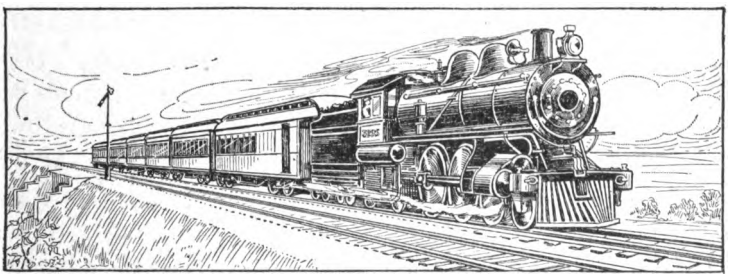
**225.** .0021318 by 38

**226.** 75 by .0125

**227.** .33615 by 12.45

**228.** 34.372 by .013

**229.** 45.76 by 650



**230.** The distance from Chicago to Denver via the Chicago and Northwestern and the Union Pacific railways is 1061 miles. If it requires 28 hours and 30 minutes for a train to make the journey, what is its average speed per hour?

**231.** If a train requires 28 hours and 30 minutes to make the journey of 1061 miles from Chicago to Denver, with 38 stops averaging 5 minutes, how many miles, on the average, does the train actually run per hour?

**232.** The distance between Chicago and Denver via the Chicago, Rock Island, and Pacific Railway is 1083 miles. If it requires 28 hours and 30 minutes for a train to make the journey, what is the average rate of speed?

**233.** A train requires 28 hours and 30 minutes for the journey from Chicago to Denver, a distance of 1083 miles; the train makes 24 stops. If the stops average 5 minutes, how many miles, on the average, does the train actually run per hour?

**234.** The distance from Chicago to Denver via the Burlington Route is 1034 miles. It requires 28 hours and 30 minutes for the Denver Limited to make the journey. What is the average speed of the train per hour?

**235.** A train that makes 37 regular stops between Chicago and Denver, requires 28 hours and 30 minutes to make the journey of 1034 miles. Allowing 5 minutes for each stop, what is the average running time of the train per hour?

**236.** The velocity of sound waves in air at 0° Centigrade is 1091 feet per second. What is the distance of a cloud if the interval between the time of seeing a flash of lightning and hearing the thunder is $1\frac{3}{4}$ seconds?

**237.** If the temperature of the atmosphere is 0° Centigrade, and $2\frac{1}{4}$ seconds elapse between seeing a flash of a gun and hearing the report, what fraction of a mile is the hunter distant from the observer?

**238.** The diameter of the earth's orbit is approximately 185,000,000 miles. How long will it require light to cross it at a speed of 186,000 miles per second?

**239.** The earth is 92,500,000 miles distant from the sun. How long will it require a ray of light to reach the earth at the rate of 186,000 miles per second?

**240.** How far distant is a hunter if $3\frac{1}{2}$ seconds elapse between seeing the smoke of the gun and hearing the report?

**241.** Measure some horse to ascertain how many hands high he is. (In measuring the height of a horse measure from the ground to the withers, the highest point in the back between the shoulders.) Make careful notation. Measure several horses and find the average height. (Make observations at home and bring data.)

**242.** Find how many feet there are in one mile; how many yards.

## MEASUREMENTS

**243.** How many square feet of paving will be required to cover an alley 16 ft. wide and 300 ft. long?

**244.** Roadways in a certain state are fixed by law at 60 ft. in width. These roads are located on the section lines, and half the width of the road is taken from each section (1 mile square) along which the road passes. How much land is lost to roadways by one section? Illustrate by a diagram.

**245.** How many cubic inches are there in a piece of lumber 28 inches long, 14 inches wide, and 8 inches thick?

**231 cu. in. = 1 gal.**

**246.** A rectangular cistern is 14 ft. long, 4 ft. 6 in. wide, and 3 ft. 3 in. deep. How long will it take to fill it with water from a pipe that discharges 6 gal. per minute?

**247.** A barrel holds $31\frac{1}{2}$ gal. How many cubic feet does it contain?

**248.** How much will it cost to excavate a cellar 36 ft. long, 28 ft. wide, and 7 ft. deep, at 16¢ per cubic yard?

NOTE. — In all problems in this book involving dollars and cents, give *final results* to the nearest cent; that is, discard less than $\frac{1}{2}$ cent and count $\frac{1}{2}$ cent or a greater fraction of a cent as a whole cent. Thus, both \$2.254 and $\$2.25\frac{1}{3} = \$2.25$; both \$2.256 and $\$2.25\frac{1}{2} = \$2.26$.

In intermediate results and in decimals not involving money, carry the decimals to three places, or when the results are *very small* to four places. Fractions with denominators larger than 25 are usually to be expressed as decimals.

**249.** How much will it cost to excavate a canal 2 mi. long, 20 ft. wide, and 8 ft. in depth, at 12¢ per cubic yard?

**250.** Find the cost of a block of marble $5\frac{1}{2}$ ft. long, $3\frac{1}{2}$ ft. wide, and $1\frac{1}{2}$ ft. thick, at \$2.20 per cubic foot.

**251.** A fill for a railroad is 300 ft. long, 20 ft. high, and 16 ft. wide. How many cubic yards of dirt are used to fill it?

**252.** A room is 20 ft. long, 14 ft. 6 in. wide, and 8 ft. 4 in. high. How many cubic feet of air will it contain?

**253.** How many cubic feet of hay will a mow hold if it is 60 ft. long, 24 ft. wide, and averages 12 ft. high?

**254.** How many pieces of ice 2 ft. by 2 ft. by 1 ft. will an ice house hold if it is 60 ft. by 18 ft. by 16 ft.?

Find the number of gallons in each of the following reservoirs:

**255.** 8 ft. × 6 ft. × 3 ft.

**256.** 9 ft. × 5 ft. × 4 ft.

**257.** 20 ft. × 10 ft. × 6 ft.

**258.** 12 ft. × 9 ft. × 5 ft.

**259.** 8 ft. × 6 ft. × 2 ft.

**260.** 11 ft. × 10 ft. × 5 ft.

**261.** 15 ft. × 3 ft. × 2 ft.

**262.** 7 ft. × 7 ft. × 12 ft.

Find the number of pints in the following cisterns:

**263.** 1 ft. 6 in. × 10 in. × 8 in.

**264.** 2 ft. × 1 ft. × 6 in.

**265.** 2 ft. 4 in. × 1 ft. × 8 in.

**266.** 3 ft. × 2 ft. × 1 ft.

Find the number of barrels in the following cisterns or reservoirs ($31\frac{1}{2}$ gal. = 1 bbl.):

**267.** 12 ft. deep and 4 ft. square at the bottom.

**268.** 12 ft. long, 6 ft. 6 in. wide, and 4 ft. 6 in. deep.

**269.** 10 ft. deep and 6 ft. square at the bottom.

**270.** How much will 4380 lb. of coal cost at $6.50 per ton?

**271.** A man used 3860 lb. of coal in October, 4350 lb. in November, 4400 lb. in December, 4500 lb. in January, 4400 lb. in February, 4200 lb. in March, and 1600 lb. in April. How much did his winter fuel cost him at $7 per ton?

**272.** What is the cost of 475 lb. of flour at $3 per hundredweight?

**273.** A farmer sold 4 loads of hay, as follows, at $11 per ton. Find the amount received for each load and for the four loads:

| No. 1 | | |
|---|---|---|
| Gross weight . . . . . | 4200 lb. | Price per ton $11 |
| Tare (wagon) . . . . . | 1400 lb. | Amount |
| Net weight . . . . . | | |

| No. 2 | | |
|---|---|---|
| Gross weight . . . . . | 4350 lb. | Price per ton $11 |
| Tare . . . . . | 1400 lb. | Amount |
| Net weight . . . . . | | |

| No. 3 | | |
|---|---|---|
| Gross weight . . . . . | 3850 lb. | Price per ton $11 |
| Tare . . . . . | 1200 lb. | Amount |
| Net weight . . . . . | | |

| No. 4 | | |
|---|---|---|
| Gross weight . . . . . | 4560 lb. | Price per ton $11 |
| Tare . . . . . | 1400 lb. | Amount |
| Net weight . . . . . | | |

## DENOMINATE NUMBERS

NOTE. — For tables, see pages 267 to 270.

Change to lower denominations:

**274.** 8 bu. 2 pk. 6 qt. to quarts.

**275.** 16 bu. 3 pk. 4 qt. to pints.

**276.** 3 pk. 6 qt. 1 pt. to pints.

**277.** 1 gal. 3 qt. 1 pt. to pints.

**278.** 5 gal. 2 qt. to pints.

**279.** 10 gal. 3 qt. 1 pt. to pints.

**280.** 6 T. 5 cwt. 12 lb. to pounds.

**281.** 6 da. 15 hr. 14 min. to minutes.

**282.** 10 cu. yd. 12 cu. ft. to cubic feet.

**283.** 2 rd. 11 ft. 5 in. to inches.

**284.** $1.10 to mills.

**285.** 2 reams 10 quires to sheets.

**286.** 1 ream 12 quires 12 sheets to sheets.

**287.** 12 gro. 8 doz. to units.

**288.** 1 cwt. 60 lb. 12 oz. avoirdupois to ounces.

**289.** 6 T. 12 cwt. to pounds.

**290.** 1 sq. yd. 1 sq. ft. to square inches.

Change to higher denominations:

**291.** 2489 gi. to gallons.

**292.** 1280 pt. to bushels.

**293.** 7562 sec. to hours.

**294.** 4640 pt. to bushels.

**295.** 346,340 lb. to tons.

**296.** 12,467 ft. to miles.

**297.** 56,600 sec. to hours.

**298.** 4670 pt. to bushels.

**299.** 10,500 gr. to pounds avoirdupois.

**300.** 1600 oz. to hundredweight.

Change the following fractions to integers of lower denominations:

**301.** $\frac{1}{4}$ da. to hours

**302.** $\frac{1}{2}$ mi. to feet

**303.** $\frac{11}{16}$ lb. av. to ounces

**304.** $\frac{5}{6}$ gro. to dozen

**305.** $\frac{3}{4}$ bu. to pints

**306.** $\frac{7}{8}$ gal. to pints

**307.** $\frac{3}{5}$ da. to minutes

**308.** $\frac{1}{5}$ ream to quires

**309.** Add 12 bu. 1 pk. 7 qt., 5 bu. 3 pk. 5 qt., 7 bu. 3 pk. 2 qt.

**310.** Add 3 gal. 3 qt. 1 pt., 8 gal. 1 qt. 1 pt., 4 gal. 2 qt. 1 pt., 6 gal. 3 qt. 1 pt.

**311.** Add 5 lb. 11 oz., 10 lb. 10 oz., 7 lb. 9 oz. (av.).

**312.** Add 2 T. 15 lb., 3 cwt. 15 lb., 1 T. 5 cwt. 10 lb., 2 T. 5 cwt. 20 lb.

**313.** Add 5 da. 6 hr. 20 min., 6 da. 12 hr. 15 min., 4 da. 8 hr. 25 min.

**314.** Add 1 ream 10 quires 20 sheets, 1 ream 18 quires 22 sheets.

**315.** Add 10 gro. 3 doz. 10 units, 5 gro. 10 doz. 5 units, 6 gro. 8 doz. 5 units.

**316.** Add 5 A. 16 sq. rd. 4 sq. yd., 6 A. 110 sq. rd. 3 sq. yd., 10 A. 85 sq. rd. 25 sq. yd.

Subtract:

**317.**

| | | | |
|---|---|---|---|
| | 4 bu. | 2 pk. | 3 qt. |
| | 2 bu. | 3 pk. | 6 qt. |

**318.**

| | | | |
|---|---|---|---|
| | £ 12 | 10*s.* | 5*d.* |
| | £ 10 | 12*s.* | 6*d.* |

**319.**

| | | | |
|---|---|---|---|
| | 8 rd. | 3 yd. | 2 ft. |
| | 3 rd. | 4 yd. | 2 ft. |

320. 2 bbl. 5 gal. 2 qt.
1 bbl. 10 gal. 3 qt.

321. 3 bbl. 10 gal. 1 qt.
2 bbl. 12 gal. 2 qt.

322. 3 wk. 3 da. 5 hr.
1 wk. 6 da. 10 hr.

323. 10 cu. yd. 5 cu. ft. 100 cu. in.
6 cu. yd. 7 cu. ft. 800 cu. in.

324. 5 T. 4 cwt. 12 lb.
2 T. 5 cwt. 15 lb.

325. 5 cwt. 15 lb. 12 oz.
3 cwt. 20 lb. 14 oz.

326. 5 oz. 10 pwt. 12 gr.
2 oz. 15 pwt. 20 gr.

Multiply:

327. 3 gal. 3 qt. 1 pt. by 6.

328. 5 bu. 3 pk. 1 qt. by 7.

329. 2 wk. 5 da. 3 hr. by 5.

330. 5 gal. 2 qt. by 10.

331. 10 bu. 3 pk. 5 qt. by 10.

332. 4 cwt. 12 lb. 10 oz. by 12.

333. 10 oz. 15 pwt. 10 gr. by 9.

334. 2 mi. 16 rd. 4 yd. by 5.

335. 1 ream 4 quires 12 sheets by 5.

Divide:

336. 4 bu. 3 pk. 2 qt. by 3.
337. 15 gal. 3 qt. 1 pt. by 6.
338. 14 cwt. 12 lb. 5 oz. by 6.
339. 18 lb. 11 oz. 16 gr. (av.) by 7.
340. 21 wk. 6 da. 12 hr. by 10.
341. 12 T. 16 cwt. 90 lb. by 9.
342. 50 bu. 2 pk. 7 qt. by 11.
343. 15 gal. 3 qt. 1 pt. by 8.

## PERCENTAGE

Change each of the following from the form indicated to the per cent form:

344. .15
345. .30
346. .48
347. .90
348. $.56\frac{2}{3}$
349. $.33\frac{1}{3}$
350. .125
351. .025
352. .01

Change to both the decimal and the per cent forms:

353. $\frac{1}{4}$
354. $\frac{1}{5}$
355. $\frac{3}{5}$
356. $\frac{1}{16}$
357. $\frac{7}{9}$
358. $\frac{2}{3}$
359. $\frac{1}{7}$
360. $\frac{5}{6}$
361. $\frac{5}{12}$

Change to the decimal form:

362. 12%
363. 18%
364. 6%
365. 72%
366. $12\frac{1}{2}$%
367. 125%
368. 65%
369. $35\frac{1}{5}$%
370. $66\frac{2}{3}$%

Find:

371. 20% of 245
372. 50% of 780
373. 25% of 844
374. 6% of 475
375. 75% of 520
376. 93% of 800

377. $16\frac{2}{3}\%$ of 708

378. $12\frac{1}{2}\%$ of 1000

379. $75\%$ of 680

380. $24\%$ of 300

381. $28\frac{4}{7}\%$ of 1169

382. $14\frac{2}{7}\%$ of 1169

383. $80\%$ of 1200

384. $40\%$ of 335

385. $66\frac{2}{3}\%$ of 330

386. $33\frac{1}{3}\%$ of 339

387. $20\%$ of 300

388. $6\frac{1}{4}\%$ of 256

389. $12\frac{1}{2}\%$ of 880

390. $37\frac{1}{2}\%$ of 440

391. A house cost \$3200, the lot \$600, the taxes and upkeep \$130 per year. What rental must be charged in order to realize $8\%$ on the investment?

392. A merchant has \$28,000 invested in his stock. He pays annual rental on building \$600, clerk hire \$2400, taxes \$400, incidental expenses \$600. What must his profits be in order to net him $8\%$ and a salary of \$1200 per year?

393. A clerk begins work at \$600 a year with a promise of $10\%$ increase each year for five years. What will be his annual salary during the sixth year of service?

394. A clerk earned \$800 a year and spent $40\%$ for board, $20\%$ for clothes, $10\%$ for amusement, and invested the balance. How much did he invest?

395. A merchant bought knives at \$7.20 a dozen. At what price apiece must he sell these knives to gain $33\frac{1}{3}\%$?

396. The internal revenue of the United States for one year amounted to \$322,529,200.79; it required an expenditure of $1.55\%$ for collection. Find the cost of collection.

397. The breadstuffs imported into the United States in a year amounted to \$11,729,802; the average rate of duty was $31.56\%$. What income accrued to the United States from this source?

**398.** The value of the cotton manufactures imported into the United States in a year amounted to $64,270,892. If the average rate of duty was 55.71 %, what amount accrued to the United States?

**399.** The value of fish imported into the United States in a year amounted to $12,915,830. The average rate of duty was 19.20 %. What revenue did the government receive?

**400.** The customs revenue of the United States for one year was $314,497,071.24; it required an expenditure of 3.50 % for collecting. Find the cost of collecting.

What per cent of:

**401.** 10 is 5?

**402.** 20 is 6?

**403.** 200 is 150?

**404.** 250 is 125?

**405.** 125 is 20?

**406.** $1.50 is $.75?

**407.** $25 is $1.50?

**408.** $1.75 is $.75?

**409.** 6 yd. is 2 ft.?

**410.** 4 bu. is 4 pk.?

**411.** 100 is $12\frac{1}{2}$?

**412.** 72 is 9?

**413.** 72 is 18?

**414.** 72 is 27?

**415.** 72 is 45?

**416.** 72 is 63?

**417.** 16 is 1?

**418.** 16 is 3?

**419.** 16 is 5?

**420.** 10 is 9?

**421.** A man received $200 for the rental of a house which cost $2400. What was the per cent of income?

**422.** A building valued at $12,000 is insured for $6500. For what per cent of its value is it insured?

**423.** A farmer bought 80 acres of land at $120 an acre. His crop the first year netted him $1800. What was the rate of income on his investment?

**424.** What per cent greater than $.80 is $1.50?

425. What per cent greater than $65 is $82?

Find the number of which:

426. 16 is 8%
427. 25 is 5%
428. 54 is 3%
429. 72 is $12\frac{1}{2}$%
430. 170 is 50%
431. 374 is 17%
432. 900 is $33\frac{1}{3}$%
433. 240 is 25%
434. 836 is 19%
435. 750 is 250%
436. 76 is $\frac{1}{4}$%
437. 18 is $\frac{1}{20}$%
438. 180 is $6\frac{2}{3}$%
439. 250 is $16\frac{2}{3}$%

## DISCOUNT

Find the net price of each of the following:

| | Price List | Discount | Net Price |
|---|---|---|---|
| 440. | $12.00 | 15% | |
| 441. | $8.00 | $12\frac{1}{2}$% | |
| 442. | $24.00 | $16\frac{2}{3}$% | |
| 443. | $30.00 | $33\frac{1}{3}$% | |
| 444. | $2.50 | 20% | |
| 445. | $60.00 | 20% and 10% | |
| 446. | $500.00 | 20% and 5% | |
| 447. | $1200.00 | $33\frac{1}{3}$% and 20% | |
| 448. | $150.00 | 30% and 10% | |
| 449. | $1600.00 | 50% and 25% | |

Find a single rate of discount equal to each series:

450. $33\frac{1}{3}$% and 25%
451. 20% and 15%
452. 25% and 20%
453. 25% and 10%
454. 25% and 5%
455. 20% and 20%
456. 50% and 10%
457. 24% and 20%
458. 35% and 25%
459. $16\frac{2}{3}$% and 10%
460. $33\frac{1}{3}$% and 10%
461. 60% and 30%

## PROFIT AND LOSS

Find the gain and the selling price, to the nearest cent, on articles sold at the following rates of profit:

462. An article costing \$6 sold at $12\frac{1}{2}\%$ profit.
463. An article costing \$2.40 sold at $33\frac{1}{3}\%$ profit.
464. An article costing \$.75 sold at 15% profit.
465. An article costing \$2.25 sold at 20% profit.
466. An article costing \$12.50 sold at 25% profit.
467. An article costing \$.60 sold at 20% profit.
468. An article costing \$.15 sold at 30% profit.
469. An article costing \$.18 sold at $33\frac{1}{3}\%$ profit.
470. An article costing \$.36 sold at $12\frac{1}{2}\%$ profit.
471. An article costing \$.21 sold at $33\frac{1}{3}\%$ profit.

Find the selling price on an article that sold at an advance of $33\frac{1}{3}\%$ if it cost:

| | | |
|---|---|---|
| 472. \$.12 | 475. \$.36 | 478. \$.60 |
| 473. \$.15 | 476. \$.24 | 479. \$.45 |
| 474. \$.09 | 477. \$.03 | 480. \$.30 |

Find the per cent of gain or loss on an article:

481. Bought for \$6 and sold for \$4.
482. Bought for \$.60 and sold for \$.40.
483. Bought for \$.18 and sold for \$.24.
484. Bought for \$10.00 and sold for \$8.
485. Bought for \$10.00 and sold for \$14.
486. Bought for \$.90 and sold for \$1.20.
487. Bought for \$.75 and sold for \$1.25.
488. Bought for \$370 and sold for \$555.
489. Bought for \$90 and sold for \$130.
490. Bought for \$16 and sold for \$28.

## INTEREST

Find the interest at 6 % on each of the following:

NOTE. — Count 30 da. to the month and 12 mo. or 360 da. to the year.

491. $18.30 for 3 yr.
492. $122.70 for $4\frac{1}{2}$ yr.
493. $764 for 1 yr. 9 mo.
494. $467 for 3 yr. 11 mo.
495. $680 for 30 da.
496. $1220 for 3 mo. 18 da.
497. $870 for 45 da.
498. $642.18 for 6 mo.
499. $663.40 for 8 mo.
500. $1840 for 6 mo. 22 da.
501. $960 for 9 mo. 25 da.
502. $1248 for 6 mo. 28 da.

Find the interest on:

503. $682 at 2 % for 5 mo.
504. $248 at 3 % for 6 mo.
505. $367 at 4 % for 7 mo.
506. $980 at 7 % for 10 mo.
507. $492 at 8 % for 11 mo.
508. $878 at $4\frac{1}{2}$ % for 12 mo.
509. $385 at 5 % for 9 mo.
510. $624 at 5 % for 90 da.
511. $783 at 6 % for 72 da.
512. $240 at 4 % for 12 da.

Find the interest on each of the following notes:

513.

*$ 690.00* *Clarinda, Iowa, July 1, 1916.*

*Six months after date, for value received, I promise to pay to the order of the* **First National Bank of Clarinda**

*Six hundred ninety and* $\frac{no}{100}$ *Dollars.*

*Payable at ---- First National Bank, Clarinda, Iowa, with interest at the rate of ---- six ---- per cent per annum from date.*

*P. O. Norwich.* *John Doe.*

**514.**

*$ 1225.00* *Toledo, Ohio, Aug. 15, 1916.*

*Three months after date, for value received, I promise to pay to the order of the* **First National Bank of Toledo** *One thousand two hundred twenty-five and* $\frac{no}{100}$ *Dollars. Payable at---First National Bank, Toledo, Ohio,---with interest at the rate of----five----per cent per annum from date.*

*P. O. Toledo.* *Marshall Thrift.*

**515.**

*$ 87.50* *Joplin, Missouri, May 10, 1916.*

*Ninety days after date, for value received, I promise to pay to the order of* **Joplin National Bank of Joplin** *Eighty-seven and* $\frac{50}{100}$ *Dollars. Payable at----Joplin National Bank, Joplin, Missouri, with interest at the rate of----six----per cent per annum from date.*

*P. O. Joplin.* *William Work.*

## RATIO

Express the value of the ratio:

**516.** 3 : 6 **518.** 32 : 8 **520.** 35 : 5

**517.** 8 : 32 **519.** 5 : 35 **521.** $\frac{1}{2} : \frac{3}{4}$

522. $\frac{4}{16} : \frac{5}{8}$ 525. $5 : \frac{1}{5}$ 528. 15 lb. : 45 lb.

523. 14.3 : 6.5 526. $12\frac{1}{2} : 25$ 529. 30 da. : 360 da.

524. $\frac{9}{10} : \frac{3}{10}$ 527. $\frac{3}{5} : \frac{5}{8}$ 530. 144 ft. : 12 ft.

531. Reduce to a simple ratio in its lowest terms the product of 6 : 7, 14 : 7, and 12 : 17.

532. Reduce to a simple ratio in its lowest terms the product of 5 : 9, 3 : 14, and 15 : 5.

## PROPORTION

Find the missing term in the following proportions:

533. $54 : 9 = 108 : ?$ 538. $\$45 : \$9 = 20 : ?$

534. $27 : 9 = 9 : ?$ 539. $\frac{7}{8} : ? = \frac{3}{3} : \frac{5}{7}$

535. $? : 5 = 8 : 4$ 540. $15 : 3 = 35 : ?$

536. $8 : ? = 20 : 5$ 541. $32 : 50 = ? : 25$

537. $\frac{3}{4} : \frac{1}{2} = ? : \frac{1}{3}$ 542. $16\frac{1}{2} : 24\frac{3}{4} = 30 : ?$

543. If 2 men pick 240 lb. of cotton in one day, how much would 3 men pick at the same rate in the same time?

544. If 3 horses eat 30 lb. of hay in one day, how many horses would eat 1 T. of hay in one day?

545. If 10 men can do a piece of work in 8 hr., how many hours will it take 2 men to do the same amount?

546. The shadow of a post 8 ft. high is 12 ft. How high is a flagstaff which casts a shadow 80 ft. long at the same time?

547. If 15 teams construct 1 mi. of railroad grading in 1 wk., how long will it take the same teams to grade 90 mi.?

# TESTS FOR ACCURACY AND SPEED

After accuracy is attained, similar problems should be solved for speed. The time limits are based on actual classroom tests.

Write from dictation, add, and test each example in 1 minute:

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 24 | 16 | 54 | 26 | 87 |
| 56 | 27 | 46 | 64 | 76 |
| 67 | 73 | 67 | 54 | 65 |
| 72 | 35 | 72 | 56 | 45 |
| 81 | 56 | 29 | 67 | 43 |
| 20 | 62 | 94 | 78 | 22 |
| 37 | 18 | 53 | 92 | 19 |
| 25 | 89 | 37 | 23 | 50 |
| 44 | 94 | 78 | 34 | 65 |

Write, add, and test each example in $1\frac{1}{4}$ minutes:

| 6. | 7. | 8. | 9. | 10. |
|---|---|---|---|---|
| 342 | 500 | 674 | 152 | 844 |
| 428 | 480 | 472 | 874 | 257 |
| 567 | 508 | 297 | 567 | 222 |
| 783 | 472 | 568 | 111 | 700 |
| 624 | 293 | 792 | 405 | 452 |
| 491 | 567 | 909 | 473 | 932 |
| 550 | 719 | 472 | 833 | 541 |
| 362 | 189 | 398 | 400 | 317 |

Write from dictation, add, and test each example in 3 minutes:

| 11. | 12. | 13. | 14. | 15. |
|---|---|---|---|---|
| 4938 | 6400 | 3425 | 3000 | 8750 |
| 2271 | 1713 | 7743 | 7630 | 4545 |
| 5642 | 1180 | 6581 | 4891 | 3897 |
| 8973 | 2843 | 4632 | 5903 | 4301 |
| 2201 | 7651 | 1790 | 3873 | 4119 |
| 3705 | 3398 | 3128 | 4444 | 5322 |
| 3100 | 7655 | 5005 | 6327 | 1439 |
| 4893 | 3267 | 3648 | 5019 | 1897 |
| 2506 | 5583 | 5597 | 3460 | 3800 |
| 3387 | 3206 | 2118 | 1500 | 3206 |
| 4338 | 5674 | 8397 | 7889 | 6458 |

Write from dictation, add, and test each example in 4 minutes:

| 16. | 17. | 18. | 19. | 20. |
|---|---|---|---|---|
| $101.75 | $750.36 | $1755.23 | $ 625.15 | $ 462.25 |
| 73.55 | 225.00 | 481.22 | 450.75 | 1555.25 |
| 247.83 | 48.79 | 5000.00 | 1214.20 | 928.75 |
| 555.00 | 715.00 | 7891.22 | 57.65 | 802.80 |
| 347.89 | 300.46 | 3432.00 | 209.78 | 1516.18 |
| 411.25 | 109.00 | 2443.75 | 2642.10 | 2452.24 |
| 961.43 | 10.15 | 800.30 | 965.55 | 6579.81 |
| 117.35 | 222.75 | 1071.15 | 428.20 | 4022.20 |
| 80.50 | 550.20 | 2045.50 | 783.05 | 29.85 |
| 500.00 | 507.06 | 2100.00 | 1910.00 | 455.55 |
| 625.04 | 432.71 | 1653.99 | 4387.64 | 3089.92 |

Copy, add, and test each example in 3 minutes:

| 21. | 22. | 23. | 24. | 25. |
|---|---|---|---|---|
| 25 | 478 | 45 | 66 | 52 |
| 126 | 501 | 128 | 78 | 48 |
| 75 | 300 | 816 | 29 | 215 |
| 42 | 717 | 79 | 293 | 375 |
| 181 | 612 | 987 | 472 | 405 |
| 500 | 220 | 763 | 519 | 510 |
| 101 | 439 | 58 | 612 | 709 |
| 62 | 76 | 511 | 784 | 84 |
| 12 | 117 | 456 | 689 | 578 |
| 447 | 800 | 672 | 345 | 300 |

Write, subtract, and test each example in 30 seconds:

| | | | | | |
|---|---|---|---|---|---|
| 26. | 85,980<br>71,409 | 33. | 23,412<br>12,462 | 40. | $8184.20<br>77.33 |
| 27. | 57,004<br>20,098 | 34. | 56,789<br>34,893 | 41. | $1455.72<br>522.13 |
| 28. | 90,642<br>34,509 | 35. | 43,467<br>24,789 | 42. | $17,450.00<br>1,801.93 |
| 29. | 86,701<br>72,593 | 36. | $345.16<br>134.50 | 43. | $1200.00<br>999.28 |
| 30. | 97,045<br>68,254 | 37. | $7879.42<br>3697.84 | 44. | $1786.40<br>342.18 |
| 31. | 56,721<br>37,862 | 38. | $687.56<br>398.63 | 45. | $3456.20<br>829.60 |
| 32. | 63,427<br>45,724 | 39. | $867.75<br>758.80 | 46. | $23470.17<br>541.20 |

Multiply five examples in 5 minutes:

| | | | | | |
|---|---|---|---|---|---|
| **47.** | 3647 | **52.** | 3487 | **57.** | 4766 |
| | 248 | | 362 | | 248 |
| **48.** | 4368 | **53.** | 4569 | **58.** | 7333 |
| | 653 | | 483 | | 210 |
| **49.** | 5782 | **54.** | 5678 | **59.** | 4502 |
| | 438 | | 429 | | 622 |
| **50.** | 7869 | **55.** | 6729 | **60.** | 6041 |
| | 678 | | 348 | | 803 |
| **51.** | 8434 | **56.** | 9786 | **61.** | 2392 |
| | 579 | | 540 | | 236 |

The following tests include examples in a variety of processes. Although a time limit is suggested, the teacher may establish a different schedule of time to suit the needs of the class.

Group of five problems to be solved and checked in 6 minutes:

**62.** Add: 246
345
765
867
734
568
257
725
345
666

**63.** Subtract: 85,671
17,658

**64.** Multiply: 2345
4267

**65.** Divide: 316,020 by 345.

**66.** Find the greatest common divisor of 48, 72, 120, and 288.

Group of five problems to be solved in 4 minutes:

67. Find the value of $\frac{2}{3} + \frac{7}{9} + {}_{2}\frac{5}{1}$.

68. $16\frac{5}{9} \times 12 = ?$

69. $\frac{9}{13} \div 1\frac{2}{39} = ?$

70. $15\frac{3}{4} \div 7\frac{3}{4} = ?$

71. $\frac{6}{7} - (\frac{2}{3} \times \frac{3}{5}) + \frac{2}{3} = ?$

Group of five problems to be solved in 4 minutes:

72. Express in decimal form $\frac{125}{1000}$.

73. Express .105 in the form of a common fraction in its lowest terms.

74. Find the sum of 18.7, .3027, 135.615, and .08.

75. From 1550.006 take 975.632.

76. Multiply 3.0702 by 60.02.

Group of five problems to be solved in 5 minutes:

77. Divide .1728 by .0144.

78. Divide 45,689 by 251; extend to three decimal places.

79. $252 \times 38 \div 126 = ?$

80. $\frac{3}{4}\frac{3}{2} \div .55 = ?$

81. $\frac{5}{8} + (\frac{9}{14} \times 63 \div .45) = ?$

Group of five problems to be solved in 5 minutes:

82. Reduce 2 bu. 3 pk. 4 qt. to pints.

83. Reduce 3 gal. 3 qt. 1 pt. to pints.

84. Change 1 cwt. 4 lb. 8 oz. to ounces.

85. Change 1 T. 12 cwt. 40 lb. to pounds.

86. Change 2 wk. 4 da. 5 hr. to hours.

# PARCEL POST

**Rates of Postage.** Rates, to be fully prepaid unsealed, are as follows within the United States and her possessions (Porto Rico, Hawaii, the Philippines, the "Canal Zone," etc.):

(*a*) Parcels weighing 4 ounces or less, except books, seeds, plants, etc., 1 cent for each ounce or fraction thereof, any distance.

(*b*) Parcels weighing 8 ounces or less containing books, seeds, cuttings, bulbs, roots, plants, etc., 1 cent for each 2 ounces or fraction thereof, regardless of distance.

(*c*) Parcels weighing more than 8 ounces containing books, seeds, plants, etc., parcels of miscellaneous printed matter weighing more than 4 pounds, and all other parcels of **fourth-class** matter weighing more than 4 ounces are chargeable, according to distance or zone, at the pound rates shown in the following table, a fraction of a pound being considered a full pound.

Packages of merchandise sent by parcel post may not be greater than 84 inches in length and girth combined. The limit of weight in the first and second zones is fifty pounds; in the third, fourth, fifth, sixth, seventh, and eighth zones, twenty pounds.

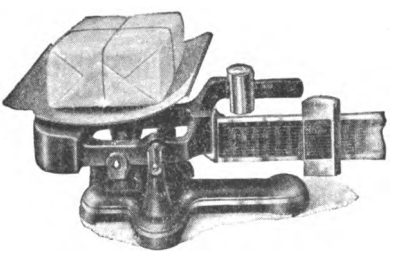
The local rate is $.05 for the first pound and $.01 for each additional 2 pounds or part thereof. This rate is applied to parcels intended for delivery at the post office where they are mailed, or on a rural route starting from that post office. The scale when enlarged further illustrates these rates.

## Parcel Post Rates

| | First Pound | Each Extra Pound |
|---|---|---|
| Local rate | $.05 | |
| 1st zone — 1 to 50 miles | .05 | $.01 |
| 2d zone — 50 to 150 miles | .05 | .01 |
| 3d zone — 150 to 300 miles | .06 | .02 |
| 4th zone — 300 to 600 miles | .07 | .04 |
| 5th zone — 600 to 1000 miles | .08 | .06 |
| 6th zone — 1000 to 1400 miles | .09 | .08 |
| 7th zone — 1400 to 1800 miles | .11 | .10 |
| 8th zone — over 1800 miles | .12 | .12 |

Scale Arm → ← Sliding Weight

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | POUNDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05 | 06 | 06 | 07 | 07 | 08 | 08 | 09 | 09 | 10 | 10 | 11 | 11 | LOCAL |
| 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 1ST. ZONE |
| 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 2 ND. " |
| 06 | 08 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 3 RD. " |
| 07 | 11 | 15 | 19 | 23 | 27 | 31 | 35 | 39 | 43 | 47 | 51 | 55 | 4 TH. " |
| 08 | 14 | 20 | 26 | 32 | 38 | 44 | 50 | 56 | 62 | 68 | 74 | 80 | 5 TH. " |
| 09 | 17 | 25 | 33 | 41 | 49 | 57 | 65 | 73 | 81 | 89 | 97 | 1.05 | 6 TH. " |
| 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91 | 1.01 | 1.11 | 1.21 | 1.31 | 7 TH " |
| 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 1.08 | 1.20 | 1.32 | 1.44 | 1.56 | 8 TH " |



**1.** By means of this table find the cost of mailing a parcel weighing 10 lb. into the fourth zone; into the third zone; into the sixth zone; into the eighth zone.

**2.** Find the cost of mailing a 5-pound parcel into the seventh zone; into the third zone; into the fifth zone.

**3.** Find the cost of mailing into the third zone a parcel weighing 11 lb.

**4.** Find the cost of mailing into the second zone a package weighing 3 lb.

5. Find the cost of mailing into the eighth zone a package weighing 7 lb.

6. Find the cost of mailing into the fifth zone a parcel weighing 2 lb.

7. Find the cost of mailing into the second zone a package weighing 49 lb.

8. Find the cost of mailing into the third zone a parcel weighing 17 lb. Find the cost of mailing the same parcel into the fourth zone; into the fifth zone; into the sixth zone; into the seventh zone.

9. Find the cost of mailing a parcel weighing 4 lb. 10 oz. into the fifth zone.

10. Find the total cost of the postage on four packages mailed as follows: a parcel weighing 2 lb. 5 oz. into the third zone; a parcel weighing 6 lb. 5 oz. into the eighth zone; a parcel weighing 4 lb. 10 oz. into the seventh zone; a parcel weighing 1 lb. 9 oz. into the third zone.

11. Find the cost of sending a 12-pound parcel from your own post office to Chicago.

NOTE. — In these problems, use a map of the United States, and by means of the scale of the map and the ruler, determine the distance and by this means, the proper zone.

12. Find the cost of sending a 16-pound parcel from your post office to New York.

13. Find the cost of sending a 3-pound parcel from Chicago to Springfield, Missouri.

14. Find the cost of sending a 7-pound parcel from the city of New York to Columbus, Ohio.

15. How much will it cost to mail from Topeka, Kansas, to Enid, Oklahoma, a parcel weighing 4 lb.?

**16.** Find the cost of sending an 18-pound parcel from Springfield, Illinois, to Terre Haute, Indiana.

**17.** Find the cost of sending an 11-pound package from Columbus, Ohio, to Bay City, Michigan.

**18.** Find the cost of sending a 5-pound parcel from Oshkosh, Wisconsin, to Aurora, Illinois.

**19.** Find the cost of sending a 10-pound package from Fort Worth, Texas, to Pine Bluff, Arkansas.

**20.** Find the cost of sending a 15-pound parcel from Nashville, Tennessee, to Montgomery, Alabama.

**21.** Find the cost of sending a 10-pound package from Jackson, Mississippi, to Frankfort, Kentucky.

**22.** Find the cost of sending a parcel weighing 9 lb. from Jackson, Mississippi, to Tampa, Florida.

**23.** Find the cost of sending a 7-pound parcel from Chicago to San Francisco.

**24.** Find the cost of sending a 19-pound parcel from Omaha, Nebraska, to Salt Lake City, Utah.

**25.** Find the cost of sending from Kansas City, Missouri, to Sheridan, Wyoming, a parcel weighing 18 lb.

**26.** Find the cost of sending from St. Louis, Missouri, to Des Moines, Iowa, a parcel weighing 15 lb.

**27.** Find the cost of sending from Boston, Massachusetts, to Portland, Maine, a parcel weighing 20 lb.

**28.** Find the cost of sending from Columbus, Ohio, to Augusta, Maine, a parcel weighing 15 lb.

**29.** Find the cost of sending from Aurora, Illinois, to Denver, Colorado, a parcel weighing 12 lb.

# LAND MEASUREMENTS

## USING A SCALE

Draftsmen find it convenient in planning extensive works to use a scale of measurement to represent these plans by means of smaller drawings. Turn to any geography and note the scale of miles used on the map in representing distance. In drafting or in making working drawings, any scale may be used, as 1 foot to $\frac{1}{2}$ in., 1 foot to $\frac{1}{4}$ in., 1 rod or 1 mile to $\frac{1}{8}$ in. In the following exercises, answers will be only approximate.

1. Note that the scale of miles on the map on the opposite page is 400 statute miles to the inch. Take a ruler and compute the distance from New Orleans to Chicago.

2. Measure the line of greatest length of Illinois.

3. Tell approximately the distance from Springfield to Chicago; from Indianapolis to Chicago; from Columbus to Chicago; from Philadelphia to Chicago. Record each measurement and the distance measured.

4. What is the greatest width of Lake Michigan? of Lake Erie? What is the greatest length of Lake Erie?

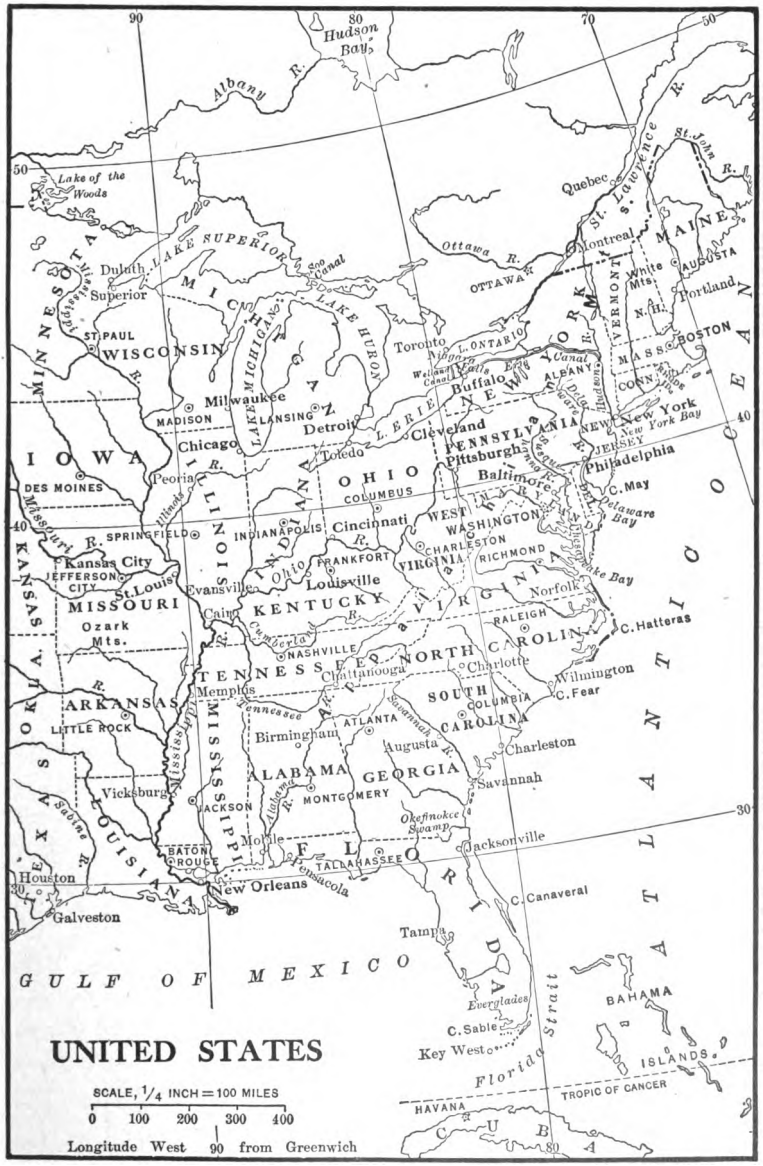
5. What is the width of Tennessee? What is the length of Tennessee on an east and west line?

6. Measure the greatest length of Pennsylvania on an east and west line; its greatest width on a north and south line.

7. Take the greatest length and breadth of Georgia in the same way.

8. Measure the greatest length and width of Lake Ontario in the same way.

9. What is the distance from Madison, Wisconsin, to Jackson, Mississippi?


UNITED STATES
SCALE, 1/4 INCH = 100 MILES
0 100 200 300 400
Longitude West 90 from Greenwich
Hudson Bay
Albany R.
Lake of the Woods
Duluth
Superior
ST. PAUL
WISCONSIN
MINNESOTA
LAKE SUPERIOR
MICHIGAN
LAKE MICHIGAN
LAKE HURON
Sault Ste. Marie Canal
Milwaukee
MADISON
LANSING
Detroit
Chicago
Toledo
Cleveland
Buffalo
ONTARIO
Welland Canal
Niagara Falls
Erie Canal
ALBANY
Ottawa R.
OTTAWA
Montreal
Quebec
St. Lawrence R.
St. John R.
MAINE
AUGUSTA
Portland
White Mts.
N.H.
VERMONT
MASS.
BOSTON
CONN.
R. I.
NEW YORK
New York
New York Bay
NEW JERSEY
Philadelphia
Baltimore
C. May
Delaware Bay
Chesapeake Bay
Norfolk
C. Hatteras
C. Fear
Wilmington
Charlotte
RALEIGH
NORTH CAROLINA
SOUTH CAROLINA
COLUMBIA
Charleston
Savannah
Augusta
ATLANTA
Chattanooga
NASHVILLE
Memphis
Louisville
Cincinnati
INDIANAPOLIS
Evansville
FRANKFORT
CHARLESTON
RICHMOND
WASHINGTON
WEST VIRGINIA
VIRGINIA
KENTUCKY
OHIO
COLUMBUS
PENNSYLVANIA
Pittsburgh
Toledo
Peoria
DES MOINES
IOWA
ILLINOIS
INDIANA
Illinois R.
Missouri R.
SPRINGFIELD
Kansas City
JEFFERSON CITY
St. Louis
MISSOURI
Ozark Mts.
KANSAS
OKLA.
Cairo
Cumberland R.
TENNESSEE
Tennessee R.
ARKANSAS
LITTLE ROCK
Ohio R.
Mississippi R.
Birmingham
ALABAMA
GEORGIA
Vicksburg
JACKSON
MONTGOMERY
Alabama R.
Mobile
Okefinokee Swamp
Jacksonville
BATON ROUGE
TALLAHASSEE
Pensacola
FLORIDA
LOUISIANA
Houston
New Orleans
Galveston
C. Canaveral
Tampa
Everglades
C. Sable
Key West
Florida Strait
BAHAMA ISLANDS
TROPIC OF CANCER
HAVANA
CUBA
GULF OF MEXICO
ATLANTIC OCEAN
90
80
70
50
40
30
20

## THE SURVEY

Congress in 1785 adopted the ordinance according to which all public lands are surveyed. This provided for certain parallels of latitude to be called **base lines** and certain meridians of longitude known as **principal meridians.** The intersection of a base line with a principal meridian is the starting point for surveys.

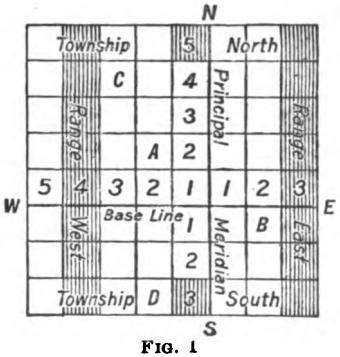



FIG. 1

**Townships** are numbered north and south from the base line, and **ranges** east and west from the principal meridian. A range is a row of townships, each of which is 6 miles square.

1. *A* in Fig. 1 is described as Township 2 North, Range 2 West; *B* is described as Township 1 South, Range 2 East.

2. Describe *C* and *D*.

## THE TOWNSHIP

A **township** (Fig. 2) is 6 miles square according to western survey and contains 36 **sections** of **1 square mile** or **640 acres** each. The sections of a township are numbered from 1 to 36, beginning in the northeast, running across the upper tier of sections, then from west to east on the section below, and thus back and forth.

A TOWNSHIP

| | | | | | |
|---|---|---|---|---|---|
| 6 | 5 | 4 | 3 | 2 | 1 |
| 7 | 8 | 9 | 10 | 11 | 12 |
| 18 | 17 | 16 | 15 | 14 | 13 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 30 | 29 | 28 | 27 | 26 | 25 |
| 31 | 32 | 33 | 34 | 35 | 36 |

FIG. 2

A SECTION

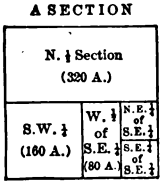



FIG. 3

Figure 3 represents a section or one of the 36 regular divisions of a township. The northern half is a half section, the southwestern quarter is a quarter section, and the other divisions are 80 acres and 40 acres. If the section is No. 10, the half section is

described as the North (N.) $\frac{1}{2}$ of Section 10; the quarter section is described as the Southwest (S.W.) quarter of Section 10; and the other divisions as represented on the diagram.

3. Select a township in the land survey and a section in the township. Locate 40 acres by means of a diagram of a section and write the description.

4. Make a diagram of a section and locate the following described piece of land: S.W. $\frac{1}{4}$ of the S.W. $\frac{1}{4}$ of Section 11, Township 7 N., Range 6 W.

5. A man sold the N.E. $\frac{1}{4}$ of the S.W. $\frac{1}{4}$ and the S.E. $\frac{1}{4}$ of the S.W. $\frac{1}{4}$ for \$87.50 per acre. How much did he receive for the land? How many acres did he sell? Make a diagram showing the location of the property.

6. A man bought the E. $\frac{1}{2}$ of the S.W. $\frac{1}{4}$ and the S.W. $\frac{1}{4}$ of the N.E. $\frac{1}{4}$ of Section 7. He paid \$70 per acre. How much land did he buy and how much did it cost him?

7. Describe the location of your schoolhouse. Draw a diagram showing the location.

8. Describe the portion of a section marked 1 in Fig. 4. What is its value at \$67.50 per acre?

9. Describe the tract marked 2. How many tons of alfalfa will it produce at $3\frac{1}{4}$ tons per acre for the season's crop?

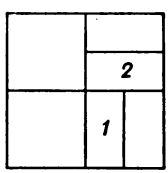


FIG. 4

## MEASURING LAND

**160 square rods = 1 acre.**

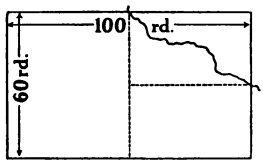
1. The school ground contains 1 acre. It is 10 rods wide; what is its length? Draw the plot and locate the school building in the center of it. Use a scale in making the drawing.

NOTE. — Have pupils construct some form of chain for measuring land; have them measure two or three tracts, make diagrams, give descriptions, and compute the acreage.

2. How many acres are there in a tract of land whose width is 80 rods and whose length is the same?

3. How many acres are there in a tract of land whose length is 160 rods and whose width is the same?

4. How many acres are there in a piece of wheat land whose width is 40 rods and whose length is the same?



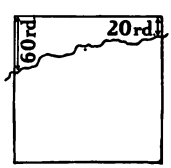

5. A farmer has a piece of land divided by a stream; the length of the field is 100 rd., the width is 60 rd. The stream intersects the field at the center of one end and passes out at the center of the side; the stream approximately evens to a straight line. How many acres are there on each side of the stream?

SOLUTION. — (60 × 100) sq. rd. = 6000 sq. rd., total area.

$\left(\frac{50 \times 30}{2}\right)$ sq. rd. = 750 sq. rd. = $4\frac{1}{8}$ A. in the triangle at the right of the stream.

(6000 − 750) sq. rd. = 5250 sq. rd. = $32\frac{3}{8}$ A. at the left of the stream.

6. A farm of 160 A. in the form of a square is cut by a stream which enters 20 rd. south from the N.E. corner and leaves the field 60 rd. south from the N.W. corner; the stream averages a straight line; the north tract is pasture. How many acres does it contain?




SOLUTION. — $\frac{60 + 20}{2} \times 160$ sq. rd. = 6400 sq. rd. = 40 A.

**7.** A piece of land is 60 rd. long. How wide a strip must a man plow who plows 3 A.?

**8.** How many acres of land are there in a section and how much is it worth at $30 per acre? How many acres are there in a township according to the western survey, and how much is it worth at $30 per acre?

**9.** If the roadway is 60 ft. and is taken from the adjacent property, what is the loss to a farm owner who holds the S.E. $\frac{1}{4}$ of a section valued at $87 per acre?

**10.** A speculator bought a section of land in a western state for $4.75 per acre. He sold it for $18 per acre. How much did he make by the transaction and what was his per cent of gain?

**11.** The roadway in a certain state is 66 ft. wide and is taken from the adjacent property. How much land is taken off one section for roadways? Make a diagram in a field book.

**12.** A man owns the N.E. $\frac{1}{4}$ of the S.E. $\frac{1}{4}$ and the S.E. $\frac{1}{4}$ of the N.E. $\frac{1}{4}$ of Section 12. What is the width of his farm? What is its length? How many acres does it contain? Make a diagram showing the location of the two divisions.

**13.** How many acres are there in the farm plotted in Fig. 1? How many acres are there in each division?


FIG. 1

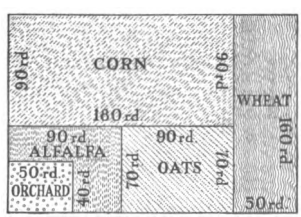



FIG. 2

**14.** How many acres are there in the farm plotted in Fig. 2? How many acres are there in each division?

# LABOR, MACHINERY, AND CROPS

## SCIENTIFIC AGRICULTURE

The following table shows the yield of corn in experiment stations as compared with the average yield raised by ordinary agriculture. Find in each case the per cent of increase due to scientific agriculture :

| | Average Number of Bushels by Ordinary Agriculture | Number of Bushels in Experiment Stations | Per Cent of Increase |
|---|---|---|---|
| 1. Arkansas . . . . | 20.8 | 32.9 | ? |
| 2. Florida . . . . . | 14.6 | 30.9 | ? |
| 3. Georgia . . . . . | 16 | 39.2 | ? |
| 4. Louisiana . . . . | 18.5 | 28.6 | ? |
| 5. Mississippi . . . | 19 | 32.4 | ? |
| 6. North Carolina . . | 18.4 | 42.6 | ? |
| 7. Oklahoma . . . | 18 | 46.3 | ? |
| 8. South Carolina . . | 18.2 | 39.2 | ? |
| 9. Tennessee . . . . | 26.8 | 46.6 | ? |

10. The average yield of corn in a certain year in nine southern states was 18.9 bushels, while the average yield in the agricultural experiment stations was 37.6 bushels. Find the per cent of gain over the yield by ordinary agriculture.

11. A farmer who has an 80-acre field of corn which, under ordinary methods, yields 42.5 bushels per acre, by applying scientific methods at an additional cost of $2.20 per acre increases his yield 40 %. What is his profit on the field if corn is worth 56¢ per bushel?

## RELATION OF EDUCATION TO LABOR INCOME

DATA COLLECTED FROM 573 FARMS

(Cornell Bulletin 295)

| EDUCATION | NUMBER OF FARMERS | LABOR INCOME |
|---|---|---|
| Attended district school . . . | 398 | $318 |
| Attended high school . . . . | 165 | 622 |
| Attended college . . . . . | 10 | 847 |

1. Using the data in the above table, find the difference in the annual income of a farmer who has attended high school and one who has not.

2. If a man has 40 years of active service before him when he leaves school, what will be the total money value in his life of his high school education?

3. If a man with a high school education is able to earn from his increased capacity $304 a year more than the farmer who attended a district school only, this added income will represent an annual investment in 6 % mortgages of what amount? ($304 is 6 % of what sum?)

4. If the length of the high school course is 180 days in a year and covers a period of 4 years, what will be the value in a man's lifetime of each school day if he lives for 41 years after graduation?

5. According to the above table, how much more does the man with some college training receive than the man with only a high school education?

6. If the yearly income of the college man on the farm is $225 in excess of that of the man with a high school education, what will be the amount of this excess in 36 years?

7. Find the investment in 4 % bonds at par necessary to produce an annual income of $225.

8. If a young man with some college education earns $529 per year more than a man with a district school education, what is the total amount of his added capacity in 40 years?

9. What investment in 4 % bonds at par will $529 annual income represent?

10. Based on problem 8, counting 4 years for high school at 180 days each and the same for college education, find the value of each day of higher education.

## FARM SALES

1. An auctioneer is paid 1 % of the sales, which amount to $4265.50. What is his commission?

2. The terms of a sale are 2 % off for cash, or 6 % interest due in 6 months. A man buys a cow for $75. How much will the cow cost if he pays cash? if he pays at the maturity of the note?

3. According to the terms of a sale all sums under $10 must be paid in cash; all over that amount will be discounted 6 % for cash. Which is better, and how much, to bid $9.50 for a plow, or $10.50 and get the discount?

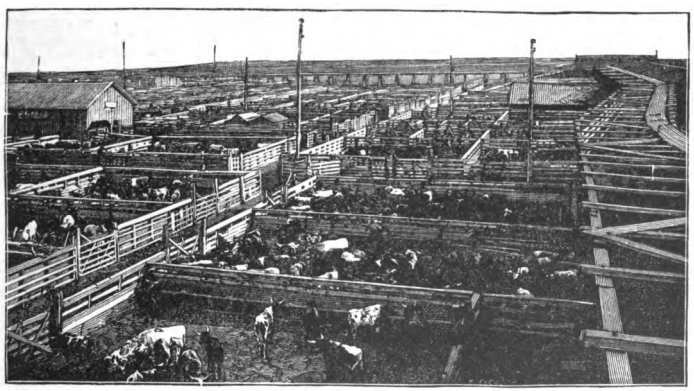
4. A farmer, when his sale was over, had $3000 in notes bearing 6 % interest due in 1 yr. He found a banker who would discount the paper at 6 %. What were the net proceeds of the sale?

SOLUTION. — 6 % of $3000 = $180, interest; $3000 + $180 = $3180, amount discounted. 6 % of $3180 = $190.80, discount; $3180 − $190.80 = $2989.20, proceeds.

**5.** A sale resulted as follows:

350 bu. of corn at $.42 a bushel.
18 T. of hay at $10 a ton.
6 Horses averaging $135 each.
14 Cows averaging $62 each.
26 Pigs at $8 each.
1 Wagon, $43.
1 Buggy, $60.
1 Harness, $6.
1 Corn planter, $30.
1 Set harness, $20.

The farmer paid the auctioneer $10 and 1 % commission, and the clerk $10. He discounted at 6 % his paper, due in 1 yr. at 6 % interest. How much did he realize?



STOCKYARD

**6.** A crib of corn 9 ft. wide, 10 ft. high, and 16 ft. long was sold by measure at 46 ¢ per bushel (4300 cu. in. to the bushel). The sale was discounted at 7 %. How much did the crib bring? Payment was made by a note due in 1 yr. at 6 % interest, which was discounted at 6 %. Find the proceeds of the note.

7. A farm sale amounted to $2875; clerk hire cost $20, the auctioneer $5 and 1% of sales; and a free luncheon $10. How much did the farmer realize from the sale?

8. At a farm sale the following property was sold: 1 horse at $142, 1 horse at $116.50, 1 horse at $154, 2 cows at $61 each, 1 cow at $54, 3 calves at $20 each, 12 pigs at $11 each, 300 bu. of corn at 51¢ per bushel, 1 wagon at $36, 1 carriage at $80, farm machinery amounting to $135, and 15 tons of hay at $11 per ton. If the auctioneer charged $1\frac{1}{4}$%, and the clerk $15, what were the net proceeds of the sale?

## CROP STATISTICS

1. During a certain year there were 94,011,000 acres of corn in the United States; the average yield was 28.8 bu. How many bushels were raised and what was its value at the average price of 41.2¢ a bushel?

2. The acreage of wheat in the United States for a certain year, according to the annual report of the Department of Agriculture, was 47,557,000; the number of bushels produced was 664,602,000. What was the yield per acre?

3. Using the data in problem 2, what was the value of the wheat crop at the average farm price of 92.8¢ per bushel?

4. If it cost $6 per acre to produce the wheat crop of the country, what was the profit to the farmers, based on problems 2 and 3?

5. In a certain year the total number of acres planted to corn in the United States was 101,788,000; the average yield per acre was 26.2 bu. What was the production of corn?

6. The value of the oats crop in the United States in a certain year on 35,000,000 acres was $381,171,000; the farm price was $.472 a bushel. What was the total number of bushels produced? If it cost $9.40 per acre, including rent for the land, to produce the crop, what was the profit to the farmer?

7. The acreage of hay for a certain year in the United States was 46,486,000; the farm value was $635,423,000, and 70,798,000 tons were produced. What was the yield per acre, and what was the price per ton?

8. The wheat crop of the world for a recent year was 3,181,115,000 bu. During the same year the United States produced 664,602,000 bu. What per cent of the world's crop was produced by the United States?

PRINCIPAL CROPS IN THE UNITED STATES FOR ONE YEAR

| CROP | ACREAGE | BUSHELS, TONS, BALES | FARM VALUE DECEMBER 1 |
|---|---|---|---|
| Corn (Bushels) . . . | 105,825,000 | 2,531,488,000 | $1,565,258,000 |
| Wheat (Bushels) . . . | 49,543,000 | 621,338,000 | 543,063,000 |
| Oats (Bushels) . . . | 37,763,000 | 922,298,000 | 414,663,000 |
| Rye (Bushels). . . . | 2,127,000 | 33,119,000 | 27,557,000 |
| Barley (Bushels) . . . | 7,627,000 | 160,240,000 | 139,182,000 |
| Buckwheat (Bushels) . | 833,000 | 17,549,000 | 12,735,000 |
| Hay (Tons) . . . . | 43,017,000 | 47,444,000 | 694,570,000 |
| Potatoes (Bushels) . . | 3,619,000 | 292,737,000 | 233,778,000 |
| Flaxseed (Bushels) . . | 2,757,000 | 19,370,000 | 35,272,000 |
| Cotton (Bales) . . . | 30,938,000 | 11,963,962 | 820,320,000 |

9. Find from this table the value of the corn per bushel, the yield per acre, and the farm value of the yield per acre.

**10.** Find the price per bushel, the yield per acre, and the value per acre of the wheat crop of the United States.

**11.** Find the price per bushel, the yield per acre, and the value per acre of the oats.

**12.** Find the price per bushel, the yield per acre, and the value per acre of the rye crop.

**13.** Find the same items concerning the barley and the buckwheat crops.

**14.** Find the number of tons of hay produced per acre, the cost per ton, and the value of the hay per acre.

**15.** Find the price per bushel, the yield per acre, and the value per acre of the potato crop.

CORN FIELD

**16.** Find the price per bushel, the yield per acre, and the value per acre of the flaxseed crop.

**17.** Find the production of cotton per acre, the price per bale, and the value per acre.

**18.** Compare the value per acre of each of the above crops and rank them in the order of their value.

PLOWING

## LABOR PROBLEMS

1. How long will it take a man and a team to plow a field 90 rods long and 70 rods wide, plowing 3 acres per day; and how much will it cost at $1.75 per acre?

2. How long will it take a man and a team to harrow the above field, lapping the harrow half, at 12 acres per day; and how much will it cost at 35¢ per acre?

NOTE. — "Lapping the harrow half" is the same as harrowing twice.

3. How long will it take a man and a team to plant a field of corn containing 70 acres at 15 acres per day; and how much will it cost at 65¢ per acre?

4. A man cultivates 7 acres of corn per day. How long will it take him to cultivate 85 acres of corn; and how much will it cost at the rate of $4 per day for man and team?

5. A farmer raised 65 acres of corn which averaged 48 bushels to the acre. How much will it cost to gather it at 3¢ per bushel?

6. How much will it cost to market 3120 bu. of shelled corn if a man and a team cost $4 per day, and 2 loads of 52 bu. each can be hauled per day?

**7.** A farmer plants 45 acres of small grain. What is the cost per acre of production figured from the following data?

Seed wheat, 1½ bu. per acre at 70¢ per bushel.
Seeding, 55¢ per acre.
Disking, 35¢ per acre.
Harrowing, 42¢ per acre.
Harvesting, $1.25 per acre.
Stacking, $15.
The wheat yields 22 bu. per acre and costs 6¢ per bushel for threshing.
Marketing, 4¢ per bushel.

**8.** In the above problem the farmer sold his wheat for 62¢ per bushel. Did he gain or lose, and how much?

**9.** If the land cost $65 per acre, what was the farmer's per cent of profit on the wheat land?

**10.** The following is an account kept by a farmer with one of his farm laborers. How much was due John Doe at settlement December 15, 1915?

JOHN DOE LABOR ACCOUNT

Commenced work March 1, 1915, at $28 per month and board.

| | | | | | |
|---|---|---|---|---|---|
| 3/15/15, | Cash | $ 8.00 | 4/1/15, | Wages for March | $28.00 |
| 4/15/15, | Cash | 25.00 | 5/1/15, | Wages for April (Idle 18th to 21st inc., acct. sickness) | |
| 5/1/15, | Cash | 20.00 | | | |
| 6/10/15, | Cash | 12.00 | | $\frac{23}{31}$ mo. | 23.69 |
| 7/1/15, | Cash | 15.00 | 6/1/15, | Wages for May | 28.00 |
| 8/16/15, | Cash | 30.00 | 7/1/15, | Wages for June | 28.00 |
| 10/1/15, | Cash | 10.00 | 8/1/15, | Wages for July (Idle 1st to 6th inc.) | |
| | | | | $\frac{26}{31}$ mo. | 21.55 |
| | | | 9/1/15, | Wages for August | 28.00 |
| | | | 10/1/15, | Wages for Sept. | 28.00 |
| | | | 11/1/15, | Wages for Oct. | 28.00 |
| | | | 12/1/15, | Wages for Nov. | 28.00 |
| | | | 12/15/15, | Wages for Dec. | |
| | | | | ½ mo. | 14.00 |

NOTE. — Count 26 working days to the month. For time between dates, consult a calendar, omitting Sundays. If a 1916 calendar is not at hand, the number of days in Ex. 11–15 may be found by subtracting the Sundays.

**11.** A farm hand worked from March 15 to July 3, 1916, inclusive. How many days did he work? (16 Sundays.)

**12.** A farm hand began work April 1, 1916, and quit at the close of December 23, 1916. How much did he earn during that time at $28 per month? (38 Sundays.)

**13.** A man employed as a farm hand began work January 6, 1916, and quit at the close of December 11, 1916. Find how much he earned at $30 per month. (49 Sundays.)

**14.** A farm hand began work March 1, 1916, but lost 11 days. He was paid $30 April 1, $10 May 10, $20 July 7. How much was due him at the close of August 3, 1916, with wages $30 per month? (22 Sundays.)

**15.** A man working at $25 per month began May 12, 1916; he lost $11\frac{1}{2}$ days; he had drawn $36.50. How much was due him at the close of August 15, 1916? (14 Sundays.)

**16.** A man is offered $1.75 per day at a job in town where he must pay $18 a month for board; he is also offered work in the country at $30 per month and board. Which is the better offer and how much better, allowing 26 working days to the month in both cases?

**17.** Which is the better offer and how much, $30 per month and board, or $10 per week and an expense of $3.50 per week for board, allowing $4\frac{2}{7}$ weeks to the month?

**18.** A man is paid 3¢ per bushel (70 lb.) for husking corn. How much does he earn in one week with loads as follows?

| | | |
|---|---|---|
| Monday | A.M. | Gross 3600 lb.; wagon 1200 lb. |
| Monday | P.M. | Gross 3700 lb.; wagon 1200 lb. |
| Tuesday | A.M. | Gross 3650 lb.; wagon 1200 lb. |
| Tuesday | P.M. | Gross 3570 lb.; wagon 1200 lb. |

| | | | |
|---|---|---|---|
| Wednesday | A.M. | Gross 3820 lb.; | wagon 1200 lb. |
| Wednesday | P.M. | Gross 3750 lb.; | wagon 1200 lb. |
| Thursday | A.M. | Gross 3650 lb.; | wagon 1200 lb. |
| Thursday | P.M. | Gross 3730 lb.; | wagon 1200 lb. |
| Friday | A.M. | Gross 3450 lb.; | wagon 1200 lb. |
| Friday | P.M. | Gross 3680 lb.; | wagon 1200 lb. |
| Saturday | A.M. | Gross 3500 lb.; | wagon 1200 lb. |
| Saturday | P.M. | Gross 3200 lb.; | wagon 1200 lb. |

HUSKING AND LOADING CORN

**19.** A farm hand husking corn for 3¢ per bushel finds that he husked 800 bushels in October, 1500 bushels in November, and 1740 bushels in December. How much is due him at the close of his labor?

**20.** A carpenter was employed on a country residence at $3.50 per day; he worked 26 days in April and 26 days in May and was charged 60¢ per day for board for 61 days. How much was due him at the close of his work?

## COST OF FARM PRODUCTION

The accompanying table is taken from the reports of the Bureau of Statistics of the Department of Agriculture and is based upon the experiments of the Minnesota Experiment Station.

In the table the land is valued at $70 an acre and 5% is charged as rental; man labor, $.12 to $.13½ an hour, and horse labor $.09¼ an hour; a general expense of $1 an acre is charged. Adjust to local conditions.

COST PER ACRE OF CORN

| | |
|---|---|
| Seed | $ .226 |
| Shelling seed | .026 |
| Plowing | 1.311 |
| Harrowing | .544 |
| Planting | .240 |
| Cultivating | 1.806 |
| Husking | 1.456 |
| Machinery cost | .549 |
| Land rent | 3.500 |
| General expenses | 1.000 |
| | $10.658 |

1. How much does it cost to produce 60 acres of corn?

2. How much corn, at 42¢ per bushel, is it necessary to raise in order to pay expenses on 60 acres?

3. Shelling seed, plowing, harrowing, planting, cultivating, and husking represent labor items. What is the amount thus expended?

4. Counting the above cost of production, what is the profit on 55 acres of corn, with an average yield of 23.9 bushels per acre, valued at 61.8 cents per bushel?

5. If the average yield of corn is 27.7 bu. @ 48¢, what is the profit per acre?

6. What is the labor cost in producing 75 acres of corn? Include shelling seed, plowing, harrowing, planting, cultivating, and husking.

7. What is the cost of seed for a field of 49½ acres?

8. How much does it cost to plow and plant 65 acres?

9. If corn husking is worth 4¢ per bushel, how much does a man earn in husking 42 acres, the average yield being 38¾ bushels per acre?

**10.** Find the gain or loss on 50 acres of corn which yield $23\frac{1}{2}$ bushels per acre worth 55¢ per bushel, the cost of production being $9.85 per acre.

**11.** If it costs $10.658 to produce an acre of corn, find the loss or gain on 35 acres which yield 18 bushels per acre, selling for 58¢ per bushel.

**12.** What is the cost of seed, machinery, rental, and general expenses in producing 50 acres of corn?

COST PER ACRE OF WHEAT.

| | |
|---|---|
| Seed | $1.05 |
| Seeding | .55 |
| Disking | .35 |
| Harrowing | .42 |
| Harvesting | 1.25 |
| Stacking | .60 |
| Threshing | 1.00 |
| General expenses | 1.00 |
| 5 % on land @ $ 70 | 3.50 |
| Insurance per acre | .60 |
| | $10.32 |

The accompanying estimate is taken from investigation throughout the central west and represents a fair average. The depreciation of machinery is included in the general expenses of $1. The estimate of labor includes man and horse labor.

**13.** In one year the average yield of wheat in the United States was 13.9 bushels per acre, while the average farm price was 88.3 cents per bushel. What was the profit per acre?

**14.** The average yield of wheat in a recent year was 15.4 bushels per acre, and the average farm price 98.6 cents. Find the profit per acre.

**15.** Find the profit per acre on a yield of 22.25 bu. of wheat per acre at 87.4 cents per bushel.

**16.** If corn raising costs $10.658 per acre and wheat $10.32, which proved a better crop when the average yield of corn was 26.2 bushels with an average farm price of 60.6 cents, and wheat averaged 14 bushels and sold at 92.8 cents?

**17.** If the expense of raising oats is the same as that of raising wheat, what profit was there in an oats crop with an average yield of 24.4 bu. and a price of 45 cents per bushel?

**18.** The rye crop for one year averaged 16 bushels per acre, with a farm value of 71.5 cents per bushel. Find the profit if the cost of production was the same as that of wheat.

**19.** Find the profit in a barley crop of 7,607,000 acres which averaged 21 bushels per acre, with a farm value of 86.9 cents per bushel, the cost of production being $10 per acre.

**20.** What would be the profit on 75 acres of corn; data as in problem 16?

**21.** What would be the profit on 75 acres of wheat; data as in problem 15?

**22.** What would be the profit on 75 acres of barley; data as in problem 19?

**23.** If disking cost 35¢ per acre and harrowing 42¢ per acre, find the cost of disking and harrowing 80 acres.

**24.** If it costs $10.32 per acre to produce wheat, find the loss or gain on 100 acres of wheat yielding 16 bu. per acre and selling for 92¢ per bushel.

**25.** If it costs $10.32 per acre to produce wheat, find the loss or gain per acre on a field of 32 acres yielding 14 bushels per acre and selling for 95¢ per bushel.

**26.** From the table on p. 56 find the cost of harvesting, stacking, and threshing 45 acres of wheat.

**27.** Which is the more profitable crop, corn at a cost of $10.658 per acre, yielding 38 bu. per acre worth 53¢ per bushel, or wheat at a cost of $10.32 per acre, yielding 16 bu. per acre worth 88¢ per bushel?

**28.** Find the net gain or loss on 25 A. of wheat which yield 21 bu. per acre worth 97¢ per bushel if, in addition to the cost of $10.32 per acre, twenty 10-hour days of labor were put upon the field in hauling fertilizer at 21½¢ per hour for man labor and 13¢ each for 2 horses.

PICKING COTTON

## COTTON RAISING

COST PER ACRE OF COTTON

| | |
|---|---|
| Rental . . . . . | $ 4.00 |
| Labor . . . . . | 11.625 |
| 5 % depreciation of machinery and team . . . . | .70 |
| Ginning, etc. . . . | .658 |
| Seed and incidentals | 1.28 |
| | $ 18.263 |

Owing to the extent of cotton growing in the United States, it forms one of our leading industries. In computing the following problems, use the accompanying table on cost of production.

**1.** What is the value of the cotton produced on 40 acres, if they yield 17 500-pound bales of cotton and 8 tons of seed, the cotton reckoned at 12.25 cents per pound and the seed at $ 16 per ton?

**2.** Find the profit in the above crop per acre if it costs $ 18.263 per acre to produce it.

**3.** A field of 30 A. of cotton yields 1114 lb. of seed cotton per acre. What is the expense of picking the crop at 50 ¢ per hundred pounds?

4. In a recent year the acreage of cotton in the United States was 30,938,000, which produced 10,386,000 500-pound bales; the value of the cotton was $688,350,000. Find the average yield in pounds per acre and the price per bale.

5. In a recent year the United States produced 4,462,000 long tons of cottonseed valued at $123,740,000. What was the price per long ton?

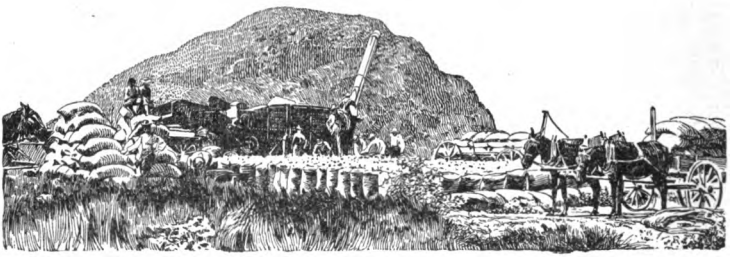
6. In a recent year the acreage of cotton in the United States was 30,938,000 and the total value of cotton and cottonseed was $812,090,000. What was the value of the crop per acre?

7. Using the data in the table and in problem No. 6, what was the profit per acre?

8. A field of 35 A. of cotton yields 1216 lb. of seed cotton per acre. If cotton pickers pick 130 lb. per day, how long will it take 10 pickers to pick the cotton and how much will each earn at 50¢ per hundred pounds?

9. Farms A and B of 55 acres each lie side by side. Farm A produces 23 500-pound bales of cotton and 11 T. of seed. Farm B adds to the cost of production $7 per acre for fertilizer and produces 33 500-pound bales and 16 T. of seed. The market value of the cotton is $11\frac{1}{4}$ cents per pound, and of the seed $17 per ton. What is the profit due to fertilizing the crop on Farm B?

10. A tenant pays $3.50 rental per acre for 20 A. of land. His yield is 14 bales of cotton of 500 lb. each, worth $.10$\frac{3}{4}$ per pound, and $5\frac{1}{2}$ tons of seed worth $16.50 per ton. His expenses are $180 for fertilizer, $75 for labor, $1.55 per bale for ginning and bagging. How much does he get for his own labor and profit?



THRESHING WHEAT

## DEPRECIATION OF MACHINERY

1. What is the value of a threshing outfit after being operated 3 years, if the original cost was $2100 and the depreciation averages 12% per year of the original cost?

2. What is the value of a harness which cost $18, if it has been used 4 years and the depreciation averages 8.72% per annum?

3. What should be the value of a set of harness after being used 2 years, the original cost being $46 and the annual depreciation 6.17%?

4. What is the value of a mower which was bought for $50 and has been used 3 years if the annual depreciation is 7.08%?

5. Find the value of a binder that has been used 2 years, its original cost being $155 and the annual depreciation being estimated at 7.91%.

6. Find the value of a wagon which has been used 7 years, its original cost being $70 and the estimated annual depreciation being 5.2%.

7. Find the value of a drill which cost $80 and has been used 5 years if the estimated annual depreciation is 7.32%.

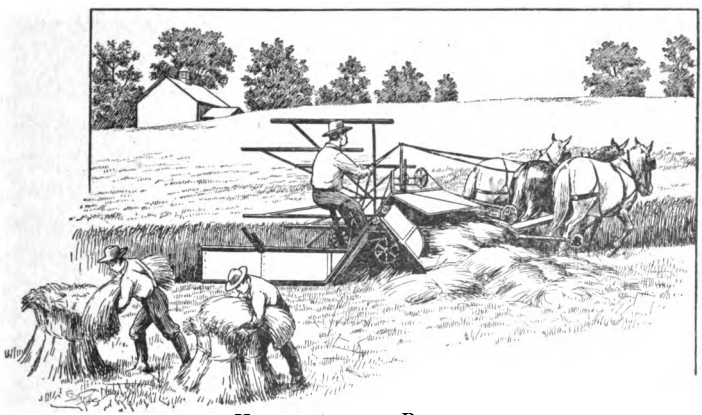
**8.** Find the estimated value of a cultivator which originally cost $32 if it has been used 2 years and the annual depreciation is 7.25%.

**9.** Find the value of a hay rake which cost $30 if it has been used 3 years and the annual depreciation is 7.76%.

NOTE. — The **duty** of farm machinery is the number of acres a machine will work in one day. With an ordinary draft a machine 1 ft. wide will cover about $1\frac{1}{2}$ acres per day.

**10.** How much work will be accomplished in one day by a 16-inch plow?

**11.** How much work will be accomplished in one day by an 18-inch plow?



HARVESTER AND BINDER

**12.** If the duty of machinery is $1\frac{1}{2}$ A. to the foot, how many acres can be cut in one day by a 9-foot binder?

**13.** If the duty of a machine is $1\frac{1}{2}$ A. to the foot, how long will it take two 16-inch plows to turn a 40-acre field?

**14.** If a mower will cut $1\frac{1}{2}$ A. to each foot of its blade, how many acres will be cut in one day by three 7-foot machines?

**15.** In plowing across a 40-acre field in the form of a square, how far will a 4-horse team travel in one day with an 18-inch plow performing the average duty of the plow, that is, $1\frac{1}{2}$ acres per foot in a day?

**16.** How many acres can be covered in one day by a 12-foot harrow, if the harrow is lapped one half and performs the usual duty of the machine?

**17.** A self-binder costs $150. It is estimated that the annual cost of interest, housing, oil, depreciation, etc. is 20 %; the machine is owned by a farmer having 120 acres of wheat. What is the annual cost of the self-binder per acre of wheat?

**18.** What is the annual cost of a self-binder per acre to a farmer who raises 30 acres of small grain, counting the annual cost of interest, depreciation, housing, etc. at 20 %, and the original cost of the machine at $150?

**19.** If a self-binder costs $135, and its depreciation, interest, etc. is 20 % annually, is it cheaper for a man who raises 30 acres of small grain to own a machine or to hire one at $1.25 per acre? (If the man owns the machine he should be credited with $4 per day for himself and team while cutting. It is estimated that he can cut 8 acres per day.)

**20.** Computing machinery to cost as follows, figuring interest at 7 %, depreciation at 8 %, housing, oil, etc. at 5 % a year, what is the per acre cost of machinery on an 80-acre farm?

| | |
|---|---|
| Wagon and harness | $122.50 |
| Walking plow | 14.00 |
| Cultivator | 22.00 |
| Corn planter | 50.00 |
| Seeder | 60.00 |
| Binder | 140.00 |
| Mower | 32.00 |
| Hay rake | 24.00 |
| Disk and harrow | 30.00 |

## SPECIAL ESTIMATES

When convenient, pupils should watch a field of grain throughout the season, making notes on every phase of crop growing, including preparation of seed bed, planting, precipitation, growth, and harvesting. Examine grain in the field to verify estimates. In reality the yield will fall short of the estimate. Study the cause of the shortage: faulty seed bed, poor seed, insects, weather conditions, and other causes.

1. Make a pasteboard box which will contain 1 cu. in. Fill this box with wheat, estimating the number of grains required and then counting them. (Multiply this number by 2150.42, the number of cubic inches in a bushel, in order to estimate the number of grains a bushel will contain.)

2. Weigh an ounce of wheat; count the grains; multiply by 16, the number of ounces in a pound; then by 60, the number of pounds in a bushel; compare the result with the estimate above. If several pupils make these estimates, have them compare notes and take the average as a working basis.

3. Taking these measures as a unit, find how many grains of wheat it will require to make one bushel.

4. If it requires $1\frac{1}{2}$ bu. to seed an acre of wheat, and only 90 % of the wheat grows, how many wheat plants will an acre contain?

5. If 90 % of the seed grows, how much space will each wheat plant occupy?

NOTE. — Pupils may use their own methods of investigation on such problems.

6. If each plant sends out an average of 6 shoots, how many heads of wheat will an acre produce?

7. If it were possible to produce a perfect yield and each head contained 36 grains, what fold of increase would result?

**8.** By the methods above given for finding the number of wheat grains in a bushel, find the number of grains in a bushel of barley.

**9.** How many grains of corn are there in a bushel?

**10.** If there are 48 lb. in a bushel of barley and 90 lb. are seeded to one acre and 90 % of the seed grows, how many barley plants will there be to the acre?

**11.** If each barley plant stools 8 straws and each straw contains a head with 72 grains, what will be the yield per acre?

**12.** If there are 9 rows of corn 80 rods long to the acre, the hills being 4 feet apart and each containing 3 grains, how many plants will there be to the acre with a perfect yield?

**13.** What portion of a bushel of corn will it require to plant one acre?

**14.** If each stalk produces one ear and 100 ears average 1 bushel, what will be the yield per acre?

**15.** If but $66\frac{2}{3}$ % of the seed grows, what is the loss per acre?

**16.** What is the money loss per acre in a field where only $66\frac{2}{3}$ % grows, and yields are valued at 62 cents per bushel?

**17.** What will be the loss in a field of 80 acres?

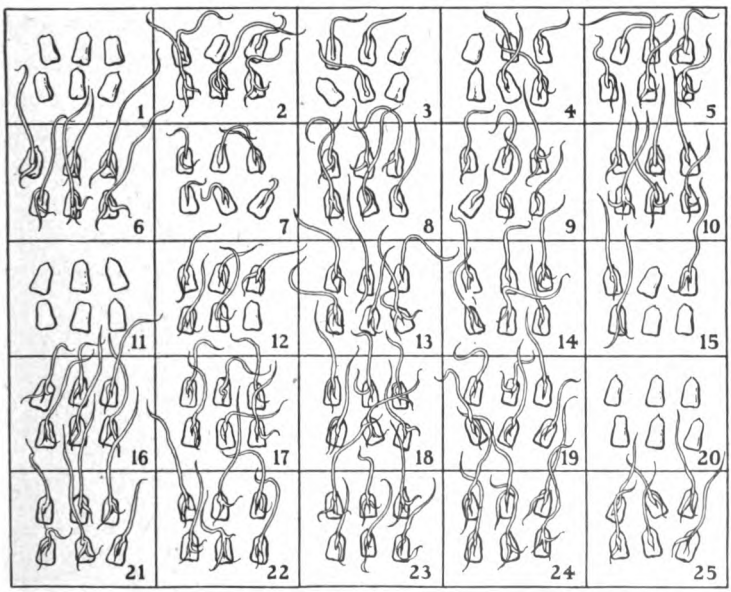
**18.** How much corn will it require to plant 10 acres?

**19.** Using the data of the above investigation, what will be the cost of the seed necessary to plant 80 acres of corn at 75 ¢ per bushel?

**20.** What is the money loss per acre if only 85 % of the seed grows, and the corn at harvest is worth 54 ¢ per bushel?

NOTE. — Real tests of seed may be made and per cents computed therefrom. Take a shallow box. Place therein some sand or earth; over this place plain white muslin marked off into squares of any size

desired. Place thereon seeds, all pointing in the same direction; cover with some strong cloth, over which place sawdust, sand, or soil. The whole should be kept moist and in moderately warm temperature. When the grain has begun to sprout, remove the cover and compute per cents.




Numbers 1, 11, and 20 of the figure show total failure, and, if planted, would bring heavy loss to the farmer.

**21.** Numbers 2 and 12 show 1 bad seed to 5 good ones. What would be the per cent of loss if planted?

**22.** If the yield is 35 bu. to the acre with seed from Nos. 2 and 12, what would it be with seed from Nos. 5, 6, 7, 8, 9, 10, 13, 14, 16, 17, 18, 19, 21, 22, 23, 24, and 25, all of which show perfect tests?

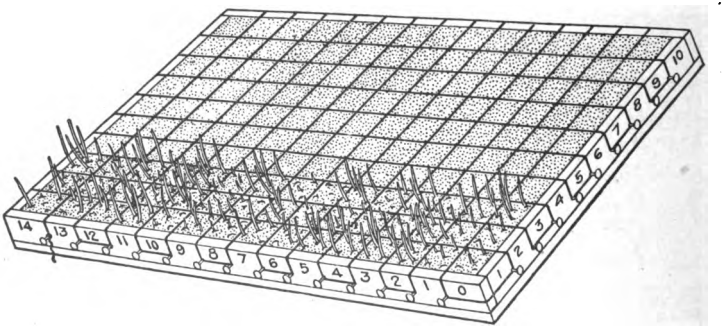
**23.** What would be the loss per acre at 56.4 cents per bushel with seed from No. 2 or 12, on the basis of problem 22?

**24.** What would be the loss on a field of 80 acres planted with seed from No. 2 or 12, on the basis of problems 22 and 23?

**25.** Numbers 3 and 15 show 3 good and 3 bad grains; what is the per cent of bad grains? In what part of a stand would such planting result?

**26.** No. 4 shows 2 bad and 4 good grains. What is the per cent of bad grains? If corn in the same neighborhood planted from seed with perfect test, averaged 42 bu. per acre, what yield could reasonably be expected from seed planted from test No. 4?

NOTE. — Some ingenious pupil may take pleasure in constructing a tray like that shown in the accompanying figure.



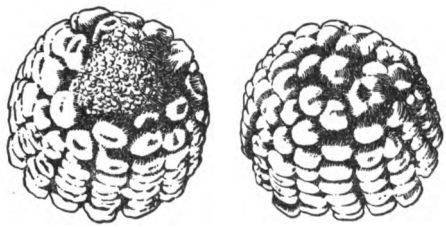
**27.** Estimate the number of kernels lacking in one row of the sample ear shown in Fig. 1, p. 67, as compared with Fig. 2.

**28.** Estimate the number of kernels on the ear shown in Fig. 2, counting 16 rows on the ear.

**29.** Estimate the number of kernels the ear shown in Fig. 1 would contain if well filled. (16 rows.)

**30.** What per cent of corn is lost on the ear of corn represented in Fig. 1 over a well-filled ear such as that shown in Fig. 2?

**31.** If Fig. 2 represents a perfect ear, what will be the margin of profit on an acre of corn which yields 46 bu. planted from such seed over an acre of corn planted from seed of No. 1, corn being worth 52¢ per bushel, and the seed yielding after its kind?



**32.** Using the data above determined, find the loss per acre with poorly filled ears of corn, if the average yield is 40 bu. per acre.

**33.** A farmer had two fields of 40 A. each. One field contained corn similar to that shown in Fig. 1, and yielded 36 bu. per acre; the other field contained corn similar to that shown in Fig. 2. What should be the yield of the latter and the gain at 50¢ per bushel?

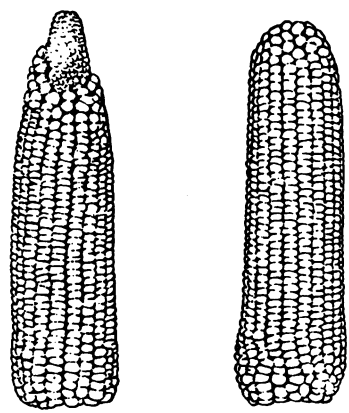


FIG. 1 FIG. 2

Figure 1 represents poorly selected seed; the kernels do not extend well to the point of the ear. Contrast this ear of corn with that shown in Fig. 2, which shows good breeding.

NOTE. — Observe the different types of cob shown in Fig. 3. Much profit may be lost in seed corn poorly selected relative to the type of cob the ear contains.

**34.** Measure the diameter of A and B, representing cross sections of the ear. It will be observed that the sections are of the same diameter. Measure the diameter of the smaller circles representing the cob. Find the per cent of loss of B over A.

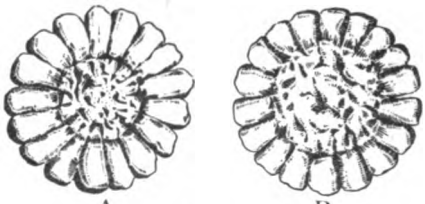



FIG. 3

**35.** What will be the loss in 1 acre of corn bearing 40 bu. with cobs like B in Fig. 3, compared with A?

**36.** What will be the money loss on 80 acres of such corn as in *B* with an average yield of 40 bu. per acre, if corn is worth 48 ¢ per bushel?

## FRUIT RAISING

PICKING APPLES

This is one of the important industries of the United States, as will be seen by the following table taken from the reports of the Department of Agriculture, Bureau of Statistics :

FRUIT GROWING IN THE UNITED STATES

| FRUIT | NUMBER OF BEARING TREES | BUSHELS | VALUE |
|---|---|---|---|
| Apples . . . . . | 151,322,840 | 147,522,318 | $83,231,492.00 |
| Peaches, nectarines . . | 94,507,000 | 35,470,276 | 28,781,078.00 |
| Plums, prunes . . . . | 23,445,000 | 15,480,170 | 10,299,495.00 |
| Pears . . . . . | 15,171,524 | 8,840,733 | 7,910,600.00 |
| Cherries . . . . . | 11,822,044 | 4,126,099 | 7,231,160.00 |
| Citrus fruits . . . . . | 11,486,768 | 23,502,122 | 22,711,448.00 |

1. Referring to the table, tell what was the average yield per apple tree in bushels. Find the average income from each apple tree.

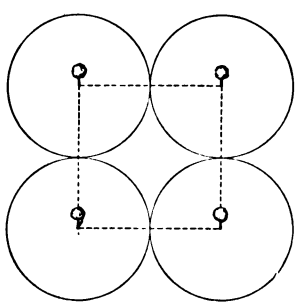
2. What was the yield of each peach or nectarine tree, and the income per tree?

3. What was the yield of each cherry tree, and the value of the fruit per bushel?

4. Find the yield of each pear tree, and the value of the fruit per bushel.

5. Find the yield of each plum tree, and the value of the fruit per bushel.

6. What was the value of the six kinds of fruit during the year?



This figure represents apple planting 30 ft. apart each way, the usual method of planting. However, there is much waste land in the center as is shown by the space between the circles.

**To find the number of trees to the acre planted according to the square system 30 ft. apart:**

Suppose the trees are planted 30 ft. apart each way; then (30 × 30) sq. ft. = 900 sq. ft., the area allotted to each tree. There are 43,560 sq. ft. in 1 A.; hence, the number of trees

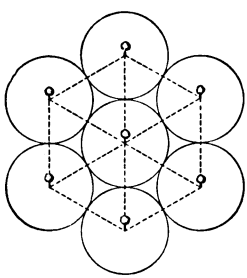
that may be planted according to this method 30 ft. apart = 43,560 sq. ft. ÷ 900 sq. ft. = 48.

*Divide 43,560, the number of square feet in an acre, by the square of the distance apart in feet.*

USUAL DISTANCE FOR TREE PLANTING

| FRUIT | FEET APART |
|---|---|
| Apples | 30 to 40 |
| Pears | 10 to 15 |
| Plums | 16 to 20 |
| Peaches | 16 to 20 |
| Cherries | 16 to 25 |

7. How many apple trees planted 35 feet apart can be planted on 1 acre according to the square system?



8. Find the number of pear trees that may be planted 12 ft. apart on 1 acre according to the square system.

NOTE. — The **hexagonal system** of tree planting is rapidly coming into use, as it utilizes much more of the available space in the orchard. With this system all but 10 per cent of the ground is used. If trees are planted 30 ft. apart, the hexagonal system allows 55 trees to the acre.

9. How many apple trees 30 ft. apart may be planted on 5 acres according to the hexagonal system?

10. If an apple orchard is planted 40 trees to the acre and each tree produces $2\frac{1}{4}$ boxes of fruit valued at \$ 2.25 per box and the cost of gathering and shipping is 85 ¢ per box, what is the profit per acre?

**11.** If each cherry tree on an acre of trees planted 16 ft. apart (square system) produces 14 qt. of cherries valued at $12\frac{1}{2}$ ¢ per quart, what is the yield and what are the gross receipts?

**12.** An apple orchard has 48 trees and each tree produces $1\frac{3}{4}$ bu. which sell at 85 ¢ net. Find the value of the land if this crop will yield 10 % on the investment.

**13.** A five-acre apple orchard yields $1\frac{1}{4}$ boxes of fruit per tree and averages 40 trees per acre. Find the net income of the orchard, if it costs $2.50 per acre for water, $70 for labor, 62 ¢ per box for freight, and 5 % of the selling price for commission. The apples bring $2 per box.

**14.** Find the annual profit in the following estimates:

INVENTORY OF FRUIT RANCH

| | |
|---|---|
| 15 A. at $400 per acre | $6000.00 |
| 1 Small house | 1200.00 |
| 1 Barn | 450.00 |
| 1 Storage building | 200.00 |
| Team, wagon, and horses | 400.00 |
| Implements | 150.00 |
| Automobile | 700.00 |
| Spraying outfit | 150.00 |

PROBABLE EXPENSES

| | |
|---|---|
| Interest on investment, | $462.50 |
| Depreciation, repairs, insurance, etc. | 125.00 |
| Taxes | 90.00 |
| Fertilizers | 70.00 |
| Incidentals | 50.00 |
| Help | 600.00 |
| Water for irrigating at $1.50 per acre | 22.50 |

PROBABLE RETURNS

| | |
|---|---|
| 10 A. peaches | $900.00 |
| 3 A. plums | 320.00 |
| 2 A. cherries | 264.00 |
| Small fruit planted in orchard | 228.00 |

**15.** If peach trees planted 20 ft. apart bear an average of $1\frac{3}{8}$ bu. valued at $.90 per bushel, how much greater is the income per acre by the hexagonal system of planting than by the square system? (Allow 108 trees to the acre, square system, and 128 trees to the acre, hexagonal system.)

**16.** If an acre accommodates 108 peach trees planted 20 ft. apart by the square system, what is the value of the crop of peaches averaging $\frac{3}{4}$ bu. per tree and worth 80¢ per bushel?

**17.** If an acre accommodates 128 peach trees planted 20 ft. apart on the hexagonal plan, what is the profit over the square plan if the trees yield an average of $1\frac{1}{8}$ bu. and the fruit is valued at 85¢ per bushel?

**18.** What is the income on a 10-acre peach orchard containing 120 bearing trees per acre averaging $1\frac{3}{8}$ bu. per tree at 90¢ per bushel?

**19.** What is the income from an acre of cherry trees containing 106 bearing trees if the trees produce an average of 21 qt. and the cherries sell for $2.50 per bushel? Find the income from 10 A.

**20.** What is the value of 3 A. of plums if the orchard contains 100 bearing trees per acre, the trees averaging 27 qt. valued at $1.10 per bushel?

The trees in the first column on p. 73 were sprayed for bitter rot with Bordeaux mixture, and the trees in the second column were unsprayed. Find in each case what per cent of the total fruit produced was sound.

| | Sprayed Trees | | Unsprayed Trees | |
|---|---|---|---|---|
| | *Sound Apples* | *Diseased Apples* | *Sound Apples* | *Diseased Apples* |
| **21.** | 1278 | 144 | | |
| **22.** | 1563 | 253 | | |
| **23.** | 1394 | 17 | | |
| **24.** | | | 3 | 1270 |
| **25.** | | | 135 | 1670 |
| **26.** | | | 50 | 1298 |

**27.** Two apple trees each bore 2500 apples. In the sprayed tree 95% of the fruit was sound and in the unsprayed tree 12%. How many sound and diseased apples did each tree produce?

**28.** An orchard of 200 trees was sprayed with a mixture of 40 lb. of bluestone at 8¢ a pound and 40 lb. of lime at ½¢ per pound. Find the cost of the mixture.

**29.** It took half a day for four men and a team to spray the trees once. Find the cost of the labor at $1.25 a day each for the men and $2 a day for the team.

**30.** Find the total cost of material and labor for spraying the 200 trees once.

**31.** Find the cost per tree for material and labor for one spraying; for 3 sprayings.

**32.** If the material for spraying a tree four times costs 13¢ and the labor 15¢, what is the cost of spraying an orchard of 100 trees?

**33.** When the cost of spraying trees is estimated at 28¢ each, find the net gain on an orchard of 100 trees, if each tree will produce 2 bu. more by spraying, apples selling for 80¢ per bushel?

**34.** In an orchard of 300 trees, the total cost of spraying per tree was 24¢; the income per tree from the sprayed trees was $2.35 and from the unsprayed trees $.81. What was the net gain per tree allowing for the cost of spraying? What was the total net gain on the 300 trees?

# FEEDING PROBLEMS

## MEASURE OF CAPACITY

**To find the number of bushels of grain in a bin:**

*Divide the number of cubic inches in the bin by 2150.42, the number of cubic inches in a bushel.*

Or, for all practical purposes:

*Diminish the number of cubic feet in the bin by one fifth.*

**To find the amount of bin room necessary to hold a given number of bushels:**

*Multiply the number of bushels by the number of cubic inches in a bushel, 2150.42, and divide the product by 1728, the number of cubic inches in a cubic foot.*

Or, for all practical purposes:

*Increase the number of bushels by one fourth.*

**To find the number of bushels of ear corn in a crib:**

*Divide the number of cubic inches in the crib by 4300.84.*

Or, for all practical purposes:

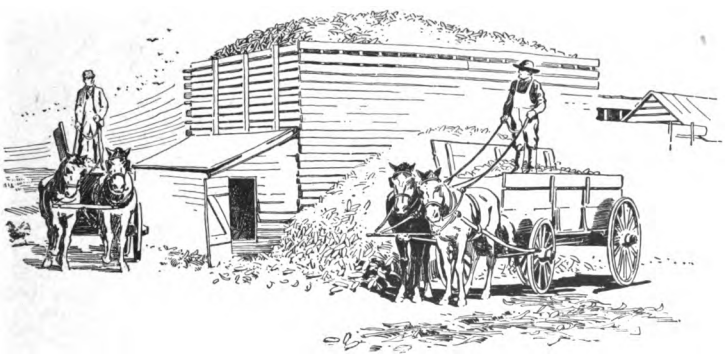
*Find the number of cubic feet in the crib and take two fifths of it; the result will represent the number of bushels in the crib.*

### COLLECTING DATA

Where conditions will permit have pupils measure a wagon box for the purpose of getting the width, the length, and the depth.

Have pupils measure bins at home and bring the data to school for the use of the class; also cribs of corn.

The regular lesson should be so assigned and the work should be done in such a manner that all that is required is to check results. The problems should be solved in a field book and the work checked at the beginning of the recitation. The teacher should be so familiar with the results of this work that the checking will require but a few minutes of



FILLING CORN CRIB

time. If any difficulties in the solution of the problems are encountered by the pupils, the first duty of the teacher is to clear them away, after which the time of the recitation may be spent with the data collected and with the solution of these original problems.

This original work will constitute a very valuable feature of arithmetic, as it not only gives a practical aspect to the teaching of the subject, but brings the pupil in actual contact with life materials. Much will depend upon the teacher in systematizing the data collected. This work will also constitute a form of laboratory instruction, which will increase the pupil's power to observe and will give him a greater grasp of affairs.

1. How many bushels of wheat will a bin hold if it is 16 ft. long, 12 ft. wide, and 8 ft. high? (Solve by both methods.)

NOTE. — In the following examples, find the *approximate* number of bushels or cubic feet, according to the second rule for each case given on page 74.

2. The capacity of a car is 36,000 lb. How many bushels of wheat will it hold and what is its value at 72¢ per bushel?

3. The average wagon box is 10 ft. long and 3 ft. wide. How many bushels of wheat will it hold if it is 24 in. high?

4. How many bushels of shelled corn will a bin hold that is 24 ft. long, 10 ft. wide, and 9 ft. high?

5. How many bushels of ear corn are there in a wagon whose box is 10 ft. long, 3 ft. wide, and 32 in. high?

6. How many bushels of ear corn are there in a round slat crib whose diameter is 16 ft. and whose height is 12 ft.?

SUGGESTION. — $(3.1416 \times 8^2 \times 12)$ cu. ft. = ? cu. ft.

7. How many bushels of ear corn are there in a two-section round slat crib whose diameter is 16 ft. and each section 8 ft. high?

8. What will be the weight of a bin filled with oats if it is 14 ft. long, 10 ft. wide, and 7 ft. high? (1 bu. oats weighs 32 lb.)

9. A workman husked three loads of corn in one day; the box was 10 ft. × 3 ft. × 26 in. What was his day's gathering?

10. A workman husked four loads of corn in one day; the box was 10 ft. × 3 ft. × 48 in. How much did he earn at 3¢ per bushel?

**11.** How many bushels of ear corn are there in a full crib 24 ft. long, 12 ft. wide, 9 ft. high on one side, and 12 ft. on the other?

SUGGESTION. — $\left(24 \times 12 \times \frac{9+12}{2}\right)$ cu. ft. = ? cu. ft.

**12.** How much shelled corn can be shipped in a car that is 36 ft. long, 8 ft. wide, and is filled $4\frac{1}{2}$ ft. deep? How much will it bring at 60¢ per bushel?

**13.** A farmer found that he could haul 4 loads of wheat to market in one day. His wagon was 10 ft. × 3 ft. × 30 in. It required five days for him to market his crop. How much wheat did he raise?

**14.** What will be the difference in weight between a wagon box 10 ft. × 3 ft. × 30 in. filled with wheat and the same box filled with oats?

**15.** What will be the difference in weight between such a wagon box filled with oats and the same box filled with barley? (1 bu. barley weighs 48 lb.)

**16.** How many pounds of shelled corn will an ordinary wagon box 32 in. deep contain? (1 bu. shelled corn weighs 56 lb.)

**17.** What is the capacity of a bin $13\frac{1}{2}$ ft. long, 10 ft. wide, and $7\frac{1}{2}$ ft. deep?

**18.** What is the capacity of a corn crib $15\frac{1}{2}$ ft. long, 10 ft. wide, and $9\frac{1}{2}$ ft. high?

**19.** A crib of ear corn is made up of two cribs, one on each side of a driveway. Each crib is 32 ft. long, 10 ft. wide, 9 ft. high on the outside and 11 ft. high on the inside. How many bushels does the whole contain? Make a diagram of the end of this crib and mark thereon the dimensions.

**20.** What is the value of the corn in the crib mentioned in problem 19 at 42¢ per bushel?

Estimate the number of bushels of grain that can be stored in each of the following bins:

21. $8' \times 8' \times 12'$
22. $10' \times 6' \times 16'$
23. $9' \times 7' \times 14'$
24. $10' \times 6' \times 20'$
25. $8'\,6'' \times 7'\,6'' \times 14'$
26. $9\frac{1}{2}' \times 8\frac{1}{2}' \times 13\frac{1}{2}'$
27. $9.5' \times 7.5' \times 12'$
28. $8' \times 6'\,6'' \times 11'\,6''$

Estimate the number of bushels of ear corn that can be stored in each of the following cribs:

29. $12' \times 9' \times 16''$
30. $12' \times 8' \times 14'$
31. $10' \times 9' \times 18'$
32. $9\frac{1}{2}' \times 8' \times 20'$
33. $9' \times 7'\,6'' \times 24'$
34. $9\frac{1}{2}' \times 8' \times 36'$
35. $9' \times 9'\,6'' \times 16''$
36. $10' \times 10' \times 20'$

## CAPACITY OF TANKS, CISTERNS, ETC.

For measuring the capacity of tanks, cisterns, reservoirs, etc., an approximation is usually sufficiently accurate. Since there are 231 cu. in. in a gallon and 1728 cu. in. in a cubic foot, it will be found that 1 cu. ft. will hold 7.48 gal., or approximately $7\frac{1}{2}$ gal. In the following problems, count $7\frac{1}{2}$ gal. to 1 cu. ft.

1. Find the number of gallons in a tank $6' \times 4' \times 2'$.

2. How many gallons of oil are there in a tank car $9'$ in diameter and $24'$ long?

3. What is the capacity of a cistern $12'$ in diameter and $16'$ deep?

4. How many gallons of water will a street sprinkler carry if it is $6'$ in diameter and $10'$ long? What is the gross

weight of the load if the wagon weighs 1800 lb.? (1 cu. ft. of water weighs $62\frac{1}{2}$ lb.)

SUGGESTION. — Area of base = 3.1416 × square of radius; capacity = area of base × length.

$$3.1416 \times 3^2 \times 10 \times 7\tfrac{1}{2} = \text{number of gallons.}$$

$$(3.1416 \times 9 \times 10 \times 62\tfrac{1}{2} \text{ lb.}) + 1800 \text{ lb.} = \text{gross weight.}$$

5. How many gallons will a standpipe hold if it is 14′ in diameter and 60′ high?

6. Find the capacity of a rectangular tank 4′ × 4′ × 12′.

7. Find the capacity of a tank 6′ 6″ × 3′ 6″ × 2′.

8. How many gallons of cream are there in a shipment of 30 cans, each can 16″ in diameter and 24″ high?

9. How much oil is there in a can 8″ in diameter and 12″ high?

10. What is the capacity of a locomotive water tank 9′ × 6′ × 20′?

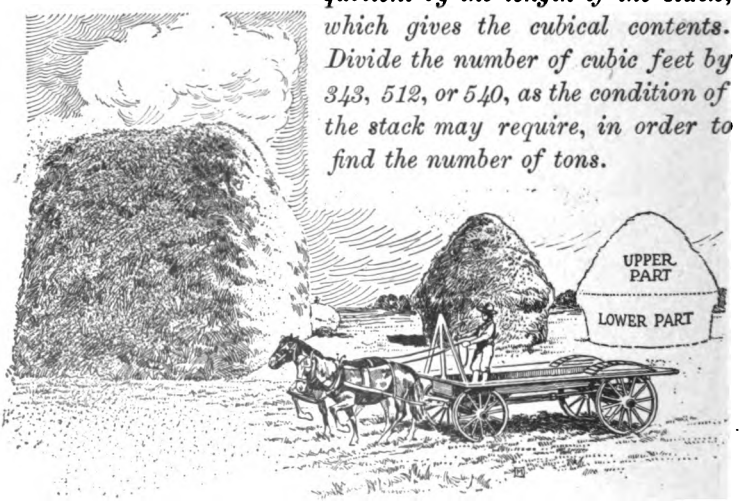
NOTE. — Have pupils measure one or two tanks and make a sketch in a field book, computing from data thus obtained. If there is a standpipe in the vicinity, let them ascertain its dimensions and compute its capacity in gallons.

## HAY MEASURE

The rules for measuring hay in the stack vary according to the quality of the hay, the character of the stack, and the length of time it has been stacked. In measuring prairie hay or alfalfa that has been stacked a month, it is usual to take an 8-foot cube, or 512 cu. ft., for a ton. When the hay has been stacked several months, a 7-foot cube, or 343 cu. ft., is taken for a ton. In measuring hay on the wagon or in new stacks, 540 cu. ft. may be used.

The method of measuring a stack depends upon its shape and size. For a long stack or rick it is usual to throw a line over the stack, measuring the distance from the bottom on one side to the bottom on the other.

*It is best to measure two or three places and take the average. Add to this the average width of the stack and divide by 4; this equals one side of the square. Multiply the square of the quotient by the length of the stack, which gives the cubical contents. Divide the number of cubic feet by 343, 512, or 540, as the condition of the stack may require, in order to find the number of tons.*




HAY STACKS

NOTE. — For small, low ricks, with "over" less than twice the width, the rule is to *subtract the width from the "over" and divide by* 2. *Multiply by the width and this product by the length of the stack.*

There is no established rule for measuring round stacks, but the following will approximate the contents of the conical stack :

*Find the average circumference of the lower part of the stack; find the height of the lower part from the ground and the slant height of the upper part to the top of the stack. Multiply the*

*square of the circumference by .08; then multiply the result by the height of the lower part plus $\frac{1}{3}$ of the slant height of the upper part.*

The hay in the round stack is usually much less compact than in a rectangular stack; for this reason it is well to calculate *512 cu. ft. per ton.*

Relative to hay measurements, many and varied practical problems may be secured in almost every community. It is a good plan to have pupils ascertain or estimate the amount of hay in the stack before computing by measurement; this will be a means of cultivating accurate observation, which is valuable. In many instances farmers will have scales and will weigh the stack as they dispose of it. If there should be an opportunity to compute by measurement before weighing, it will greatly increase the value of the computation. Although the only accurate test is weighing, for all practical purposes an estimate of such bulky materials will be sufficient.

The teacher should not be content with fictitious problems, but should make use of as many real problems as it is possible to collect. Fictitious problems are useful only in the theory of the computation, and in large measure lose their value after the principle involved is understood. If the pupil goes out into the farmyard or the meadow and measures a stack, makes his notations, and computes according to these notations, the whole process acquires life value.

1. Find the number of tons of hay in a circular stack whose average circumference is 48 ft., the height of the lower part being 8 ft., and the slant height of the upper part 12 ft. (512 cu. ft. per ton.)

2. How much hay is there in an alfalfa stack which has stood over winter, the width of the stack being 16 ft., the "over" 36 ft., and the length $28\frac{1}{2}$ ft.? (343 cu. ft. per ton.)

3. How much wild hay is there in a new stack whose width is $14\frac{1}{2}$ ft., the "over" $32\frac{1}{2}$ ft., and the length $36\frac{1}{2}$ ft.? (540 cu. ft. per ton.)

4. How much wild hay is there in a stack which has stood 30 da. if the width is 15 ft., the mean "over" 35 ft., and the length 42 ft.? (512 cu. ft. per ton.)

5. Find the value of the stack in Ex. 4 at $7.50 per ton.

6. How much hay can be hauled on a hay rack which is 7 ft. wide and 12 ft. long, the standards to the top of which the hay can be loaded being $7\frac{1}{2}$ ft.? (540 cu. ft. per ton.)

7. How many loads of 630 cu. ft. each will it require to build a stack 29 ft. long, 14 ft. wide, and 40 ft. "over"?

8. Find the cost of the above stack at $9.50 per ton.

9. Find the value of a circular stack whose average circumference is 42 ft., the height of the lower part being 11 ft., and the slant height of the upper part 14 ft., hay being valued at $9 per ton. (512 cu. ft. per ton.)

10. How many bales of 100 lb. each can be made from a rick of hay 36 ft. long if the width is 14 ft. and the mean "over" 36 ft.? (343 cu. ft. per ton.)

11. If convenient, measure a stack of hay; make diagram and careful notes of the measurements. How many tons does it contain, and how much is it worth at the prevailing price?

12. Estimate the number of acres of hay yielding 1.2 T. per acre, necessary to produce a stack 32 ft. long, 13 ft. wide, and having a mean "over" of 28 ft. (540 cu. ft. per ton.)

### Value of Hay as Food

| | Per 100 lb. |
|---|---|
| Working horse | 3.08 lb. |
| Fatting oxen | 2.40 lb. |
| Milch cows | 2.40 lb. |
| Young growing cattle | 3.08 lb. |
| Sheep | 3.00 lb. |

This table shows the amount of hay or its equivalent **per day** required by each **100 lb.** of live weight of various animals.

**13.** Find from the table how much hay will be required to feed a team of horses for one year, each horse weighing 1200 lb.

**14.** If the grass season is from May 1 to October 1, how much hay will be required to feed a cow during the season (210 da.) when grass is not available, the weight of the cow being 800 lb.?

**15.** How many tons of hay should a farmer put up in order to feed 4 horses for one year, the horses weighing as follows: 1100 lb., 1300 lb., 1400 lb., and 1400 lb.?

**16.** How many tons of hay should a farmer reserve for 365 da., if he has 3 horses averaging 1300 lb. and 6 growing cattle averaging 750 lb.?

PUTTING HAY IN BARN

**17.** If hay is valued at $9 per ton, how much will it cost to provide hay for a team of horses for one year, if the weight of the team is 2500 lb.?

**18.** What will be the cost, at $9 per ton, of providing hay for 4 horses, each weighing 1200 lb., and 6 cows averaging 800 lb., the horses requiring hay the year round and the cows from grass season to grass season? (In the central United States the grass season is about 6 mo.)

19. How much hay will 1000 sheep eat in 30 da., if each sheep weighs 200 lb.?

20. How much will it cost to purchase the hay required in problem 19 at $10 per ton?

21. How much hay will 100 head of fattening cattle require for one month, if they average 1000 lb. each, and how much will it cost at $8.50 per ton?

22. How much more will it cost to keep a two-year-old weighing 600 lb. for 6 mo. than to keep a milch cow weighing 750 lb. for the same time, if hay is worth $9.25 per ton?

23. What is the cost of sufficient hay at $10.50 per ton to keep a team of work horses for a year, each horse weighing 1400 lb.?

24. How much will it cost to keep 12 young cattle in hay for 210 da. at $9.75 per ton, the average live weight being 600 lb.?

25. How many acres of meadow yielding 1.5 T. per acre should a farm contain, to support the year round 6 horses averaging 1200 lb., and for 180 da. 8 cows averaging 800 lb., and 12 young cattle averaging 500 lb.?

26. How many acres of upland meadow yielding .8 T. per acre must a farm contain to support the year round 3 horses weighing 1100 lb. each, and for 180 da. 4 cows weighing 700 lb. each?

## THE SILO

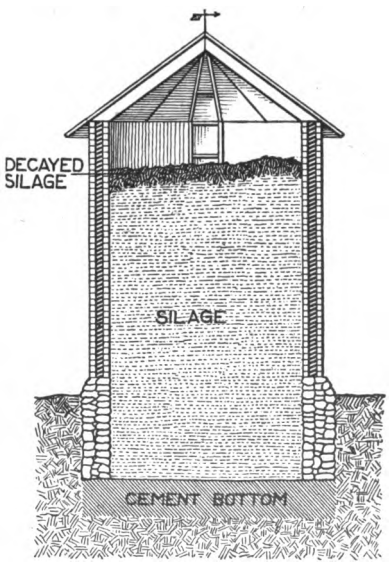
A **silo** is an air-tight chamber or tank, usually above ground, in which is stored green succulent food to feed during the winter or during the hot, dry summer months.

**DATA**

Corn yields about 10 T. to 15 T. per acre.
Average ration for cattle is 40 lb. daily.
One ton of silage occupies about 50 cu. ft.
Silos range from 10 ft. to 18 ft. in diameter.
The height of silos is from 20 ft. to 36 ft.
The size of the silo depends upon the size of the herd.
The cost of filling the silo is estimated at 56 ¢ per ton.

**1.** What is the capacity of a silo whose diameter is 10 ft. and whose height is 20 ft.?

SOLUTION. — Capacity = area of base times height ($3.1416 \times 5^2 \times 20$) cu. ft. = 1570.8 cu. ft.




**2.** What is the capacity, in tons, of a silo whose diameter is 12 ft. and whose height is 22 ft.?

SUGGESTION. — Divide the number of cubic feet by 50.

**3.** If a cow requires 40 lb. of ensilage per day, how many tons will it take to keep her 180 da., or from grass until grass?

**4.** If corn averages 12 T. per acre, how many acres will it require to fill a silo 12 ft. in diameter and $25\frac{1}{2}$ ft. high?

**5.** If a cow requires 3.6 T. of ensilage in 6 mo., how many cattle will a silo 12 ft. in diameter and $25\frac{1}{2}$ ft. high support for 6 mo.? (Omit decimal in answer.)

6. Each 100 lb. of silage contains 20.9 lb. of dry matter, 0.9 lb. of protein, 11.3 lb. of carbohydrates, and 0.7 lb. of fat. Find the amount of each of these elements in 40 lb. of silage.

7. At 56¢ per ton (50 cu. ft.), how much will it cost to fill a silo 10 ft. in diameter and 20 ft. high?

8. At 60¢ per ton, how much will it cost to fill a silo 12 ft. in diameter and 28 ft. high?

9. When corn yields 12 T. of ensilage per acre, how many acres are required to feed 16 cows 90 da., if each cow requires 40 lb. of ensilage per day?

10. How much will it cost to fill a silo whose diameter is 12 ft. and whose height is 24 ft. if the labor of filling costs 56¢ per ton? How many acres will be required to fill this silo if 1 A. of corn yields 10 T. of ensilage?

11. If a silo has a diameter of 12 ft., what must be its height in order to hold 75 T.?

12. Find the difference in capacity in tons between two silos, one 14 ft. in diameter and 28 ft. high, the other 16 ft. in diameter and 22 ft. high.

13. Find the difference in capacity in tons between two silos, one 12 ft. in diameter, round, and 26 ft. high, the other 15 ft. square and 26 ft. high.

## FEEDING STANDARDS

CORN

| | |
|---|---|
| Dry matter | 89.4 lb. in 100 lb. |
| Protein | 7.8 lb. in 100 lb. |
| Carbohydrates | 66.7 lb. in 100 lb. |
| Fat | 4.3 lb. in 100 lb. |

1. If corn contains 89.4 lb. of dry matter in 100 lb., how much dry matter is contained in 6 lb.? How much protein is there in 6 lb. of corn if 100 lb. contain 7.8 lb.? How many pounds of car-

bohydrates are there in 6 lb. of corn if 100 lb. contain 66.7 lb.? How much fat is there in 6 lb. of corn if 100 lb. contain 4.3 lb.?

NOTE. — Find the amount of dry matter, etc. in 1 lb. by dividing by 100, that is, by *moving the decimal point two places to the left.* Multiply this result by the number of pounds.

SOLUTION. — 6 × .894 lb. = 5.364 lb. *dry matter* in 6 lb. corn.
6 × .078 lb. = .468 lb. *protein* in 6 lb. corn.
6 × .667 lb. = 4.002 lb. *carbohydrates* in 6 lb. corn.
6 × .043 lb. = .258 lb. *fat* in 6 lb. corn.

**2.** Find the dry matter and each of the nutritive elements in 4 lb. of shelled corn.

OATS

| | |
|---|---|
| Dry matter | 89.0 lb. in 100 lb. |
| Protein | 9.2 lb. in 100 lb. |
| Carbohydrates | 47.3 lb. in 100 lb. |
| Fat | 4.2 lb. in 100 lb. |

WHEAT BRAN

| | |
|---|---|
| Dry matter | 88.1 lb. in 100 lb. |
| Protein | 12.2 lb. in 100 lb. |
| Carbohydrates | 39.2 lb. in 100 lb. |
| Fat | 2.7 lb. in 100 lb. |

COTTONSEED

| | |
|---|---|
| Dry matter | 89.7 lb. in 100 lb. |
| Protein | 12.5 lb. in 100 lb. |
| Carbohydrates | 30.0 lb. in 100 lb. |
| Fat | 17.3 lb. in 100 lb. |

**3.** Find the dry matter and each of the nutritive elements in 6 lb. of oats.

**4.** Find the dry matter and each of the nutritive elements in 4 lb. of oats.

**5.** Find the dry matter and each of the nutritive elements in 6 lb. of wheat bran.

**6.** Find the dry matter and each of the nutritive elements in 4 lb. of wheat bran.

**7.** Find the dry matter and each of the nutritive elements in 4 lb. of cottonseed.

**8.** Find the dry matter and each of the nutritive elements in 2 lb. of cottonseed.

TIMOTHY HAY

| | |
|---|---|
| Dry matter | 86.8 lb. in 100 lb. |
| Protein | 2.8 lb. in 100 lb. |
| Carbohydrates | 43.4 lb. in 100 lb. |
| Fat | 1.4 lb. in 100 lb. |

ALFALFA HAY

| | |
|---|---|
| Dry matter | 91.6 lb. in 100 lb. |
| Protein | 11.0 lb. in 100 lb. |
| Carbohydrates | 39.6 lb. in 100 lb. |
| Fat | 1.2 lb. in 100 lb. |

**9.** Find the amount of dry matter in 20 lb. of timothy hay.

**10.** Find the amount of each of the nutritive elements in 20 lb. of timothy hay.

**11.** Find the amount of dry matter in 18 lb. of alfalfa.

**12.** Find the amount of each of the nutritive elements in 18 lb. of alfalfa.

**13.** Find the amount of each of the nutritive elements in 18 lb. of alfalfa, 20 lb. of cottonseed, and 12 lb. of bran.

**14.** Find the amount of each of the nutritive elements in 8 lb. of corn, 6 lb. of oats, and 18 lb. of timothy.

**15.** Find the amount of each of the nutritive elements in a bushel of oats.

**16.** Find the amount of each of the nutritive elements in a bushel of corn.

**17.** Compare the amount of each of the nutritive elements in 50 lb. of corn and 50 lb. of oats.

**18.** Compare the amount of each of the nutritive elements in 100 lb. each of timothy and alfalfa hay.

**19.** Compare the amount of each of the nutritive elements in 100 lb. of bran and 100 lb. of cottonseed.

**20.** Compare the amount of each of the nutritive elements in 20 lb. of oats and 20 lb. of cottonseed.

**21.** Find the amount of each of the nutritive elements in 10 lb. each of corn, oats, bran, and alfalfa.

AVERAGE DRY AND DIGESTIBLE MATTER IN SOME FEEDING MATERIALS

| | Dry Matter in 100 lb. | Digestible Matter in 100 lb. | | |
|---|---|---|---|---|
| | | Protein | Carbohydrates | Fat |
| | lb. | lb. | lb. | lb. |
| Wheat | 89.5 | 10.2 | 69.2 | 1.7 |
| Cottonseed meal | 91.8 | 37.2 | 16.9 | 12.2 |
| Cowpeas | 85.2 | 18.3 | 54.2 | 1.1 |
| Cane molasses | 77.2 | | 65.9 | |
| Corn silage | 20.9 | 0.9 | 11.3 | .7 |
| Corn and cob meal | 84.9 | 4.4 | 60.0 | 2.9 |
| Red clover hay | 84.7 | 6.8 | 35.8 | 1.2 |
| Dried brewery grains | 91.8 | 15.7 | 36.3 | 5.1 |
| Wheat middlings (shorts) | 87.9 | 12.5 | 53.0 | 3.4 |
| Corn stover, no ears | 77.2 | 2.8 | 42.3 | .7 |
| Oat hay cut in milk | 85.0 | 5.0 | 33.0 | 1.4 |
| Corn meal | 85.0 | 6.2 | 65.2 | 3.5 |

## HORSES

The standard balanced ration for a horse of 1000 lb. weight, moderately worked, is, according to the Louisiana Experiment Station Bulletin No. 115: dry matter, 21.0 lb.; protein, 1.7 lb.; carbohydrates and fat, 11.8 lb.

**22.** Find the value as a ration of 13 lb. of timothy hay, 4 lb. of oats, and 4 lb. of corn.

SOLUTION.—

13 lb. TIMOTHY HAY

13 × .868 lb. = 11.284 lb. dry matter.
13 × .028 lb. = .364 lb. protein.
13 × .434 lb. = 5.642 lb. carbohydrates.
13 × .014 lb. = .182 lb. fat.

4 lb. OATS

4 × .890 lb. = 3.560 lb. dry matter.
4 × .092 lb. = .368 lb. protein.
4 × .473 lb. = 1.892 lb. carbohydrates.
4 × .042 lb. = .168 lb. fat.

4 lb. Corn

4 × .894 lb. = 3.576 lb. dry matter.
4 × .078 lb. = .312 lb. protein.
4 × .667 lb. = 2.668 lb. carbohydrates.
4 × .043 lb. = .172 lb. fat.

Hence the ration:

| | Pounds Dry Matter | Pounds Protein | Pounds Carbohydrates | Pounds Fat |
|---|---|---|---|---|
| Timothy hay . . 13 lb. | 11.284 | .364 | 5.642 | .182 |
| Oats . . . . . 4 lb. | 3.560 | .368 | 1.892 | .168 |
| Corn . . . . 4 lb. | 3.576 | .312 | 2.668 | .172 |
| | 18.420 | 1.044 | 10.202 | .522 |

Note. — In comparing carbohydrates and fat with the standard, add $2\frac{1}{4}$ times the number of pounds of fat to the carbohydrates.

There is not sufficient quantity of any of these elements. Change the hay to 18 lb. and try the ration.

Note. — If the ration of a horse of 1000 lb. weight is made up of dry matter 21 lb., protein 1.7 lb., and carbohydrates and fat 11.8 lb., a horse of 1200 lb. weight would require $\frac{200}{1000}$ or $\frac{1}{5}$ more, while a horse of 800 lb. would require $\frac{1}{5}$ less.

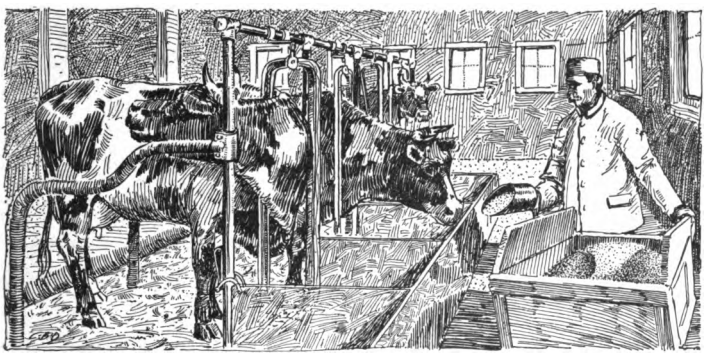
**23.** Find the elements in the following ration: 3 lb. cottonseed meal; 10 lb. wheat bran; 15 lb. timothy hay. Compare the ration with the standard given above.

**24.** Compute both dry and nutritive elements in the following ration: 5 lb. oats; 8 lb. corn and cob meal; 15 lb. timothy hay. Compare it with the standard ration.

## Milch Cows

The daily standard ration of a milch cow of 1000 lb. is: dry matter 24.0 lb.; protein 2.5 lb.; carbohydrates and fat 13.4 lb.

**25.** A herd of dairy cows is receiving the following daily ration per 1000 lb. of weight: 3 lb. dried brewery grains; 6 lb. wheat middlings; 15 lb. corn stover; 5 lb. alfalfa hay. Compute the ration and compare with the standard.



INTERIOR OF MODERN DAIRY BARN

**26.** What is the cost of a daily ration of 5 lb. oats, 8 lb. corn and cob meal, and 15 lb. timothy hay?

SCHEDULE OF PRICES

| | PER TON |
|---|---|
| Oats | $20.00 |
| Shelled corn | 18.00 |
| Wheat bran | 21.00 |
| Timothy hay | 12.00 |
| Alfalfa | 12.00 |
| Red clover hay | 12.00 |
| Cottonseed | 18.00 |
| Corn and cob meal | 18.00 |
| Wheat middlings | 24.00 |
| Corn silage | 3.00 |
| Corn meal | 30.00 |
| Corn stover | 2.00 |

SOLUTION

Cost of 2000 lb. oats = $20.00.

Cost of 1 lb. = $\frac{1}{2000}$ of $20.00 = $.01.

Cost of 5 lb. = 5 × $.01 = $.05.

Cost of 2000 lb. corn and cob meal = $18.00.

Cost of 1 lb. = $\frac{1}{2000}$ of $18.00 = $.009.

Cost of 8 lb. = 8 × $.009 = $.072.

Cost of 2000 lb. hay = $12.00.

Cost of 1 lb. = $\frac{1}{2000}$ of $12.00 = $.006.

Cost of 15 lb. = 15 × $.006 = $.09.

$.05 + $.072 + $.09 = $.212.

**27.** The following ration was used successfully by a feeder in fattening cattle. Compute the cost per day. 8 lb. alfalfa; 12 lb. corn and cob meal; 5 lb. oats.

**28.** From the data found in problem 27, how much will it cost per day to feed 70 head of steers?

**29.** How much will it cost per month of 30 days?

**30.** If it requires 120 days to fatten for the market, what is the cost of feed for the 70 head?

**31.** If it requires 5 lb. of alfalfa per day for one steer, how much hay will it require to feed 70 head 120 da.?

**32.** If it requires 18 lb. of corn for one animal for one day, how much corn will it require to feed the 70 head 120 da.?

**33.** If it requires 5 lb. of oats for each animal per day, how much oats will be required to feed the 70 head 120 da.?

**34.** If it requires 8 lb. oats, 4 lb. shelled corn, 6 lb. wheat bran, and 10 lb. hay for a work horse one day, how much will it require to keep one horse one year?

**35.** With the data found in problem 34, and the prices in the table, find how much it will cost to feed one horse one year. Find the cost of feed for a team for one year.

**36.** Find the dry matter and each of the nutritive elements in a ration for a horse consisting of 10 lb. of timothy hay, 2 lb. of cottonseed meal, 8 lb. of oats, and 5 lb. of shelled corn.

FEED REPORT

| YARD | CATTLE | POUNDS FED ONE WEEK | | |
|---|---|---|---|---|
| | | Corn | Cottonseed | Alfalfa |
| 1 | 144 | 25,760 | 2100 | 1816 |
| 2 | 120 | 21,000 | 1750 | 1680 |

NOTE. — Actual figures taken from two feed yards.

**37.** It is observed that the report of the feed yard No. 1 includes 144 head of fattening cattle for one week. Find the number of pounds of each of the feeding stuffs consumed per week by each animal.

**38.** Find the number of pounds of each of the feeding stuffs consumed per week by each animal in feed yard No. 2.

**39.** If it requires 140 days to prepare for market, how much will the feed cost for yard No. 1?

**40.** If it requires 140 days to prepare for market, how much will it cost for feed for yard No. 2, if the above feed is a fair average?

**41.** How much will it cost to feed each animal in yard No. 1 for 140 days?

**42.** How much will it cost to feed each animal in yard No. 2 for 140 days?

**43.** When corn is worth 56¢ per bushel, find the cost of each pound of digestible matter.

**44.** When oats sell for 32¢ per bushel, what is the cost of each pound of digestible matter?

**45.** When cottonseed meal sells for $28 per ton, what is the value of 10 lb. of digestible nutrients?

**46.** A man fed his 1000-pound horse 15 lb. of timothy hay and 8 lb. of oats per day. Compare this with the Louisiana ration (page 89).

**47.** If the daily ration for fattening a steer is 15 lb. of alfalfa hay, 95 lb. of beet pulp, 4.5 lb. of molasses, and 2 lb. of cottonseed cake, what is the cost of the feed for one day, when alfalfa hay is worth $8 per ton, beet pulp is worth 75¢ per ton, molasses is worth $10 per ton, and cottonseed cake is worth $36 per ton?

**48.** I buy 40 steers averaging 900 lb. each, at $6.90 per hundredweight. I feed them the ration in Ex. 47 for a period of 90 days. When sold, I find that they have gained 220 lb. per head, and I receive $8.40 per hundredweight for them. How much do I gain or lose per head?

**49.** The following rations have been found successful in fattening cattle. Find the nutritive elements:

(*a*) 5 lb. clover hay.
11 lb. corn meal.
2 lb. cottonseed meal.
30 lb. corn silage.

(*b*) 8 lb. alfalfa hay.
12 lb. corn meal.
5 lb. oats.

(*c*) 5 lb. timothy.
30 lb. corn silage.
13 lb. oats.

(*d*) 15 lb. clover hay.
16 lb. corn silage.
13 lb. corn meal.
3 lb. wheat bran.

## TERMS OF NUTRITIVE RATIOS

A **nutritive ratio** is the proportion of carbohydrates and fat to protein. Nutritive ratios are narrow, medium, and wide.

NOTE. — Fats are changed to the basis of carbohydrates by multiplying them by 2¼. They are then added to the carbohydrates.

A **narrow ratio** is one in which the proportion of carbohydrates and fat is small as compared with the protein. Any nutritive ratio less than 1 part protein to 5.5 parts carbohydrates and fat (usually expressed 1 : 5.5) is a narrow ratio.

A **wide ratio** is a nutritive ratio in which the proportion of carbohydrates and fat is large as compared with the protein. Any nutritive ratio of 1 part protein to 8 parts carbohydrates and fat, 1 : 8, is called a wide ratio.

A **medium ratio** is a nutritive ratio between 1 : 5.5 and 1 : 8.

1. What is the nutritive ratio of red clover, 1 lb. of which contains .029 per cent protein and .164 per cent carbohydrates and fat?

(Divide the carbohydrates and fat by the protein.)

SOLUTION. — $.164 \div .029 = 5.6$. *Ans.* 1 : 5.6.

2. What is the nutritive ratio of alfalfa, 1 lb. of which contains .039 lb. of protein and .138 lb. of carbohydrates and fat?

3. What is the nutritive ratio of corn ensilage, which contains .009 of protein and .129 of carbohydrates and fat?

4. What is the nutritive ratio of timothy hay, which contains .028 of protein and .465 of carbohydrates and fat?

5. What is the nutritive ratio of alfalfa hay, which contains .110 of protein and .423 of carbohydrates and fat?

6. Is corn a narrow, a medium, or a wide nutritive ratio, since it contains .078 of protein and .764 of carbohydrates and fat?

7. Corn and cob meal contains .044 of protein and .665 of carbohydrates and fat. Find its nutritive ratio. Is it narrow, medium, or wide?

8. Find the nutritive ratio of a ration which contains 1.244 of protein and 14.628 of carbohydrates and fat. Is it narrow, medium, or wide?

9. Wolff's standard ration, made up of hay, corn, and oats, contains 2.5 of protein and 13.4 of carbohydrates and fat. Find its nutritive ratio. Is it narrow, medium, or wide?

10. A ration containing 20 lb. of timothy hay, 4 lb. of oats, and 4 lb. of buckwheat middlings results in 1.808 lb. of protein, 13.396 lb. of carbohydrates and fat. Find its nutritive ratio. Is it narrow, medium, or wide?

**11.** A ration containing 18 lb. of timothy hay, 4 lb. of oats, 4 lb. of buckwheat middlings, and 2 lb. of cottonseed meal results in 2.496 lb. of protein, 13.354 lb. of carbohydrates and fat. What is its nutritive ratio?

**12.** Arrange a medium nutritive ratio of the food available in your own neighborhood for a horse of 1000 lb. weight.

STANDARD RATION FOR MILCH COWS PER 1000 LB.

| | DRY MATTER | PROTEIN | CARBOHYDRATES AND FAT | NUTRITIVE RATIO |
|---|---|---|---|---|
| | LB. | LB. | LB. | LB. |
| Wisconsin standard . . | 24.5 | 2.2 | 14.9 | 1 : 6.8 |
| Wolff's standard . . . | 24.0 | 2.5 | 13.4 | 1 : 5.4 |

Rations for milch cows should have a large percentage of protein substances; the ration should not only provide for milk substances, but should supply materials for general repair and energy required for maintenance of the animal body.

Approved materials for milch cows are corn chop, bran, middlings, cottonseed hulls, hay (various kinds), roots, ensilage. A variety of materials in rotation is better than two feeds if the proper balance is maintained.

**13.** A herd of dairy cows is being fed as follows: 3 lb. of cottonseed meal, 3 lb. of wheat bran, 10 lb. of red clover hay, and 15 lb. of stover per day per 1000 lb. weight. From the preceding tables, find the nutritive ratio.

**14.** In Colorado the practical ration for a dairy cow is as follows: 30 lb. corn silage; 10 lb. alfalfa; 10 lb. red clover hay; 5 lb. wheat bran; 2 lb. corn meal. Following the schedule of prices on page 91, find how much this ration will cost per month of 30 days.

**15.** A cow requires 2.5 lb. of hay, or its equivalent, per day for each 100 lb. of her weight. How much hay will be required to keep a cow weighing 1000 lb. from the time the

grass is killed in the fall until grass comes in the spring? Estimate the time in your locality. In most northern states, from November 1 to May 1 (180 days) may be reckoned as the feeding period.

**16.** A farmer has 16 A. of meadow hay, which averages 1.35 T. per acre. How many cows will this enable him to keep?

**17.** How much will it cost to keep 7 cows for a year, if each cow requires 22 lb. of hay, 5 lb. of corn meal, and 3 lb. of wheat middlings per day during the feeding season from November 1 to May 1 (180 days), and pasturage at $1.50 per month for the grass season? Estimate hay at $11 per ton, corn meal at $30 per ton, and middlings at $24 per ton.

**18.** How much will it cost to keep one cow for a year at the rate found in problem 17?

THREE MONTHS' RECORD OF MILK IN POUNDS AND BUTTER FAT IN PER CENT AND POUNDS

| Cow | October | | | November | | | December | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lb. Milk | % B. F. | Lb. B. F. | Lb. Milk | % B. F. | Lb. B. F. | Lb. Milk | % B. F. | Lb. B. F. |
| No. 1 | 520 | 3.8 | | 520 | 3.8 | | 500 | 3.8 | |
| No. 2 | 680 | 3.5 | | 600 | 3.6 | | 550 | 3.1 | |
| No. 3 | 640 | 4.0 | | 600 | 4.2 | | 600 | 4.2 | |
| No. 4 | 770 | 3.0 | | 740 | 3.2 | | 720 | 3.4 | |
| No. 5 | 700 | 3.2 | | 690 | 3.4 | | 660 | 3.5 | |
| No. 6 | 540 | 4.5 | | 520 | 4.2 | | 500 | 4.4 | |
| No. 7 | 560 | 4.2 | | 550 | 4.3 | | 550 | 4.3 | |

**19.** From the table, what is the production of butter fat for each of the cows for each month? for the 3 months?

**20.** If butter fat costs 26¢ per pound, what is the value of the total production of the herd for 3 months?

**21.** What is the total number of pounds of milk from each cow for 3 months?

**22.** What is the total production of milk from each cow after the butter fat is removed?

**23.** What is the average per cent of butter fat from each cow?

**24.** At 4¢ a gallon (8.625 lb. to the gallon), find the value of the milk from each cow after the butter fat is removed.

BUTTER MAKING

**25.** If the record for the three months given in the table is an average for the other three periods of the year, and milk (with butter fat removed) is worth 4¢ a gallon and butter fat 20¢ a pound, what is the income from each cow for the year?

**26.** If a cow averages 3.8 gal. of milk per day which tests 3.3% butter fat, how many pounds of butter fat does she yield per month of 30 da.? (Milk weighs 8.625 lb. per gallon.)

**27.** What is the difference in the value of two cows for 30 da. if one gives 4.2 gal. of milk per day with an average test of 4.4% butter fat, and the other gives 3.5 gal. of milk which tests 3.3%, milk (with butter fat removed) being worth 5¢ per gallon and butter fat 24¢ per pound?

**28.** If the owner of the above herd gives the following ration to each cow in the herd every day for the three months, what is the expense incurred in feeding each cow? (For prices refer to the table on page 91.)

| | Dry Matter | Digestible Protein | Digestible Carbohydrates | Digestible Fat |
|---|---|---|---|---|
| 3 lb. cottonseed meal . . | 2.754 | 1.116 | 0.507 | .366 |
| 3 lb. wheat bran . . . . | 2.643 | .366 | 1.176 | .081 |
| 10 lb. red clover hay . . . | 8.470 | .680 | 3.580 | .120 |
| 15 lb. corn stover . . . . | 11.580 | .420 | 6.345 | .105 |
| 31 lb. Total . . . | 25.447 | 2.582 | 11.608 | .672 |

**29.** Find the profit from cow No. 1, page 97, for October if the feed costs $4.14, and if the milk less butter fat sells for 11¢ a gallon and the butter fat for 31¢ a pound.

Solution. — 3.8 % of 520 lb. = 19.76 lb. of butter fat.
520 lb. − 19.76 lb. = 500.24 lb., milk with butter fat removed.
500.24 lb. ÷ 8.625 lb. (number of pounds in 1 gal.) = 57.998, no. of gal. milk.

19.76 lb. butter fat @ 31¢ = $6.125
57.998 gal. milk @ 11¢ = 6.379
Total . . . . . $12.504
$12.50 − $4.14 = $8.36.

**30.** Using the same prices, fill out the columns for the other cows.

Statement of Herd for October

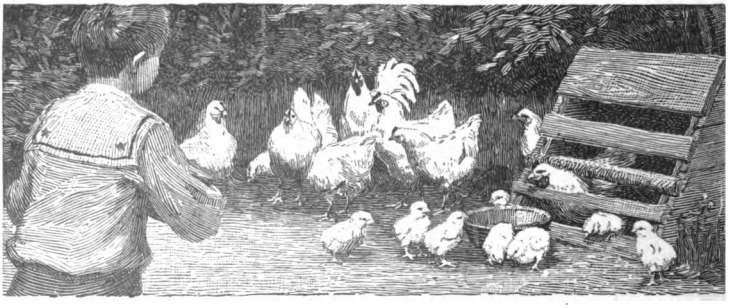
| Cow No. | Value of B. F. | Value of Milk | Total Value | Value of Feed | Profit | Loss |
|---|---|---|---|---|---|---|
| 1 | $6.125 | $6.379 | $12.504 | $4.14 | $ 8.36 | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| Totals: | | | | | | |

# FARM ANIMALS

## POULTRY

**1.** According to the United States Statistical Abstract, there were reported in the United States in a certain year 250,636,673 fowls, which produced 1,293,819,186 doz. eggs. Find the average number of eggs per fowl.

**2.** Ten years later there were reported in the United States 488,468,354 fowls, which produced 1,591,311,371 doz. eggs. Find the average number of eggs per fowl.



POULTRY

**3.** What was the increase in the number of fowls?

**4.** What was the per cent of increase in poultry in the ten years?

**5.** What was the value of the 1,293,819,186 doz. eggs produced in the earlier year at 16 ¢ per dozen?

6. Find the value of the 1,591,311,371 doz. eggs produced in the later year at 32¢ per dozen. What was the income from each fowl?

7. At 25¢ per dozen, find the value of 25,694,860 dozen eggs produced in Arkansas.

8. At 30¢ per dozen, find the value of 24,443,540 dozen eggs produced in California.

TABLE SHOWING THE PRODUCTION OF EGGS IN VARIOUS STATES

| | STATE | NUMBER OF FOWLS | DOZENS OF EGGS | EGGS PER FOWL | VALUE OF EGGS AT 30¢ A DOZEN |
|---|---|---|---|---|---|
| 9 | Iowa | 20,043,343 | 99,621,920 | | |
| 10 | Ohio | 15,017,989 | 91,766,630 | | |
| 11. | Illinois | 17,737,262 | 86,402,670 | | |
| 12. | Missouri | 16,076,713 | 85,203,290 | | |
| 13. | Kansas | 12,556,195 | 73,190,590 | | |
| 14. | Indiana | 11,949,821 | 70,782,200 | | |
| 15. | Pennsylvania | 11,044,981 | 67,038,180 | | |
| 16. | New York | 9,353,412 | 62,096,690 | | |
| 17. | Texas | 14,861,346 | 58,040,810 | | |
| 18. | Michigan | 6,224,219 | 54,318,410 | | |
| 19. | Wisconsin | 8,447,541 | 46,249,580 | | |
| 20. | Minnesota | 8,142,693 | 43,208,130 | | |
| 21. | Nebraska | 7,812,239 | 41,132,140 | | |
| 22. | Kentucky | 7,855,468 | 35,337,340 | | |
| 23. | Tennessee | 6,971,837 | 31,807,990 | | |
| 24. | Virginia | 5,041,470 | 25,550,460 | | |

Draw scheme and fill in blank columns, eggs per fowl, and the value of the eggs produced in each state at 30¢ a dozen.

25. The Ohio Agricultural Experiment Station made a series of investigations covering a large number of poultry flocks. The following represents a well-managed flock:

FLOCK NO. 20. NUMBER OF FOWLS 96

| | |
|---|---|
| Feed cost per fowl | $.526 |
| Labor cost per fowl | $.364 |
| Eggs produced | 11,514 |
| Average price per dozen | $.277 |
| Value of eggs sold | $234.43 |
| Value of poultry sold | $53.45 |

**26.** From the above data, find the cost of keeping each fowl.

**27.** Find the average number of eggs per fowl and their value.

**28.** Find the difference between the value of the eggs per fowl and the cost of the keep per fowl.

**29.** Reckoning each fowl at 65 cents, find the per cent of net income from each fowl in flock No. 20.

FLOCK NO. 16. NUMBER OF FOWLS 82

| | |
|---|---|
| Cost of feed per fowl | $.668 |
| Cost of labor per fowl | $.409 |
| Eggs produced | 5775 |
| Average price per dozen | $.23 |
| Value of eggs sold | $101 |
| Value of poultry sold | $25.29 |

**30.** From the above figures, find the loss or gain for the entire flock No. 16; for each fowl.

**31.** Find the average number of eggs produced per fowl.

**32.** Find the gross income for each fowl.

**33.** If each fowl is valued at 60 cents, find the per cent of loss or gain on the investment.

An Oregon lady sent to an agricultural paper the following statement of her poultry flock:

REPORT FOR 10 MONTHS

Stock on hand January 1:

| | |
|---|---|
| 43 Pullets valued at $1.50 each | $64.50 |
| 12 Hens valued at $1 each | 12.00 |
| 3 Cockerels | 7.00 |
| Building valued at | 30.00 |
| Parks | 10.00 |
| Amount of feed used in 10 months | 81.00 |

Amount of sales:

| | |
|---|---|
| Eggs sold for family use, 210 dozen | $57.57 |
| Eggs for setting, 92 dozen | 50.35 |
| Day-old chicks, 253 | 26.75 |
| Friers, 71 | 23.85 |
| Old hens and roosters, 37 | 33.40 |
| Eggs used at home, 72 dozen | 21.60 |
| Chickens used at home | 13.00 |

GATHERING EGGS

**34.** Find the gross proceeds of the above flock for 10 mo.

**35.** Find the gain on the above flock for 10 mo.

**36.** Find the per cent of gain on the investment.

**37.** Find the income from each one of the 58 fowls.

The following represents the investment, expenses, and income from a chicken business from March 1 to December 1:

Investment and expenses:

| | |
|---|---|
| On hand March 1, 75 hens valued at 50 cents each | $37.50 |
| Cost of feed | 52.65 |
| Loss in flock | 1.00 |
| Oil for incubator | 4.00 |
| Eggs used for incubator | 18.40 |
| Chicken house | 28.00 |
| Incubator | 10.00 |

Income and inventory December 1:

| | |
|---|---|
| Chickens sold | $100.44 |
| Eggs sold | 224.27 |
| Eggs on hand December 1 | 1.70 |
| Hens on hand December 1, 232 valued at 50 cents | 116.00 |
| Incubator | 10.00 |
| Chicken house | 28.00 |

**38.** Find the total for investment and expenses.

**39.** Find the total for income and inventory.

**40.** Find what per cent the value of the hens on hand March 1 was of those on hand December 1.

**41.** In a certain year Illinois ranked first in the production of fowls, having produced 32,352,888. What was the per cent of increase over 17,737,262 fowls produced ten years before?

**42.** In the same year Missouri ranked second, having produced 31,913,210. What was the per cent of increase over 16,076,713 fowls produced ten years before?

**43.** Iowa ranked third, the number of fowls produced being 29,990,147. What was the per cent of increase over 20,043,343 fowls produced ten years before?

**44.** The following table shows the increase in ten years in the production of eggs in various states:

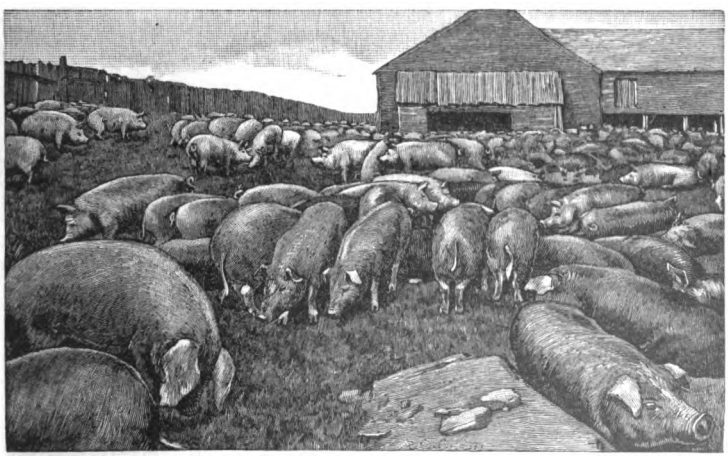
| | | |
|---|---|---|
| Missouri | 85,203,290 | 111,816,693 |
| Iowa | 90,621,920 | 109,760,487 |
| Ohio | 91,766,630 | 100,889,599 |
| Illinois | 86,402,670 | 100,119,418 |
| Kansas | 73,190,590 | 81,659,304 |
| Indiana | 70,782,200 | 80,755,437 |
| Texas | 58,040,810 | 77,845,047 |
| Pennsylvania | 67,038,180 | 74,729,705 |
| New York | 62,096,690 | 72,349,034 |
| Michigan | 54,318,410 | 59,915,851 |

Draw a scheme in your field book and compare in per cents the production of eggs in each of the above-named states with the production of ten years previous.

**45.** The census of 1910 showed the population of the United States to be 91,972,266, while the production of eggs in the United States was 1,293,819,186 dozen. How many eggs could be allotted for consumption to each person in the United States?

## HOGS

A farmer may not always be able to keep a daily record of his feeding, nor is it necessary; but he should make close estimates from time to time and record them for future



A Source of Wealth

guidance. In stock feeding, it is not sufficient that a farmer make a fair price for his grain, but his success as a husbandman depends upon his ability to gather margins of profit here and there, to see that nothing is wasted, and to make the most of all the agricultural combinations possible.

The following problems are based upon the experiments in feeding presented in Bulletin No. 107, Nebraska Experiment Station, University of Nebraska. (Both dates included.)

LOT NO. 1

| Av. weight Oct. 3, 96.4 lb. | Av. weight Feb. 9, 210 lb. | Shelled corn consumed by each pig 651 lb. at 40 ¢ a bushel |
|---|---|---|

1. Find the exact number of days these pigs were on feed. What was the total gain of each pig during that time?

2. Find the average daily gain of each pig during the time of feeding.

3. The lot was fed on corn and each pig consumed 651 lb., which was charged at 40 ¢ per bushel. Find the cost of feeding each pig. (56 lb. = 1 bu. corn.)

4. Find the number of pounds of corn consumed daily and the price per pound of gain.

5. If each pig gains .88 lb. per day on 5 lb. corn valued at $\frac{5}{7}$ ¢ per pound, what is the value of the corn required to produce each pound of gain?

6. On the same conditions as in problem 5, how much grain is required for each 100 lb. of gain and what is its value?

7. There were four pigs in the lot. Find the value of the corn necessary to feed the lot. (See problem 3.)

8. If the pigs were sold at $6.40 per hundred, find the value per bushel realized for the corn.

LOT NO. 2 (4 pigs)

| Av. weight Oct. 13, 95.2 lb. | Av. weight Feb. 9, 216 lb. | Av. consumption, 504 lb. corn at 40 ¢ per bu. 160 lb. shorts at $20 per T. |
|---|---|---|

9. Find the gain on each pig; on the lot of 4 pigs.

**10.** Find the average amount of feed per day consumed by each pig; by the lot.

**11.** Find the cost of the feed necessary to fatten the 4 pigs.

**12.** Find the feed cost for each pound of grain.

**13.** The pigs were sold at $6.40 per hundred pounds. Find the gain in feeding the grain over selling it at the prices given in the table on p. 106.

**14.** A farmer has a lot of 46 pigs averaging 102 lb. Corn is worth 58¢ per bushel on the local market. His previous experience assures him that he can add 1 lb. per day to each pig for 120 da., and that each pig will consume 5.47 lb. of grain per day. He has prospects of selling the finished product for $8.20 per 100 lb. Will it pay him to feed, and if so, how much will he receive per bushel for his corn?

**15.** Find the cost of preparing 100 pigs for the market and the profit on them if it costs $4.46 to produce a 100-pound pig ready for fattening October 15. The pigs are fed 120 days and gain on an average .97 of a pound per day each; they consume 5.58 lb. corn per day each; corn is quoted at 54¢ per bushel, and hogs at the close of feeding at $7.65 per 100 lb.

**16.** A farmer has on October 1 a lot of 36 pigs, averaging 97 lb., which he can sell at $7.50 each; the corn required for their feed is worth 58¢ per bushel and shorts $20 per ton; he is assured of $7.80 per hundred after feeding 116 days. If it requires 675 lb. of feed per head, $\frac{3}{4}$ corn and $\frac{1}{4}$ shorts, and the pigs take on an average of 1.10 lb. per day, which is the better proposition, — to sell or to feed, and how much better?

THIS EXPERIMENT BEGINS MAY 14 AND CLOSES JULY 8

(Nebraska Experiment Station Bulletin No. 94)

| | LOT NO. 1 | LOT NO. 2 | LOT NO. 3 |
|---|---|---|---|
| Number of pigs in experiment | 10 | 10 | 10 |
| Weeks in experiment | 8 | 8 | 8 |
| Average first weight | 145 lb. | 144 lb. | 144 lb. |
| Average last weight | 216 lb. | 229 lb. | 230 lb. |
| Cost per 100 lb. of gain | $3.04 | $2.88 | $3.09 |

NOTE. — Lot No. 1 was fed soaked corn.
Lot No. 2 was fed soaked corn 95 %, tankage 5 %.
Lot No. 3 was fed corn 90 %, tankage 10 %.

**17.** Find the number of pounds gained in each lot of pigs.

**18.** Find the gain per day in pounds for each lot and the cost of this gain.

**19.** The pigs sold at 6¢ per pound. Find the amount received for the corn in each lot.

COMPARISON OF RATIONS FOR FATTENING HOGS, AVERAGE TWO TESTS

| | AVERAGE FIRST WEIGHT | AVERAGE LAST WEIGHT | AVERAGE DAILY GAIN | CORN FOR 100 LB. GAIN | COST 100 LB. GAIN | DAILY PROFIT PER PIG |
|---|---|---|---|---|---|---|
| | LB. | LB. | LB. | LB. | | |
| Corn | 118.7 | 220.7 | 1.08 | 518 | | |
| Corn 9 parts, chopped alfalfa 1 | 120.0 | 245.8 | 1.31 | 441 | | |
| Corn 3 parts, chopped alfalfa 1 | 118.2 | 227.2 | 1.11 | 435 | | |
| Corn 1 part, chopped alfalfa 1 | 115.2 | 190.0 | .78 | 355 | | |
| Corn 3 parts, alfalfa meal 1 | 115.0 | 230.7 | 1.20 | 403 | | |
| Corn 1 part, alfalfa meal 1 | 115.2 | 195.4 | .82 | 346 | | |

**20.** Draw scheme and compute cost of 100 lb. of gain and the profit per pig daily, when sold at 6¢ per pound. Figure corn at 47¢ per bushel, alfalfa hay at $8 per ton, alfalfa meal at $15 per ton, and chopped alfalfa at $10 per ton.

# FARM RECORDS AND ACCOUNTS

## FARM INVENTORIES

Business institutions of all kinds keep accurate account of their affairs. The following accounts are taken from records of successful farmers.

A **farm inventory** is a list of the value of farm property (including buildings, equipment, live stock, and produce) and of farm debts.

Note. — Pupils should be encouraged to make an inventory of some farm in the vicinity of the school.

1. Total the following inventory:

INVENTORY

| 1915 | | |
|---|---|---|
| Dec. 31 | 80 A. of land at $100.00 an acre | $8,000.00 |
| | 4 Head of horses | 600.00 |
| | 2 Sets of harness | 65.00 |
| | 1 Wagon | 60.00 |
| | 6 Cows | 390.00 |
| | 8 Young cattle | 280.00 |
| | 2 Colts | 170.00 |
| | 26 Hogs | 300.00 |
| | 70 Chickens | 40.00 |
| | Machinery | 215.00 |
| | Grain and hay | 360.00 |
| | Household goods | 185.00 |
| | Groceries on hand | 22.00 |
| | Cash in bank | 92.00 |

2. Find loss or gain on 20 acres of wheat according to the following account:

ACCOUNT WITH WHEAT, 20 ACRES

| | | | |
|---|---|---|---|
| | COST | | |
| Oct. 1915 | Seeding in corn | $ 18.50 | |
| | 25 bu. seed | 25.00 | |
| Mar. 1916 | Clearing in spring | 11.00 | |
| June 1916 | Cutting | 25.00 | |
| Aug. 1916 | Threshing 520 bu. @ $.04 | 20.80 | |
| | Meals for threshers | 5.75 | |
| | Land investment @ 6 % | 120.00 | |
| | Man labor, 120 hr. @ $.20 | 24.00 | |
| | Horse labor, 100 hr. @ $.12½ | 12.50 | |
| | RETURNS | | |
| | 520 bu. wheat @ $.96 | | $499.20 |
| | 22 T. of straw @ $2 | | 44.00 |

3. A farmer seeded 16 A. of wheat. The items of labor in preparing the ground, etc., were: plowing and harrowing, $40; seed, $14.40; seeding, $8; threshing 480 bu. at 4¢ per bushel; meals for threshers, $4.75; extra hours labor for man, 85 hr. @ 20¢; for horse, 50 hr. @ 12½¢. The land was valued at $115 per acre upon which was reckoned interest at 5½ %. The yield of wheat was 480 bu., valued at 87½¢; the straw was valued at $22.75. Find the profit on the 16 acres.

4. Find the profit or loss on 30 A. of wheat with cost and returns as follows: cost of starting crop, $95; twine and cutting, $24; threshing 842 bu. at 5¢ per bushel; meals for threshers, $9.25; coal for threshing, $4.70; extra time for man and horse, $46; interest, $180. The yield of wheat was 842 bu., valued at 94¢; the straw was valued at $15.

5. Find the profit or loss on 45 A. of spring wheat, cost and returns as follows: cost of labor in starting crop, $130;

seed, $42; twine and cutting, $35; threshing 855 bu., $34.20; coal for threshing, $3; meals for threshers, $7.25; extra time for man and team, $60; interest, $270; the wheat yielded 855 bu., worth 92¢ per bushel; the straw was valued at $36.

6. Find the loss or gain on 10 A. of wheat, cost and returns as follows: preparation of ground, $30; seed, $9; harvesting, $7.50; threshing, all expenses, $11; extra time, $14; interest $60. The yield was 16 bu. per acre at $.96 per bushel.

7. In the following account, find the loss or gain on the 16 acres, if the land is valued at $85 an acre and money is worth 6%.

ACCOUNT WITH OATS, 16 ACRES

| 1915 | COST | | |
|---|---|---|---|
| Oct. | Fall plowing: Man 40 hr. @ $.20 | $ 8.00 | |
| | Horse, 120 hr. @ $.12½ | 15.00 | |
| March | Seed | 9.60 | |
| July | Harvest | 20.00 | |
| | Extra time, horse and man labor | 22.00 | |
| Sept. | Threshing | 42.00 | |
| | RETURNS | | |
| Sept. | 1400 bu. @ $.36 | | $504.00 |
| | Value of straw | | 10.00 |

8. Find the loss or gain on 24 A. of oats, cost and returns as follows: Jan. 1, as per inventory, 130 hr. man labor @ 20¢; 250 hr. horse labor @ 12½¢; 66 bu. seed oats, $33; in March, 2 bu. seed oats, $2; fertilizer, $10; in April, insurance, $3; in July, twine and cutting, $22; in September, coal for threshing, $1.30; meals for threshers, $2; threshing 668 bu. @ 3¢; use of land, $65; 270 man hours extra @ 20¢; 410 hr. horse @ 12½¢; 410 equipment hours @ 3¢; returns, 668 bu. oats to feed

@ 50¢; 5 T. of straw to cows, $15; 6 T. of straw for other purposes, $18.

9. Find the loss or gain on 20 A. of oats as follows: 150 hr. man labor @ 20¢; 412 hr. horse labor @ 13¢; 412 hr. equipment @ 3¢; 60 bu. oats, $31; expenses of cutting, $15; expense of threshing, $36; returns, 1200 bu. oats @ 42¢; straw valued at $18. The land is valued at $90 per acre and money is worth 5½%.

10. Find the profit or loss in the following account:

ACCOUNT WITH PASTURE, 40 ACRES

| | | | |
|---|---|---|---|
| | COST | | |
| Oct. 31 | Use of land | $120.00 | |
| | 20 hr. for man @ $.20 | 4.00 | |
| | 40 hr. for horse @ $.13 | 5.20 | |
| | RETURNS | | |
| Dec. 31 | Pasture used by cows | | $115.00 |
| | Pasture used by horses | | 18.00 |
| | Received from pasturing other stock | | 14.00 |

11. In the following account, find the gain if land is valued at $125 per acre and money is worth 6%:

ACCOUNT WITH CORN, 40 ACRES

| | | | |
|---|---|---|---|
| | COST | | |
| Apr. | Cost of plowing | $80.00 | |
| | Cost of harrowing | 16.00 | |
| May | Seed and planting | 18.00 | |
| | Cultivating | 80.00 | |
| | Gathering | 64.00 | |
| | RETURNS | | |
| | 1600 bu. @ $.50 | | $800.00 |
| | Pasturage of stalks | | 20.00 |

**12.** Find the loss or gain on the 12 acres of alfalfa, as shown in the following account:

ACCOUNT WITH ALFALFA, 12 ACRES

| | | | |
|---|---|---|---|
| | COST | | |
| Jan. 1 | Value of land $1500 @ 6 % | $90.00 | |
| | ⅓ cost of starting crop | 12.00 | |
| | Cutting and stacking, 240 man hours @ .20 | 48.00 | |
| | Horse labor, 260 hr. @ .12½ | 32.50 | |
| | Equipment, 130 hr. @ .03⅓ | 4.33 | |
| | RETURNS | | |
| Oct. | 26 T. hay | | $208.00 |
| | 8 bu. seed | | 48.00 |

**13.** Find the value of the man labor during the first ten days of April at 21½¢ per hour, and the horse labor at 13½¢ per hour:

LABOR ACCOUNT

| | | | HORSE HOURS | MAN HOURS |
|---|---|---|---|---|
| April | 1 | Plowing | 9 | 27 |
| | 2 | Plowing | 9 | 27 |
| | 3 | Plowing | 10 | 30 |
| | 4 | Plowing | 8½ | 25½ |
| | 5 | Teaming | 7 | 14 |
| | 6 | Plowing | 9 | 27 |
| | 7 | Harrowing | 10 | 30 |
| | 8 | Harrowing | 9 | 27 |
| | 9 | Seeding oats | 10 | 30 |
| | 10 | Seeding | 8 | 24 |

**14.** Find the value of man and horse labor, as shown in the table on page 114, at 21½¢ per hour for man and 13¢ per hour for horse.

DAILY WORK REPORT

| KIND OF WORK | HORSES | | MAN | |
|---|---|---|---|---|
| | Hours | Minutes | Hours | Minutes |
| Plowing | 22 | | 5 | 30 |
| Seeding | 15 | | 3 | 45 |

| CHORES | HR. | MIN. |
|---|---|---|
| Horses | | 45 |
| Cows | 1 | 30 |
| Hogs | | 30 |
| Fowls | 2 | 15 |
| Personal | | 15 |

**15.** Find the profit on 15 acres of alfalfa:

COST

Interest at 5½ % on the land valued at $95 per acre.
280 Man hours @ 21¢.
220 Horse hours @ 13½¢.
110 Equipment hours @ 3¾¢.
Bailing $32.

RETURNS

42 tons valued at $10.50 per ton.

**16.** Find the total loss or gain on the following crops:

ACCOUNT WITH CROPS

| | | | | |
|---|---|---|---|---|
| Dec. | 31 | Cost of 20 acres of wheat | $262.55 | |
| | | Returns from 20 acres of wheat | | $543.20 |
| | | Cost of 16 acres of oats | 108.60 | |
| | | Returns from 16 acres of oats | | 514.00 |
| | | Cost of 40 acres of pasture | 129.20 | |
| | | Returns from 40 acres of pasture | | 147.00 |
| | | Cost of 40 acres of corn | 258.00 | |
| | | Returns from 40 acres of corn | | 820.00 |
| | | Cost of 12 acres of alfalfa | 186.83 | |
| | | Returns from 12 acres of alfalfa | | 240.00 |

17. Find the cost per acre of wheat.

18. Find the net returns per acre of wheat.

19. Find the cost per acre of oats.

20. Find the net returns per acre of oats.

21. Find the cost per acre of corn.

22. Find the net returns per acre of corn.

23. Find the cost per acre of alfalfa.

24. Find the net returns per acre of alfalfa.

25. The following are actual figures from a large farm in New York.[1] Find the total investment on the farm.

| | |
|---|---|
| Farm, 276 acres @ $30 | $8280.00 |
| Waterworks | 1000.00 |
| Dairy barn and silos | 4500.00 |
| Henhouse, 20′ × 60′ | 200.00 |
| Hog pen, 20′ × 40′ | 200.00 |
| Horse barn, 28′ × 40′, with sheds | 800.00 |
| Tool and carriage house | 200.00 |
| Outlying hay and straw barn | 800.00 |
| 2 Tenant houses | 1400.00 |
| 5 Work horses | 400.00 |
| 2 Colts, unbroken | 200.00 |
| Harness | 40.00 |
| Wagons | 100.00 |
| Sleighs | 40.00 |
| Separator | 150.00 |
| Dairy engine | 50.00 |
| Dairy room | 50.00 |
| Churns, milk cans, and small utensils | 30.00 |
| Steam engine | 200.00 |
| Ensilage cutter | 60.00 |

[1] From "Farm Management," by Fred W. Card, published by Doubleday Page and Company.

| | |
|---|---|
| Corn harvester | $115.00 |
| 2 Mowing machines | 50.00 |
| Tedder | 15.00 |
| Hay rake | 15.00 |
| Hay press | 40.00 |
| Reaper | 50.00 |
| Grain drill | 55.00 |
| Thresher | 40.00 |
| 4 Plows | 25.00 |
| Disk harrow | 20.00 |
| 3 Spring-tooth harrows | 15.00 |
| Corn cultivator | 20.00 |
| Roller | 15.00 |
| Fanning mill | 5.00 |
| Grist mill | 5.00 |
| Buzz saw | 15.00 |
| Pulleys and shafting | 10.00 |
| Small implements | 100.00 |
| 39 Cows | 1190.00 |
| 8 Yearlings and 2-year-olds | 150.00 |
| 9 Calves | 45.00 |
| 30 Sheep | 120.00 |
| 47 Hogs | 265.00 |
| 150 Chickens | 52.50 |
| 12 Swarms bees | 30.00 |

### Expense of Management

| | |
|---|---|
| Help (3 regular men @ $250 with perquisites) | $1200.00 |
| Feed | 700.00 |
| Supplies and incidentals | 300.00 |
| Fertilizers (5 tons acid phosphate) | 60.00 |
| Taxes | 30.00 |

### Interest and Depreciation

| | |
|---|---|
| Interest on investment | $1,058.13 |
| Depreciation, repairs, and insurance on buildings | 405.00 |
| Depreciation on team and tools | 193.00 |
| Total expense | |

RETURNS

| | |
|---|---|
| Butter | $2,470.00 |
| Cows sold | 245.00 |
| Pork | 600.00 |
| Wool and lambs | 180.00 |
| Eggs and poultry | 260.00 |
| Pork and beef consumed in family | 90.00 |
| Milk and cream consumed in family | 100.00 |
| Apples | 250.00 |
| Rye straw | 135.00 |
| Hay | 150.00 |
| Buckwheat | 140.00 |
| Potatoes | 30.00 |
| Garden stuff | 50.00 |
| Honey | 30.00 |
| Calves | 20.00 |
| Total | |

**26.** Find the total expense of management and of interest and depreciation.

**27.** Find the total receipts for the year.

**28.** Find the profit on the farm for the year.

**29.** What is the per cent of profit on the investment?

**30.** What is the total value of a farm as per the following inventory?

| | |
|---|---|
| 160 A. at $100 per acre | $16,000.00 |
| House | 1,800.00 |
| Barn | 900.00 |
| Other buildings | 300.00 |
| 6 Head of horses | 800.00 |
| 1 Wagon, fair condition | 40.00 |
| 3 Sets of harness | 65.00 |
| 1 Buggy | 60.00 |
| Farm implements | 465.00 |
| 7 Head of cattle | 350.00 |

**31.** The farmer whose inventory is found in problem 30 sold 3000 bu. of corn at 40¢ a bushel, 800 bu. of wheat at 60¢ a bushel, and 500 bu. of oats at 36¢ a bushel; he sold $120 worth of berry products, 2 three-year-old colts at $150 each, and 3 head of cattle at $40 each; his living cost him $600 besides the living materials he produced on his farm; labor for the season cost $270; interest $800. What was the per cent of profit on the farm?

**32.** Find the total value of the following property:

| | |
|---|---|
| 80 A., valued at $85 an acre | $6,800.00 |
| House, valued at | 1,200.00 |
| Other buildings, valued at | 800.00 |
| 4 Horses, valued at | 500.00 |
| 1 Wagon, valued at | 50.00 |
| 2 Sets of harness | 55.00 |
| 1 Stirring plow, valued at | 50.00 |
| 1 Harvester | 135.00 |
| Other farm machinery | 85.00 |
| 5 Cows | 300.00 |
| 100 Chickens, valued at | 25.00 |
| 70 Hogs, valued at | 560.00 |

**33.** The farmer whose inventory is given in problem 32 sold the products of his farm as follows:

| | |
|---|---|
| Proceeds from poultry and dairy | $360.00 |
| 50 Hogs | 900.00 |
| 1 Three-year-old colt | 160.00 |
| 600 bu. of wheat at $.70 a bushel | 420.00 |

His cash living expenses amounted to $530; he paid out $60 for labor. What was the rate of income on his investment?

**34.** A farmer owned 120 acres of land valued at $100 per acre. During the year he sold the following produce:

2000 bu. of corn @ $.42 . . . . . .
540 bu. of wheat @ $.75 . . . . . .
200 bu. of oats @ $.40 . . . . . .
18 head of hogs, average weight 335 lb., at $6.40 per hundred .
8 head of cattle, averaging 1300 lb., at $6 per hundred . . .
2 head of horses @ $140 . . . . . .
125 doz. eggs @ $.25 . . . . . .
260 lb. butter @ $.30 . . . . . .
10 T. of alfalfa @ $9 . . . . . .

What per cent of the value of the farm were the gross earnings?

**35.** The living expenses of the farmer mentioned in problem 34 were $700; he paid out for labor $280; interest $600. What was the per cent of profit on the farm value?

**36.** Mr. Jones owns 150 A. of land valued at $75 per acre. Find the income and the rate of interest he is able to clear on his investment, using the following data:

Wages of man and team, $4 per day.
A team will plow 3 A. per day.
A team will harrow 15 A. per day.
A team will seed 15 A. per day.
A team will cultivate 6 A. per day.
Cutting small grain, $1.25 (including twine) per acre.
Man's wages, $2 per day.
A man will shock 6 A. per day.
Expense of threshing wheat, 7¢ per bushel.
Expense of threshing oats, 5¢ per bushel.
A team will plant 12 A. of corn per day.
A team will haul 60 bu. of grain to market at a load, 2 loads per day.
It costs 3¢ per bushel to husk corn and crib it.
Wheat is worth 80¢ per bushel.
Oats are worth 36¢ per bushel.
Corn is worth 45¢ per bushel.
Average yield: wheat, 22½ bu.; oats, 45 bu.; corn, 43 bu.
Acreage: wheat, 50 A.; oats, 30 A.; corn, 70 A.

EXTERIOR OF DAIRY BARN

**37.** Find the total investment of the following farm:

A TYPICAL DAIRY FARM — PENNSYLVANIA[1]

INVENTORY

| | |
|---|---|
| Land without buildings, 120 acres @ $40 | $4800.00 |
| Water supply | 100.00 |
| Buildings: | |
| Dwelling | 1200.00 |
| Barns | 2200.00 |
| Other farm buildings | 200.00 |
| Live stock: | |
| 20 Cows @ $35 | 700.00 |
| Young cattle | 296.00 |
| 50 Hogs @ $8 | 400.00 |
| 100 Hens @ 50¢ | 50.00 |
| Teams and tools: | |
| 4 Horses at $50 | 200.00 |
| Farm harness | 40.00 |
| Farm wagons | 50.00 |
| Corn harvester | 125.00 |
| Other farm implements | 100.00 |
| Binder | 115.00 |

[1] From "Farm Management," by Fred W. Card, published by Doubleday Page and Company.

AVERAGE EXPENSES

| | |
|---|---|
| Taxes | $ 52.00 |
| Help | 250.00 |
| Feeds | 350.00 |
| Supplies and incidentals | 25.00 |

AVERAGE RETURNS

| | |
|---|---|
| 5000 lb. butter @ 22 ¢ | $1100.00 |
| 8000 lb. pork @ 5 ¢ | 400.00 |
| Eggs | 150.00 |
| 100 bu. potatoes @ 50 ¢ | 50.00 |
| Stock sold | 750.00 |

**38.** Find the total expense of management.

**39.** Find the total returns.

**40.** Find the net profit on the farm.

# SOILS AND RAINFALL

## IMPOVERISHMENT AND ENRICHMENT OF SOILS

Different plants take from the soil for food different elements or different amounts of the same elements. The same crop planted year after year will deplete or impoverish the soil and the yield will decrease. If the soil is impoverished of any essential element, that element becomes the limiting factor in crop production. The farmer must then return this element to the soil, either by a change of crop or by some form of artificial fertilization.

1. Using the following table, find how much an acre of orchard would be impoverished in the bearing life of the trees (estimated 30 years).

MATERIALS USED AND REMOVED FROM ONE ACRE IN ONE YEAR BY A BEARING APPLE ORCHARD

| | POUNDS OF NITROGEN | POUNDS OF PHOSPHORIC ACID | POUNDS OF POTASH |
|---|---|---|---|
| Apples . . . . . | 24.93 | 1.91 | 36.42 |
| Leaves . . . . . | 22.63 | 6.30 | 22.05 |
| Trees . . . . . | 14.15 | 5.37 | 13.21 |
| Total . . . . . | 61.71 | 13.58 | 71.68 |

2. One year the average production of wheat in the United States was 12.5 bu. per acre. How much of the following soil elements were removed per acre provided the weight of the straw was 1400 lb. to the acre?

AMOUNTS OF ELEMENTS REMOVED BY WHEAT IN POUNDS PER ACRE

| CROP | GROSS WEIGHT | NITROGEN | PHOSPHORIC ACID | POTASH | LIME |
|---|---|---|---|---|---|
| Wheat, 20 bu. . . . | 1200 | 25 | 12.5 | 7 | 1 |
| Straw . . . . . | 2000 | 10 | 7.5 | 28 | 7 |
| Totals . . . . | | 35 | 20 | 35 | 8 |

3. If the yield of wheat is 15 bu. per acre and the weight of the straw is 1500 lb. to the acre, how much of each of the soil elements will be reduced by the crop?

FERTILIZER SPREADER

COMPOSITION OF FERTILIZERS

Available Percentages

| NAME OF FERTILIZER | AVAILABLE PHOSPHORIC ACID | NITROGEN | POTASH |
|---|---|---|---|
| Acid phosphate . . . . . | 14.0 | | |
| Kainit . . . . . | | | 12.0 |
| Muriate of potash . . . . . | | | 50.0 |
| Sulphate of potash . . . . | | | 50.0 |
| Cottonseed meal . . . . . | 2.5 | 6.2 | |
| Nitrate of soda . . . . . | | 15.5 | |

4. If a farmer wishes to restore to his soil 25 lb. of nitrogen, how much nitrate of soda must he purchase if 15.5 % is available?

SOLUTION

25 lb. ÷ .155 = 161.29 lb.

Since 15.5 % or .155, of nitrate of soda is available nitrogen, as many pounds of nitrate of soda are required to furnish 25 lb. of nitrogen as .155 is contained times in 25, or 161.29 lb.

5. In order to restore to the soil 35 lb. of nitrogen, how much nitrate of soda will be required?

6. In order to restore to the soil 20 lb. of phosphoric acid, how much acid phosphate will be required if it is 14 % available?

7. In order to restore to the soil 35 lb. of potash, how much muriate of potash will be required?

AMOUNTS OF ELEMENTS REMOVED BY BARLEY, IN POUNDS PER ACRE

| CROP | GROSS WEIGHT | NITROGEN | PHOSPHORIC ACID | POTASH | LIME |
|---|---|---|---|---|---|
| Barley, 40 bu. . . . | 1920 | 28 | 15 | 8 | 1 |
| Straw . . . . . | 3000 | 12 | 5 | 30 | 8 |
| Total . . . | | 40 | 20 | 38 | 9 |

8. In one year the average yield of barley in the United States was 21 bu. per acre. How many pounds per acre of each of the above elements were removed by the crop if the straw weighed 1575 lb. per acre?

9. How many pounds of each of these elements will be removed in a crop of barley that yields 60 bu. if the straw weighs 3600 lb. per acre?

**10.** How many pounds of nitrate of soda will it require to replace 40 lb. of nitrogen removed with a crop of 40 bu. of barley per acre?

**11.** How many pounds of cottonseed meal will it require to replace 20 lb. of phosphoric acid removed with a crop of barley which averaged 40 bu. per acre?

**12.** How many pounds of sulphate of potash will it require to replace 38 lb. of potash removed with a crop of barley which yielded 40 bu. per acre?

AMOUNTS OF ELEMENTS REMOVED BY OATS IN POUNDS PER ACRE

| CROP | GROSS WEIGHT | NITROGEN | PHOSPHORIC ACID | POTASH | LIME |
|---|---|---|---|---|---|
| Oats, 50 bu. . . | 1600 | 35 | 12 | 10 | 1.5 |
| Straw . . . . | 3000 | 15 | 6 | 35 | 9.5 |
| Totals . | | 50 | 18 | 45 | 11 |

**13.** One year the oats crop of the United States averaged 24.4 bu. per acre. How many pounds of each of the above elements did the crop require from the soil, the straw weighing 2400 lb. per acre?

**14.** How much acid phosphate will be required to restore to the soil the 18 lb. of phosphoric acid in a 50-bushel yield of oats?

**15.** How much nitrate of soda will be required to restore to the soil the 50 lb. of nitrogen in a 50-bushel yield of oats?

**16.** How much muriate of potash will be required to restore to the soil the 45 lb. of potash in a 50-bushel yield of oats?

AMOUNTS OF ELEMENTS REMOVED BY CORN IN POUNDS PER ACRE

| CROP | GROSS WEIGHT | NITROGEN | PHOSPHORIC ACID | POTASH | LIME |
|---|---|---|---|---|---|
| Corn (Grain), 65 bu. | 3640 | 65 | 25 | 15 | 1 |
| Stalks . . . . . | 6000 | 45 | 14 | 80 | 20 |
| Totals. . . | | 110 | 39 | 95 | 21 |

**17.** The average crop of corn in the United States in one year was 23.9 bu. per acre. How many pounds per acre of each of the above elements will be removed in such a crop, provided the weight of the stalks is 5000 lb.?

**18.** How much of each of the three elements of a fertilizer are required to replenish the soil after removing a crop of 52 bu. of corn per acre?

**19.** If a crop of potatoes yielding 300 bu. per acre removed 80 lb. of nitrogen, 40 lb. of phosphoric acid, and 150 lb. of potash, how much will it cost to purchase the materials to replenish these elements, when nitrate of soda costs 16¢ per pound, acid phosphate 5¢ per pound, and sulphate of potash 5¢ per pound? (See table, p. 123.)

## RAINFALL

The following results were determined by experts after six years of experimentation in the state of Utah relative to the amount of water required on fertile soil to raise 1 lb. of dry matter:

Wheat . . . 1048 lb. water
Corn . . . 589 lb. water
Sugar beets . 630 lb. water

**1.** On the above basis, if an acre produces 12 T. of corn, how much water is required?

**2.** How much water is required to produce an acre of wheat if the grain weighs 1200 lb. and the straw 2000 lb.?

3. How much water is required for the grain portion of a crop of wheat which yields 30 bu. or 1800 lb.?

4. How much water is required to produce the straw on an acre of wheat if it weighs 2650 lb.?

5. How much water is required to produce an acre of wheat, if it yields 28 bu. per acre and the straw weighs 2600 lb.?

6. How much water is required to raise an acre of beets with a gross weight of 28 T.?

7. How much water is required to produce 1 A. of sugar beets yielding 20 T. of beets and 4 T. of tops?

8. How much water is required to produce an acre of corn if the yield is 65 bu. (70 lb. per bushel) and 6 T. of stalks?

9. How much water is required to produce 10 A. of corn with a gross weight of 8 T. per acre?

10. A farmer had a field of 40 A. of corn; the yield was 48 bu. per acre, while the stover averaged 7000 lb. How much water was required to produce the crop?

11. A farmer raised 20 A. of wheat. The yield was $24\frac{3}{4}$ bu. per acre; the straw averaged 2100 lb. How much moisture was required to produce the crop?

12. How many tons of water will fall on an acre of ground in a $\frac{1}{4}$-inch rainfall? (1 cu. ft. of water weighs $62\frac{1}{2}$ lb.)

13. How many tons of water will fall on an acre of land in a rainfall measuring .42 in.?

14. Find the weight in tons of water which falls on an acre of land in one year if the rainfall is 32 in.

15. A farmer raises a crop consisting of 35 A. of corn, which yields a gross weight per acre of 12,000 lb.; 18 A. of wheat, which yields a gross weight of 3600 lb.; and 12 A. of sugar beets with a gross weight of 26 T. Find the amount of water in tons required to produce the crop.

# LIGHT, FUEL, AND WATER

## GAS

### Gas

| Range of Prices in Some Cities of the United States | Gross | Net |
|---|---|---|
| *Manufactured Gas* | | |
| Goldsboro, N.C. | $2.00 | $1.50 |
| Niagara, N.Y. | 1.90 | 1.40 |
| Dayton, O. | 1.00 | .85 |
| Chickasha, Okla. | 1.30 | 1.20 |
| Portland, Ore. | 1.00 | .95 |
| Allentown, Pa. | 1.10 | .70 |
| Aberdeen, S.D. | 1.80 | 1.70 |
| Memphis, Tenn. | 1.10 | 1.00 |
| Abilene, Tex. | 1.60 | 1.50 |
| Ogden, Utah (light) | 1.90 | 1.71 |
| Ogden, Utah (fuel) | 1.40 | 1.26 |
| Richmond, Va. | .90 | .90 |
| Everett, Wash. | 1.50 | 1.00 |
| Lincoln, Nebr. | 1.00 | 1.00 |
| *Natural Gas* | | |
| Atchison, Kan. | | .30 |
| Joplin, Mo. | | .25 |
| Titusville, Pa. | | .27 |
| Atlantic, Tex. (domestic) | | .27 |
| Atlanta, Tex. (industrial) | | .10 |

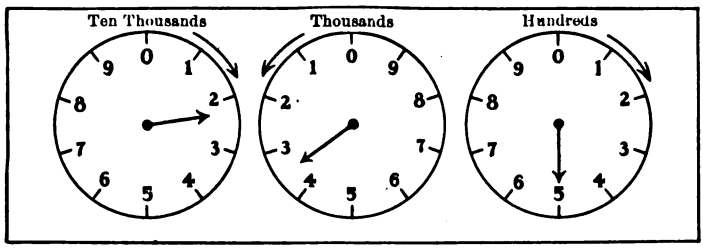
Gas is bought by the cubic foot and is computed by the thousand. Usually there is a meter attached to the supply pipe. This measures the quantity consumed. The price varies with the conditions of the locality. Where natural gas is supplied, the price per 1000 cu. ft. is very low, ranging from 25¢ to 30¢ for domestic uses, and as low as 10¢ for industrial purposes, while in places where it is necessary to manufacture it, the price often reaches $2 per thousand.

Note. — It will be observed that the table contains gross and net prices. The net prices prevail if the bill is paid at the office within a certain number of days.

### The Gas Meter

The right-hand dial indicates *hundreds* of cubic feet; the middle dial, *thousands* of cubic feet, and the left-hand dial *ten-thousands* of cubic feet.

Ten revolutions of the hand of any dial produce 1 revolution of the hand of the dial next on the left. When the indicator of the right-hand dial passes from 0 to 1, 100 is registered. When it has revolved completely back to 0, 1000 is registered and the indicator of the middle dial passes to 1. When the middle dial has revolved completely back to 0, 10,000 is registered and the left-hand indicator passes around to 1. Notice that in the first and last dials the figures read around the dial from right to left but in the middle dial from left to right.




GAS METER

Beginning with the left-hand dial and reading *the last number passed* by the indicator on each dial, we have 235, to which we add two ciphers. The reading thus becomes 23,500.

1. If the indicators, beginning at the right, point to 0, 0, and 7, how many cubic feet have been consumed?

2. If the indicators are at 0, 3, and 2, what is the reading?

3. If the indicators point to 3, 9, and 7, what is the reading of the meter?

4. What is the amount of gas consumed when the indicators point to 7, 7, and 3?

5. What is the reading of the meter when the indicators point to 2, 9, and 6?

6. What is the reading when the indicators point to 0, 2, and 9?

KEARNEY, NEBRASKA, Dec. 1, 1916.

J. J. JONES

To THE MIDWAY GAS COMPANY, DR.

| | | | | |
|---|---|---|---|---|
| For gas supplied for month of November 1916 | | | | |
| Statement of meter | 76,300 cu. ft. | 3200 cu. ft. at $1.75 | 5 | 60 |
| Last statement | 73,100 cu. ft. | cu. ft. at 1.67 | | |
| Gas consumed | 3,200 cu. ft. | cu. ft. at 1.50 | | |
| RATES | | | | |
| For the first | 5000 | $1.75 per 1000 | | |
| For the second | 5000 | 1.67 per 1000 | | |
| All in excess of | 10,000 | 1.50 per 1000 | | |

GAS BILL

7. On the above bill, what is the cost of gas for the month of November?

SOLUTION. — Statement of meter at present reading . . . . 76,300
Last statement of meter . . . . . 73,100
Gas consumed for month . . . . . 3,200

Cost of 1000 cu. ft. = $1.75.

Cost of 3200 cu. ft. = 3.200 × $1.75 = $5.60.

8. Which is cheaper, and how much, 1200 lb. of coal at $6.50 per ton, or 2400 cu. ft. of gas at $1.75 per 1000?

9. What is the cost of 3200 cu. ft. of gas at Goldsboro, N.C., if paid in sufficient time to secure the net rate?

10. How much is saved at Niagara, N.Y., on 4200 cu. ft. of gas if paid in time to secure the net rate?

11. What is the cost at Dayton, Ohio, of 1800 cu. ft. of gas, the net rate being accepted?

12. What is the cost at Ogden, Utah, of 2800 cu. ft. of gas for lighting and 4300 cu. ft. for fuel at the net rate?

**13.** Find the cost of 1200 cu. ft. of gas at Aberdeen, S.D., at the gross rate. How much will be saved if paid in time to receive the net rate?

**14.** A gas bill in Chickasha, Okla., is as follows. Find the cost of gas for the year at the net rate:

| | |
|---|---|
| January | 2400 cu. ft. |
| February | 2300 cu. ft. |
| March | 2600 cu. ft. |
| April | 2300 cu. ft. |
| May | 2200 cu. ft. |
| June | 2200 cu. ft. |
| July | 2000 cu. ft. |
| August | 1800 cu. ft. |
| September | 2100 cu. ft. |
| October | 2300 cu. ft. |
| November | 2400 cu. ft. |
| December | 2300 cu. ft. |

**15.** A family living at Atchison, Kan., burned 37,000 cu. ft. of gas during one year. How much did it cost?

**16.** Find the cost of 12,000 cu. ft. of gas as follows: \$1.75 for the first 5000 cu. ft.; \$1.67 for the second 5000 cu. ft., and \$1.50 for all in excess of 10,000 cu. ft.

**17.** How much is saved by a consumer who lives at Allentown, Pa., on an annual consumption of gas of 28,000 cu. ft. if he accepts the net rate?

## ELECTRICITY

An electric meter is used to measure the amount of electricity used. The unit of measure is the **kilowatt hour**, usually abbreviated K. W. H.

The **volt** is the unit of electromotive force.

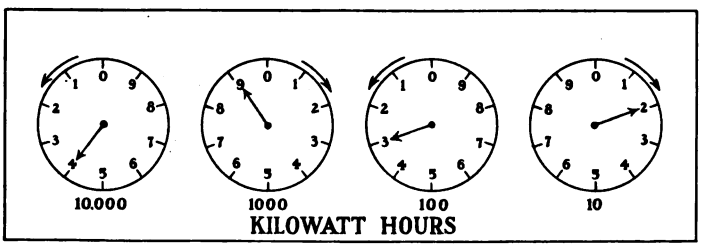
The **ampere** is the unit of current.

The **watt** is the product of the voltage multiplied by the amperage. The **kilowatt** equals 1000 watts.

Thus, the number of watts required to burn a lamp in which a current of 0.363 ampere is used on a 110-volt circuit is 110 × 0.363, or 40 watts.

The **kilowatt hour** (K. W. H.) is the number of kilowatts of energy per hour.

Great improvement is being made in the efficiency of electric lamps, the object being to obtain the maximum amount of light with the least expenditure of energy. Indeed, so rapid is the stride that it is hard to keep pace with the prog-




THE ELECTRIC METER

ress. The general use of electricity for lighting purposes makes it necessary to acquire some elementary knowledge of the means of its use.

Electric lamps are usually run on a current of 110 volts or 220 volts. In 110 voltage an ordinary 16 candle power (c. p.) lamp carries about .5 ampere; in 220 voltage, about .25 amperes.

A 16 c. p. lamp with 110 voltage equals (110 × .5) watts, or 55 watts. One such lamp running 2 hours would consume 110 watt hours of energy.

Electricity for heat, light, and power is sold at from 3¢ to 12½¢ per K. W. H., depending upon local conditions.

*Rated wattage ÷ efficiency = candle power.*

1. If a lamp consumes 1.25 watts per candle power, what is the candle power of a 40-watt lamp?

SOLUTION. — $40 \div 1.25 = 32$. Ans. 32 c. p.

2. If a lamp consumes 2 watts per candle power, what is the candle power of an 80-watt lamp?

3. What is the candle power of a 100-watt lamp that consumes .98 watt per candle power?

4. What is the candle power of a 40-watt lamp that consumes 3.75 watts per candle power?

5. A 16 c. p. carbon lamp will consume .5 ampere on a 110-volt system in one hour. How many watts will it consume?

SOLUTION. — $110 \times .5 = 55$. Ans. 55 watts per hour.

6. How many kilowatt hours will a 55-watt lamp use in 30 da., burning 10 hr. per day?

7. How many kilowatt hours will be used in a residence if five 60-watt lamps are lighted 6 hr. a day for 30 da.?

8. How much does it cost for light for one month if 62 K. W. H. are consumed at 10 ¢ per K. W. H.?

9. The last statement of meter showed 3265 K. W. H.; the present reading 3327 K. W. H. How many K. W. H. were consumed since the last statement?

10. Find the cost of 62 K. W. H. of electricity at 9 ¢ per K. W. H.

11. At 12 ¢ per K. W. H., find the cost to Mr. Warner of 24 K. W. H. of electricity, if he receives a discount of $\frac{1}{2}$ ¢ per K. W. H. for cash.

12. What is the cost of electricity to a company if it consumes 362 K. W. H. at 7 ¢ per K. W. H.?

13. A resident used electricity as follows for each month in the year. Find the cost at 9 ¢ per K. W. H.: January,

85 K. W. H.; February, 126 K. W. H.; March, 143 K. W. H.; April, 87 K. W. H.; May, 68 K. W. H.; June, 70 K. W. H.; July, 66 K. W. H.; August, 75 K. W. H.; September, 56 K. W. H.; October, 88 K. W. H.; November, 92 K. W. H.; December, 112 K. W. H.

**14.** A residence contains six 55-watt lights. How many watts will they consume in an hour?

**15.** A residence uses eight 40-watt lamps. They burn on an average 3 hr. per day during November. How many kilowatt hours do they consume during the month?

**16.** How much will it cost, at 12¢ per kilowatt hour, to use five 60-watt lamps for the month of November on an average of $3\frac{1}{2}$ hr. per day?

**17.** How much will ten 40-watt lamps cost during December if they burn on an average 4 hours per day at 12¢ per kilowatt hour, less 25% for prompt payment?

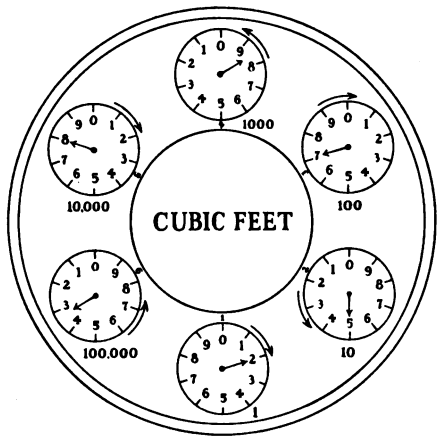
## WATER

The water meter is attached to the supply pipe and registers the number of gallons passing through the meter. In towns and cities, water is pumped by companies formed for that purpose, or by the municipality (town or city). It is supplied to the consumer at prices varying from 5¢ to 25¢ per thousand gallons. In many instances a graduated scale is used, decreasing the cost as the quantity of water consumed by the customer is increased.

### Reading the Water Meter

The lowest dial registers 1's, or 10 cu. ft. for a complete revolution; the second dial registers 10's, or 100 cu. ft. for a complete revolution; the sixth dial 100,000's, or 1,000,000 cu. ft. for a complete revolution.

Begin with dial No. 6 and write the numbers indicated down to No. 1, thus: 388,752.




WATER METER

1. If the indicators, beginning with dial No. 1, point to 5, 1, 9, 8, 0, 0, what is the reading?

2. If the indicators, beginning with dial No. 6, point to 2, 6, 4, 7, 3, 8, what is the reading?

3. What is the reading of a water meter whose indicators, beginning with dial No. 6, point as follows: 0, 0, 0, 8, 6, 2?

4. Read a meter whose indicators, beginning with dial No. 6, point to 0, 0, 0, 0, 7, 3.

5. Read a meter whose indicators, beginning with dial No. 6, point to 1, 1, 1, 1, 2, 2.

6. How much do 16,000 cu. ft. of water cost at 15¢ per 100 cu. ft.?

7. The meter shows a consumption of 640 cu. ft. How much does this amount to at 10¢ per 1000 gallons?

8. How much will it cost to sprinkle a lawn during the summer if it requires 700 cu. ft. for May, 750 cu. ft. for June, 860 cu. ft. for July, 800 cu. ft. for August, and 650 cu. ft. for September, at 5¢ per 100 cu. ft.?

9. A family consumed the following amounts of water for the twelve months of the year. Find the total cost of water for the year at 10¢ per 100 cu. ft.

| | |
|---|---|
| January | 450 cu. ft. |
| February | 440 cu. ft. |
| March | 460 cu. ft. |
| April | 500 cu. ft. |
| May | 1000 cu. ft. |
| June | 1200 cu. ft. |
| July | 1500 cu. ft. |
| August | 1400 cu. ft. |
| September | 1000 cu. ft. |
| October | 800 cu. ft. |
| November | 500 cu. ft. |
| December | 400 cu. ft. |

**10.** How much will the water in problem 9 cost at 5¢ per 1000 gallons?

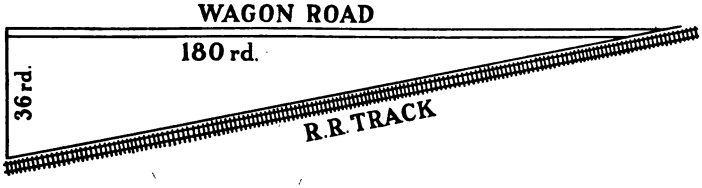
**11.** If the meter indicates the use of 700 cu. ft., how much will it cost at 15¢ per 100 cu. ft.?

# TESTS FOR KNOWLEDGE AND ACCURACY

### Group I

**1.** A blue grass court is 92.25 ft. long and 60.5 ft. wide. A gravel walk extends through it from the center of one long side to the center of the opposite side, $12\frac{1}{2}$ ft. wide. How much space is occupied by the walk and how much space by the blue grass? Make a drawing in your field book according to a scale of your own selection.

**2.** Find the area of a triangular strip of land between a wagon road and a railroad track, with dimensions as given in the following diagram.




**3.** How much will it cost to lay one mile of cement of the Lincoln Highway 16 ft. wide at \$2.10 per square yard?

**4.** Find the circumference of a circle whose diameter is 3 ft.

SUGGESTION. — 3.1416 × 3 ft. = ?

**5.** Find the area over which a cow tethered to a rope 60 ft. in length may graze.

SUGGESTION. — Multiply the square of the radius (60 ft.) by 3.1416.

6. What is the area of a 60° sector of a circle whose diameter is 12 in.?

SUGGESTION. — A 60° sector is $\frac{1}{6}$ of the area of the circle.

7. How many cubic inches are there in a rectangular prism whose base is 14 in. by 28 in. and whose altitude is 37 in.?

SUGGESTION. — (14 × 28 × 37) cu. in. = ?

8. Find the convex surface of a cylinder whose diameter is 4 in. and whose height is 10 in.

SUGGESTION. — (3.1416 × 4 × 10) sq. in. = ?

9. Find the solid contents of a cylinder whose diameter is 5 in. and whose height is 11 in.

SUGGESTION. — (3.1416 × $(\frac{5}{2})^2$ × 11) cu. in. = ?

10. How many gallons of water are there in a standpipe 12 ft. in diameter and 50 ft. high? (1 cu. ft. = $7\frac{1}{2}$ gal.)

### Group II

1. Find the solid contents of a square pyramid whose base is $\frac{3}{4}$ in. on each side and whose altitude is $1\frac{1}{4}$ in.

SUGGESTION. — ($\frac{1}{3}$ × $(\frac{3}{4})^2$ × $\frac{5}{4}$) cu. in. = ?

2. Find $66\frac{2}{3}\%$ of \$1275.

3. Find $37\frac{1}{2}\%$ of 375 bushels.

4. A merchant owned $33\frac{1}{3}\%$ of the capital stock of a company incorporated for \$45,000 and received $16\frac{2}{3}\%$ of his share in dividends. How much did he receive?

5. A stockholder in a national bank received \$1200, which was a $12\frac{1}{2}\%$ dividend. How much stock did he own?

6. A stockholder owned \$22,000 of the capital stock of a bank and received \$1760 as a semiannual dividend. What was the per cent declared?

7. How many acres of land are there in one half of the N.E. $\frac{1}{4}$ of the N.E. $\frac{1}{4}$ of Section 1, and what is its value at $85 per acre?

8. A farmer, when his sale was over, found that the sales amounted to $3755. How much had he left after paying the clerk $20, the auctioneer 1 % of the sales, and discounting the paper 2 %?

9. From the reports of the Department of Agriculture there were 37,260,000 head of cattle in the United States in a certain year. Their value was estimated at $790,064,000. What was their value per head?

10. Reports of the Department of Agriculture show that in one year there were 20,508,000 horses in the United States, having a total value of $2,172,573,000. What was their value per head?

### Group III

1. The reports of the Department of Agriculture show that in one year there were 20,699,000 milch cows in the United States, with a total value of $815,414,000. What was their value per head?

2. If a team drawing a 14-inch plow travels 7 mi. in plowing 1 A., how far will it travel in plowing $3\frac{1}{4}$ A.?

3. How much will it cost to gather a field of 47 A. of corn, averaging 38 bu. per acre, at 4 ¢ per bushel?

4. If land is worth $75 per acre, what is the per cent of gross income in wheat which yields 23 bu. per acre and sells for 72 ¢ per bushel?

5. If the cost of production of corn is $12.658 per acre, what is the profit on an acre of corn which yields 41 bu. and sells for 48 ¢ per bushel?

6. What is a farmer's loss per acre of corn, with 80 % of a stand, the yield being 36 bu. and corn 55¢ per bushel, conditions otherwise the same as in problem 5?

7. What is the capacity in ear corn of a crib 16 ft. long, 12 ft. wide, and 9 ft. high?

8. What is the capacity of a bin 12 ft. long, 8 ft. wide, and 8 ft. high?

9. What is the capacity of a cement water tank whose inside measurements are: length, 6 ft. 4 in.; width, 4 ft. 6 in.; depth, 1 ft. 10 in.?

10. How much hay is there in a stack 32 ft. long, 13 ft. wide, and 28 ft. average over, well settled, and how much is it worth at $10.50 per ton? (See page 80. Allow 343 cu. ft. per ton.)

**Group IV**

1. Find the nutritive ratio of sugar beet pulp, 1 lb. of which contains .068 of protein and .65 lb. of carbohydrates and fat.

2. Find the nutritive ratio of hominy chops if 1 lb. contains .075 protein and .705 carbohydrates and fat.

3. Tabulate the elements in 18 lb. timothy hay, 4 lb. oats, 4 lb. wheat middlings, and 2 lb. cottonseed meal. (See tables, pages 88 and 89.)

4. Find the nutritive ratio of the ration given in problem 3.

5. What will be the monthly profit in keeping a cow that yields per month of 30 da. 640 lb. of milk containing 4.1% butter fat, if it costs $5 for feed and requires 1 hour's labor per day at 18¢ per hour, the butter fat being valued at 31¢ per pound, and the milk with the butter fat removed, at 8¢ per gallon?

6. Find the monthly profit in a herd of 7 cows, each averaging per month 634 lb. of milk containing 4.3% butter fat, valued at 28¢ per pound, if the cost of labor and feed average $3.35 each per month. (Allow $40 for milk with butter fat removed.)

7. Find the profit in a herd of 5 cows for one year, each cow averaging per month 480 lb. of milk containing 4.2% butter fat, valued at 26¢, if each cow costs $3.90 per month, no allowance being made for labor. (Allow $21.30 per month for milk with butter fat removed.)

8. Find the dry matter and each of the nutritive elements in 56 lb. of corn. (See table, page 86.)

9. Find the dry matter and each of the nutritive elements in 100 lb. of alfalfa hay. (See table, page 88.)

10. Find the cost of keeping a cow for 90 da. if the daily ration contains 2 lb. corn and cob meal, 3 lb. bran, 12 lb. alfalfa hay, and 12 lb. stover. (See table, page 91.)

# TIME AND TRAVEL

## INTERNATIONAL DATE LINE

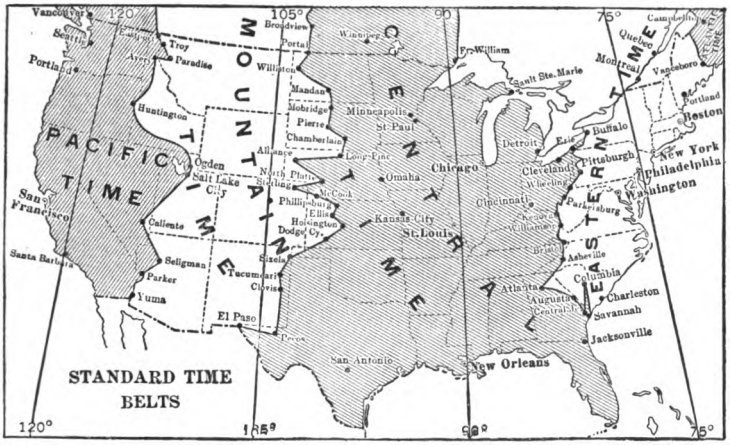
The **international date line** is an irregular line passing through Bering Strait, thence south on the Pacific Ocean, avoiding land but approximating the meridian of 180° of longitude. The days begin at this time. If a vessel steaming westward approaches this line at 10 o'clock A.M. on Sunday, when the line is crossed the day is changed to 10 o'clock A.M. Saturday, thus gaining a day on the calendar. If a vessel steaming eastward approaches the line at 10 o'clock A.M. on Sunday, when the line is crossed the day is changed to 10 o'clock A.M. on Monday, thus losing a day on the calendar.

## STANDARD TIME

For the convenience of the railroads, there was established by mutual agreement, in 1883, a standard of time by which trains are run and local time is regulated. According to this system the United States is divided into four time belts, as shown on the map, each 15° of longitude in width.

**Eastern Standard Time**, the time of the **75th Meridian**, is kept by all trains in the eastern time belt. **Central Standard Time**, the time of the **90th Meridian**, is kept by all trains in the central time belt. **Mountain Standard Time**, the time of the **105th Meridian**, is kept by all trains in the mountain time belt. **Pacific Standard Time**, the time of the **120th Meridian**, is kept by all trains in the Pacific time belt.

The time in the various belts differs by exact hours. Central time is 1 hr. earlier than Eastern time; Mountain time is 1 hr. earlier than Central time; and Pacific time is 1 hr. earlier than Mountain time. When it is 11 A.M. in the Eastern belt, it is 10 A.M. in the Central belt, 9 A.M. in the Mountain belt, and 8 A.M. in the Pacific belt.




1. When it is 10 P.M. in New York, what is the time in Chicago? in Omaha? in San Francisco?

2. When it is 2 A.M. in Seattle, what is the time in Boston? in St. Louis?

## TRAVEL

Americans are extensive travelers and, especially within our own country, trains are crowded at almost all seasons of the year. Hence it is desirable to become familiar with the use of time-tables. The accompanying pages give sections of time-tables of the Pennsylvania Lines and great Overland Route, showing two of their finest through trains. The following problems are based on these time-tables.

NOTE. — The light-faced figures in the time-tables indicate A.M. time, that is, time from midnight to noon, and the dark-faced figures P.M. time, time from noon to midnight. In the tables on pp. 147 and 148 where there are time schedules at the left as well as at the right of the names of the stations, the time schedules in the left-hand columns are to be read downwards, and in the right-hand columns, upwards.

| Mls. | EASTERN TIME | 23 Daily | 21 Daily |
|---|---|---|---|
| | | PM | AM |
| 0 | Lv **New York** Penna. Station | 5.04 | ..... |
| ..... | " Hudson Ter.(N.Y. | 5.00 | ..... |
| ..... | " Jersey City.... | 5.03 | ..... |
| ..... | " Manhattan Trans. | 5.23 | ..... |
| 8.7 | " Newark..... | ..... | ..... |
| 56.8 | " Trenton..... | ..... | ..... |
| 84.8 | " North Phila... | 7.02 | ..... |
| 90.3 | " Philadelphia.. | ..... | ..... |
| 158.4 | " Lancaster.... | ..... | ..... |
| 0 | " Washington.. | 6.15 | ..... |
| 40 0 | " Baltimore..... | 7.25 | ..... |
| 96.1 | " York..... | 9.05 | ..... |
| 194.2 | " Harrisburg.... | 9.39 | ..... |
| 325.3 | " Altoona..... | 1235 | ..... |
| 362.7 | " Johnstown.... | ..... | ..... |
| 386.8 | " Blairsville Int. | ..... | ..... |
| 439.1 | Ar / Lv **Pittsburgh** (E.T. / C.T. | 3.30 / 2.50 | ..... / 4.05 |
| 440 1 | " Allegheny..... | ..... | 4.10 |
| 451.6 | " Sewickley..... | ..... | ..... |
| 464.8 | " Rochester..... | ..... | ..... |
| 467.5 | " New Brighton. | ..... | ..... |
| 469.3 | " Beaver Falls.. | ..... | ..... |
| 489.0 | " East Palestine. | ..... | ..... |
| 498.7 | " Columbiana... | ..... | ..... |
| 502.2 | " Leetonia..... | ..... | ..... |
| 508.6 | " Salem..... | ..... | 5.55 |
| 518.1 | " Sebring..... | ..... | ..... |
| 522.1 | Ar / Lv **Alliance**.... | ..... / 5.16 | 6.20 / 6.20 |
| 540.4 | " Canton..... | ..... | 6.50 |
| 548.6 | " Massillon..... | ..... | 7.05 |
| 563.1 | " Orrville..... | ..... | 7 30 |
| 574.1 | " Wooster..... | ..... | 7.48 |
| 583.6 | " Shreve..... | ..... | 8.01 |
| 595.6 | " Loudonville... | ..... | 8.16 |
| 614.3 | " Mansfield..... | 6 55 | 8.54 |
| 627.8 | Ar / Lv **Crestline**... | 7 25 / 7.30 | 9.25 / 9.30 |
| 640.3 | " Bucyrus..... | ..... | 9.50 |
| 657.1 | " Upper Sandusky. | ..... | 10.13 |
| 668.8 | " Forest..... | ..... | ..... |
| 675.9 | " Dunkirk..... | ..... | ..... |
| 685.2 | " Ada..... | ..... | 10.53 |
| 700.0 | " Lima..... | 8.57 | 11.15 |
| 714.2 | " Delphos..... | ..... | ..... |
| 727.1 | " VanWert.... | ..... | 11.53 |
| 759.4 | Ar / Lv **Fort Wayne** | 10.10 / 10.15 | 12.35 / 12.40 |
| 778.4 | " Columbia City | ..... | ..... |
| 796.9 | " Winona Lake. | ..... | 1.36 |
| 798.8 | " Warsaw..... | ..... | 1 41 |
| 812.9 | " Bourbon..... | ..... | ..... |
| 823.6 | " Plymouth..... | ..... | 2.15 |
| 863.9 | " Valparaiso ... | ..... | 3.09 |
| 874.4 | " Hobart..... | ..... | ..... |
| 880.0 | " Gary..... | ..... | ..... |
| 887 6 | " IndianaHarbor | ..... | ..... |
| 890.7 | " Whiting..... | ..... | ..... |
| 894.0 | " South Chicago. | ..... | ..... |
| 898.3 | " CottageGroveAve | ..... | ..... |
| 900.4 | " Englewood.... | 1.35 | 4.16 |
| 907.5 | Ar **Chicago**.... | 2.00 PM | 4 45 PM |

Manhattan Limited. No accommodations for coach passengers on this train.

Extra-Fare Train.

| Mls. | CENTRAL TIME | 40 Daily | 22 Daily |
|---|---|---|---|
| | | AM | AM |
| 0 | Lv **Chicago**..... | 8.45 | 10.30 |
| 7.1 | " Englewood.... | 9.04 | 10.46 |
| 9.2 | " CottageGroveAve | ..... | ..... |
| 12.5 | " South Chicago | 9.17 | 10.58 |
| 16.8 | " Whiting..... | ..... | ..... |
| 19.9 | " Indiana Harbor | ..... | ..... |
| 27.5 | " Gary..... | 9.43 | ..... |
| 33.1 | " Hobart..... | ..... | ..... |
| 43.6 | " Valparaiso.... | 10.03 | ..... |
| 83.9 | " Plymouth..... | 10.57 | ..... |
| 94.6 | " Bourbon..... | ..... | ..... |
| 108 7 | " Warsaw..... | 11.32 | ..... |
| 110.6 | " Winona Lake.. | 11.36 | ..... |
| 129.1 | " Columbia City | ..... | ..... |
| 148.1 | Ar / Lv **Ft. Wayne**.. | 12.24 / 12.30 | 1 55 / 2.00 |
| 180.4 | " Van Wert..... | 1.15 | ..... |
| 193.3 | " Delphos..... | ..... | ..... |
| 207.5 | " Lima..... | 1 55 | 3.17 |
| 222.3 | " Ada..... | ..... | ..... |
| 231.6 | " Dunkirk..... | ..... | ..... |
| 238.7 | " Forest..... | ..... | ..... |
| 250.4 | " Upper Sandusky. | 2.53 | ..... |
| 267.2 | " Bucyrus..... | 3 19 | ..... |
| 279.7 | Ar / Lv **Crestline**... | 3.40 / 3.45 | 5.00 / 5 05 |
| 293.2 | " Mansfield..... | 4.07 | 5.27 |
| 311.9 | " Loudonville... | ..... | ..... |
| 323.9 | " Shreve..... | ..... | ..... |
| 333.4 | " Wooster..... | 5.03 | ..... |
| 344.4 | " Orrville..... | 5 25 | ..... |
| 358.9 | " Massillon..... | 5.45 | ..... |
| 367.1 | " Canton..... | 6.03 | 7.10 |
| 385.4 | Ar / Lv **Alliance**.... | 6.35 / 6.35 | 7.40 / 7.40 |
| 389.4 | " Sebring..... | ..... | ..... |
| 398.9 | " Salem..... | 6 56 | ..... |
| 405.3 | " Leetonia..... | ..... | ..... |
| 408.8 | " Columbiana... | ..... | ..... |
| 418.5 | " East Palestine. | ..... | ..... |
| 438.2 | " Beaver Falls... | 7.50 | ..... |
| 440.0 | " New Brighton. | ..... | ..... |
| 442 7 | " Rochester.... | ..... | ..... |
| 455.9 | " Sewickley..... | ..... | ..... |
| 467.4 | " Allegheny..... | 8 40 | 9 45 |
| 468.4 | Ar / Lv **Pittsburgh** (C.T. / E.T. | 8.45 / 11.00 | 9.50 / 11.14 |
| 520.7 | Ar Blairsville Int.. | ..... | ..... |
| 544.8 | " Johnstown.... | ..... | ..... |
| 582.2 | " Altoona..... | 1.48 | 2.06 |
| 713.3 | " Harrisburg.... | 4 30 | 4.50 |
| 740.5 | " York..... | 5.25 | 5.25 |
| 796.6 | " Baltimore..... | 7 05 | 7 05 |
| 836.6 | " Washington... | 8.26 | 8 26 |
| 749.1 | " Lancaster..... | ..... | ..... |
| 817.2 | " Philadelphia... | ..... | ..... |
| 822.7 | " North Phila... | 7.02 | 7.19 |
| 850.7 | " Trenton..... | ..... | ..... |
| 898.8 | " Newark..... | ..... | 9.05 |
| ..... | " Manhattan Trans | 8.38 | 909 |
| ..... | " Jersey City | 9.01 | 9.24 |
| ... | " Hudson Ter. (N.Y.) | 9.04 | 9 27 |
| 907 5 | Ar **New York**.... Penna. Station | 8 57 AM | 9 28 AM |

Only first-class tickets honored on this train.

Fare

Manhattan Limited. No accommodations for coach passengers.

Extra-Fare Train.

1. On leaving New York on the Pennsylvania Line, at what point does the time change from Eastern to Central time?

2. How many hours are required for the Manhattan Limited (No. 23) to make the trip from New York to Chicago?

SUGGESTION. — Add 1 hr. to the time between 5.04 P.M. and 2 P.M. of the following day.

3. What is the distance from New York to Chicago via the Pennsylvania Line?

4. What is the average speed of the Manhattan Limited from New York to Chicago?

5. Counting five minutes for each of the stops scheduled, what is the running time of the train?

6. What is the greatest distance covered by this train without a stop?

7. What is the distance from New York to Pittsburgh?

8. If a passenger leaves Chicago at 10.30 A.M. on Monday, when will he arrive in New York?

9. Which requires the shorter time from Chicago to New York, train No. 40 or train No. 22, and what is the difference in time?

10. Calculate the speed per hour of train No. 40 from Chicago to New York.

11. Counting 5 minutes for each stop on the time-table, what is the running time of No. 40? of No. 22?

12. A business man leaves New York on train No. 23 Monday at 5.04 P.M. On what day and hour can he reach New York on his return if he leaves Chicago on train No. 40 at the first opportunity?

13. How many miles will a man travel in going from Chicago to New York and return? How much will it cost him at 2¢ per mile and $10 each way for extra fare?

**14.** From the time-table on p. 147, what is the distance from Chicago to Omaha?

**15.** What is the distance from Omaha to San Francisco? (See time-tables, pp. 147 and 148.)

**16.** What is the distance from Omaha to Sacramento?

**17.** What is the distance from Chicago to Sacramento?

**18.** What is the distance from Chicago to San Francisco?

**19.** Where on the trip west does the change from Central to Mountain time take place? Locate this place on the map on p. 143.

**20.** At what point does the change from Mountain to Pacific time take place? Find this place on the map.

**21.** In going west on the Overland Limited No. 1, explain why the time schedule indicates that the traveler arrives in North Platte at 2.40 P.M. and leaves at 1.45 P.M. or 55 minutes earlier than the time of arrival.

**22.** What is the average speed of Overland Limited No. 2 from Omaha to Chicago? (Read up.)

**23.** What is the average speed of No. 19 from Omaha to Cheyenne? (Notice change of time.)

**24.** What is the average speed of Overland Limited No. 1 from Chicago to San Francisco?

**25.** If a train is composed of an engine valued at $18,700 and seven steel sleeping coaches and two baggage cars valued at $16,700 each, what is the cost of the equipment for one train?

**26.** If an engine weighs 225,000 lb. and each car 115,000 lb., what is the weight of the train in tons?

**27.** What is the average increase in elevation per mile from Omaha to Sherman? from Omaha to Cheyenne?

| Pacific Limited 19- Daily | ✦ Over-land Limited 1- Daily | MILES | BETWEEN CHICAGO, OMAHA, OGDEN, SAN FRANCISCO, AND Los Angeles (via So. Pac.) | | ROUTE | TIME | Elevation | ✦ Over-land Limited 2 Daily | Pacific Limit'd 20- Daily |
|---|---|---|---|---|---|---|---|---|---|
| 10.15 | 7.00 | 0 | Lv. Chicago | Ill. Ar. | C. & N. W. | C | 590 | 9.30 | 9.15 |
| 11.30 | 7.05 | 488 | Ar. Co. Bluffs | Iowa Lv. | " | C | 981 | 8.25 | |
| | 7.30 | 491 | Ar. Omaha | Neb. Lv. | " | C | 1034 | 8.00 | 7.50 |
| 12.01 | 7.15 | | Lv. U. P. Transfer | Ia. Ar. | Un. Pacific | C | 981 | 8.20 | 8.15 |
| 12.15 | 7.30 | 0 | Ar. Omaha | Neb. Lv. | " | C | 1034 | 8.05 | 8.00 |
| 12.30 | 8.00 | 0 | Lv Omaha | " Ar. | " | C | 1034 | 8.45 | 7.35 |
| 1.30 | 8.53 | 46 | Lv. Fremont | " Lv. | " | C | 1196 | 7.41 | 6.28 |
| | | 61 | Lv. North Bend | " Lv. | " | C | 1274 | | |
| 2.16 | | 75 | Lv. Schuyler | " Lv. | " | C | 1349 | | |
| 2.43 | 9.51 | 91 | Lv. Columbus | " Lv. | " | C | 1444 | 6.44 | 5.21 |
| | | 120 | Lv. Clarks | " Lv. | " | C | 1619 | | |
| | | 132 | Lv. Central City | " Lv. | " | C | 1699 | | |
| | | 142 | Lv. Chapman | " Lv. | " | C | 1764 | | |
| 4.20 | 11.20 | 153 | Ar. Grand Island | " Lv. | " | C | 1861 | 5.25 | 3.50 |
| 4.25 | 11.25 | 153 | Lv. Grand Island | " Ar. | " | C | 1861 | 5.20 | 3.45 |
| 4.53 | | 169 | Lv. Wood River | " Lv. | " | C | 1963 | | |
| 5.07 | | 176 | Lv. Shelton | " Lv. | " | C | 2016 | | |
| 5.20 | | 183 | Lv. Gibbon | " Lv. | " | C | 2058 | | |
| 5.45 | 12.25 | 196 | Lv. Kearney | " Lv. | " | C | 2146 | 4.20 | 2.41 |
| 6.10 | | 211 | Lv. Elm Creek | " Lv. | " | C | 2262 | | |
| 6.24 | | 220 | Lv. Overton | " Lv. | " | C | 2320 | | |
| 6.45 | 1.11 | 231 | Lv. Lexington | " Lv. | " | C | 2387 | 3.31 | 1.45 |
| 7.10 | | 245 | Lv. Cozad | " Lv. | " | C | 2485 | | |
| 7.32 | | 256 | Lv. Gothenburg | " Lv. | " | C | 2561 | | |
| 7.57 | | 268 | Lv. Brady Island | " Lv. | " | C | 2649 | | |
| 8.45 | 2.40 | 291 | Ar. North Platte | " Lv. | " | C | 2800 | 2.10 | 12.15 |
| 7.50 | 1.45 | 291 | Lv. North Platte | " Ar. | " | M | 2800 | 1.05 | 11.10 |
| 9.20 | | 341 | Lv. Ogallala | " Lv. | " | M | 3211 | | |
| | | 366 | Lv. Barton | " Lv. | " | M | 3414 | | |
| 10.18 | 3.45 | 372 | Lv. Julesburg | Colo. Lv. | " | M | 3465 | 11.18 | |
| | | 382 | Lv. Ralton | Neb Lv. | " | M | 3614 | | |
| 10.48 | | 387 | Lv. Chappell | " Lv | " | M | 3934 | | |
| 11.06 | | 396 | Lv. Lodge Pole | " Lv. | " | M | 4269 | | |
| 11.60 | 4.53 | 414 | Lv. Sidney | " Lv. | " | M | 4673 | 10.15 | 8.10 |
| | | 433 | Lv. Potter | " Lv. | " | M | 4979 | | |
| | | 451 | Lv. Kimball | " Lv. | " | M | 5182 | | |
| | | 468 | Lv. Smeed | " Lv. | " | M | 4937 | | |
| | | 473 | Lv. Pine Bluffs | Wyo. Lv. | " | M | 5043 | | |
| 3.20 | 7.55 | 516 | Ar. Cheyenne | " Lv. | " | M | 6058 | 7.45 | 5.35 |
| 10.30 | 10.00 | 0 | Lv. Kansas City | Mo. Ar. | " | C | 681 | 9.15 | 7.20 |
| 6.40 | 3.50 | 640 | Ar. DENVER | Colo. Lv. | " | M | 5170 | 12.20 | 10.00 |
| 11.30 | 4.30 | 640 | Lv. DENVER | Colo. Ar. | " | M | 5170 | 11.30 | 9.30 |
| 3.15 | 7.35 | 746 | Ar. Cheyenne | Wyo. Lv. | " | M | 6050 | 8.30 | 6.00 |
| 3.35 | 8.10 | 516 | Lv. Cheyenne | " Ar. | " | M | 6058 | 7.35 | 5.20 |
| | | 535 | Lv. Granite Canon | " Lv. | " | M | 7312 | | |
| | | 543 | Lv. Buford | " Lv. | " | M | 7858 | | |
| | | 547 | Lv. Sherman | " Lv. | " | M | 8010 | | |
| 5.35 | 10.05 | 573 | Ar. Laramie | " Lv. | " | M | 7145 | 5.45 | 3.20 |
| 5.40 | 10.10 | 573 | Lv. Laramie | " Ar. | " | M | 7145 | 5.42 | 3.15 |
| | | 612 | Lv. Rock River | " Lv. | " | M | 6904 | | |
| | | 630 | Lv. Medicine Bow | " Lv. | " | M | 6560 | | |
| | | 650 | Lv. Hanna | " Lv. | " | M | 6769 | | |
| | | 669 | Lv. Walcott | " Lv. | " | M | 6618 | | |
| | | 674 | Lv. Ft. Steele | " Lv. | " | M | 6505 | | |

| No. 19 | No. 1 | Mls. | | | | Un. Pacific | | Elev. | No. 2 | No. 20 |
|---|---|---|---|---|---|---|---|---|---|---|
| 9.05 | 1.15 | 690 | Lv.....Rawlins.... | " | Lv. | " | M | 6741 | 2.41 | 11.40 |
| ..... | ..... | 731 | Lv..Wamsutter.. | " | Lv. | " | M | 6702 | ..... | ..... |
| ..... | ..... | 764 | Lv..Bitter Creek. | " | Lv. | " | M | 6692 | ..... | ..... |
| 12.35 | 4 20 | 809 | Lv..Rock Springs. | " | Lv. | " | M | 6256 | 11.17 | 7.38 |
| 1.00 | 4.40 | 824 | Ar...Green River.. | " | Lv. | " | M | 6077 | 10.53 | 7.15 |
| 1.15 | 4.45 | 824 | Lv..Green River.. | " | Ar. | " | M | 6077 | 10.48 | 7.10 |
| ..... | ..... | 854 | Lv.....Granger.... | " | Lv. | " | M | 6264 | ..... | ..... |
| ..... | ..... | 883 | Lv.....Carter..... | " | Lv. | " | M | 6491 | ..... | ..... |
| ..... | ..... | 905 | Lv..Spring Valley. | " | Lv. | " | M | 7003 | ..... | ..... |
| ..... | ..... | 911 | Lv.....Altamont... | " | Lv. | " | M | 7214 | ..... | ..... |
| 4.20 | 7 50 | 924 | Lv....Evanston... | " | Lv. | " | M | 6739 | 7.58 | 4.05 |
| ..... | ..... | 935 | Lv...Wahsatch..Utah | | Lv. | " | M | 6806 | ..... | ..... |
| ..... | ..... | 944 | Lv..Castle Rock.. | " | Lv. | " | M | 6217 | ..... | ..... |
| 5.32 | ..... | 960 | Lv.....Echo..... | " | Lv. | " | M | 5454 | ..... | ..... |
| ..... | ..... | 969 | Lv...Devils Slide.. | " | Lv. | " | M | 5224 | ..... | ..... |
| ..... | ..... | 976 | Lv.....Morgan.... | " | Lv. | " | M | 5064 | ..... | ..... |
| 6.50 | 10.20 | 1000 | Ar.....Ogden..... | " | Lv. | " | M | 4293 | 5.05 | 1.10 |
| 7.15 | 10.30 | 1000 | Lv .....Ogden..... | " | Ar. | O. S. L. | M | 4293 | 4.50 | 12.55 |
| 8.15 | 11.35 | 1036 | Ar...SALT LAKE.. | " | Lv. | " | M | 4260 | 3.50 | 12.01 |
| 6.05 | 9.35 | 1000 | Lv .....Ogden..... | " | Ar. | So. Pacific | P | 4293 | 3.50 | 11.55 |
| ..... | ..... | 1006 | Lv...West Weber | " | Lv. | " | P | ---- | ..... | ..... |
| ..... | ..... | 1024 | Lv.Promontory Pt. | " | Lv. | " | P | 4901 | ..... | ..... |
| ..... | ..... | 1048 | Lv....Lakeside.... | " | Lv. | " | P | -- - | ..... | ..... |
| ..... | ..... | 1103 | Lv.....Lucin..... | " | Lv. | " | P | 4492 | ..... | ..... |
| ..... | ..... | 1113 | Lv.....Tecoma....Nev. | | Lv. | " | P | 4805 | ..... | ..... |
| 10.05 | 1.03 | 1120 | Lv.....Montello... | " | Lv. | " | P | 4985 | 12.35 | 8.30 |
| 10.50 | ..... | 1138 | Lv.....Cobre..... | " | Lv. | " | P | ---- | ..... | 7.54 |
| 12.03 | ..... | 1174 | Lv.....Wells..... | " | Lv. | " | P | 5625 | ..... | 6.50 |
| ... | ..... | 1206 | Lv.....Halleck.... | " | Lv. | " | P | 5229 | ..... | ..... |
| 1.22 | ..... | 1226 | Lv.....Elko..... | " | Lv. | " | P | 5060 | ..... | 5.28 |
| 2.00 | 4.25 | 1248 | Lv.....Carlin..... | " | Lv. | " | P | 4899 | 8.58 | 4.55 |
| 2.15 | ..... | 1257 | Lv.....Palisade.... | " | Lv. | " | P | 4837 | ..... | 4.34 |
| 3.30 | ..... | 1307 | Lv.Battle M'ntain | " | Lv. | " | P | 4511 | ..... | 3.21 |
| ..... | ..... | 1349 | Lv....Golconda... | " | Lv. | " | P | 4385 | ..... | ..... |
| 5.03 | ..... | 1365 | Lv..Winnemucca. | " | Lv. | " | P | 4332 | ..... | 1.53 |
| 6.00 | 7.53 | 1398 | Lv .....Imlay..... | " | Lv. | " | P | 4231 | 5.10 | 1.05 |
| 7.02 | ..... | 1438 | Lv....Lovelock.... | " | Lv. | " | P | 3974 | ..... | 12.04 |
| 8.30 | 10.07 | 1494 | Lv.....Hazen..... | " | Lv. | " | P | .... | 3.03 | 10.35 |
| 8.55 | 11.25 | 1536 | Ar .....Sparks..... | " | Lv. | " | P | 4085 | 2.00 | 9.25 |
| 10.05 | 11.30 | 1536 | Lv..... Sparks..... | " | Ar. | " | P | 4085 | 1.55 | 9.15 |
| 10.19 | 11.40 | 1539 | Lv.....Reno..... | " | Lv. | " | P | 4497 | 1.45 | 9.05 |
| ..... | ..... | 1559 | Lv.....Floriston...Cal. | | Lv. | " | P | 5344 | ..... | ..... |
| ..... | ..... | 1565 | Lv.....Boca..... | " | Lv. | " | P | 5526 | ..... | ..... |
| 11.40 | 1.00 | 1574 | Lv.....Truckee.... | " | Lv. | " | P | 5819 | 12.28 | 7.43 |
| ..... | ..... | .... | Lv...Lake Tahoe.. | " | Lv. | " | P | 6225 | ..... | ..... |
| ..... | ..... | 1589 | Lv.....Summit.... | " | Lv. | " | P | 7012 | ..... | ..... |
| ..... | ..... | 1610 | Lv. Emigrant Gap | " | Lv. | " | P | 5225 | ..... | ..... |
| ..... | ..... | 1615 | Lv...Blue Canon.. | " | Lv. | " | P | 4695 | ..... | 5.35 |
| ..... | ..... | 1624 | Lv.....Towle..... | " | Lv. | " | P | 3393 | ..... | ..... |
| ..... | ..... | 1626 | Lv...Dutch Flat... | " | Lv. | " | P | ---- | ..... | ..... |
| ..... | ..... | 1628 | Lv....Cold Run... | " | Lv. | " | P | 3218 | ..... | ..... |
| 3.08 | 4.01 | 1639 | Lv.....Colfax..... | " | Lv. | " | P | 2242 | 9.07 | 4.00 |
| ..... | ..... | 1662 | Lv....Newcastle.. | " | Lv. | " | P | 964 | ..... | ..... |
| ..... | ..... | 1671 | Lv.....Rocklin.... | " | Lv. | " | P | 243 | ..... | ..... |
| ..... | ..... | 1675 | Lv.....Roseville... | " | Lv. | " | P | 159 | 7.50 | 2.30 |
| 5.10 | 6.00 | 1693 | Ar..Sacramento.. | " | Lv. | " | P | 30 | 7.15 | 1.45 |
| 5.20 | 6.05 | 1693 | Lv..Sacramento. | " | Ar. | " | P | 30 | 7.10 | 1.40 |
| 7.20 | 8.05 | 1751 | Lv...Port Costa.. | " | Ar. | " | P | 12 | 5.12 | 11.35 |
| ..... | ..... | 1754 | Lv...Vallejo Jct.. | " | Lv. | " | P | 9 | ..... | ..... |
| 8.10 | 8.50 | 1774 | Lv.....Oakland.... | " | Lv. | " | P | 9 | 4.29 | 10.53 |
| 8.29 | 9.09 | 1776 | Lv..Oakland Pier. | " | Lv. | " | P | 9 | 4.23 | 10.45 |
| 8.50 | 9.30 | 1782 | Ar. San Francisco | " | Lv. | " | P | 14 | 4.00 | 10.20 |

**28.** What is the cost of a regular-fare trip from Chicago to Denver, including the following items: car fare each way, $30; Pullman each way, $6; 4 meals en route each way at an average of $1.10 each; tips to Pullman porter, $1?

**29.** If a traveler leaves New York for San Francisco at 5.04 P.M. on Monday, designate the time when he will arrive in San Francisco.

**30.** In making the journey from New York to San Francisco, at what points does the traveler pass from one time belt into another?

**31.** What changes should you make in your watch on the westbound trip?

**32.** What changes should you make in your watch on the trip from San Francisco to New York?

**33.** What change as to time do you notice when you arrive at Pittsburgh, at North Platte, and at Ogden on the westbound trains?

**34.** If you leave Chicago at 7.00 P.M. on Monday, name the day and the time of day when you will arrive at Omaha; at Ogden; at San Francisco.

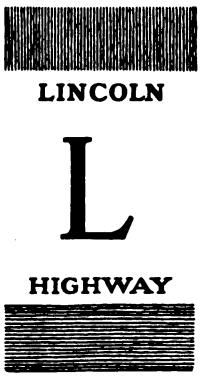
**35.** In the column marked "elevation" find the highest point between Ogden and Reno.

**36.** What is the difference in elevation between Reno and San Francisco?

**37.** At 3¢ per mile, what is the cost of transportation from Ogden to Sacramento? from Rawlins, Wyo., to San Francisco? from Chicago to Julesburg?

**38.** What is the distance from Wahsatch, Utah, to Sacramento, Cal., and what is the fare between the two stations at 3¢ per mile?

**39.** What is the cost of a trip from Chicago to Yellowstone National Park if a round-trip ticket costs $51.10, tourist sleeper each way, $4.75; meals en route each way, $6; seeing the park, $45; incidentals, $12?




In many years nothing has made a stronger appeal to the American people than the Lincoln Highway. The idea of building a public highway from the Atlantic to the Pacific, a distance of about 3400 miles, and of dedicating it to Lincoln is inspiring.

The Lincoln Highway will be of cement construction, about 16 ft. wide and leveled to the dirt road on either side. Many branch lines will be built connecting with the main highway at various points. Such a road will inspire good road-building all over the country and the influence will be far-reaching.

| | Route and Mileage |
|---|---|
| 0.0 | New York |
| 106.3 | Philadelphia, **Penn.** |
| 225.0 | Gettysburg |
| 405.0 | Pittsburgh, change from Eastern to Central time |
| 539.7 | Canton, **Ohio** |
| 601.7 | Mansfield |
| 689.8 | Lima |
| 753.1 | Ft. Wayne, **Ind.** |
| 820.0 | Elkhart |
| 837.5 | South Bend |
| 864.1 | Laporte |
| 886 8 | Valparaiso |
| 919.0 | Chicago Heights, **Ill.** |
| 932.6 | Joliet |
| 956.3 | Aurora |
| 966.3 | Geneva |
| 989.8 | De Kalb |
| 1007.5 | Rochelle |
| 1018.6 | Ashton |
| 1023.3 | Franklin Grove |
| 1033.3 | Dixon |
| 1046.7 | Sterling |
| 1061.1 | Morrison |
| 1071.8 | Fulton |
| 1073.4 | Clinton, **Iowa** |
| 1099.4 | Grandmound |
| 1134.4 | Mechanicsville |

**40.** If the cost of construction is $8000 per mile on an average, what will be the cost of constructing the entire highway, 3400 miles in extent?

**41.** If it costs $8000 per mile, what will be the cost of constructing the road 106 miles through New Jersey?

**42.** The extent of the Lincoln Highway in Pennsylvania is 298.7 miles. What will be the cost of construction at $8200 per mile?

**43.** How much will it cost to build the highway 313.8

| | Route and Mileage |
|---|---|
| 1143.1 | Mount Vernon |
| 1161.5 | Cedar Rapids |
| 1197.5 | Belle Plaine |
| 1223.7 | Montour |
| 1237.5 | Marshalltown |
| 1268.0 | Nevada |
| 1276.3 | Ames |
| 1292.5 | Boone |
| 1313.5 | Grand Junction |
| 1321.5 | Jefferson |
| 1331.5 | Scranton |
| 1350.5 | Carroll |
| 1364.3 | Westside |
| 1370.1 | Vail |
| 1379.3 | Denison |
| 1391.5 | Arion |
| 1398.7 | Dunlap |
| 1410.3 | Woodbine |
| 1430.5 | Missouri Valley |
| 1445.8 | Crescent |
| 1453.5 | Council Bluffs |
| 1458.3 | Omaha, Neb. |
| 1474.9 | Elkhorn |
| 1478.3 | Waterloo |
| 1494.1 | Fremont |
| 1501.0 | Ames |
| 1509.3 | North Bend |
| 1522.0 | Schuyler |
| 1542.2 | Columbus |
| 1551.6 | Duncan |
| 1561.9 | Silver Creek |
| 1573.3 | Clarks |
| 1584.5 | Central City |
| 1594.9 | Chapman |
| 1607.5 | Grand Island |
| 1625.4 | Wood River |
| 1634.0 | Shelton |
| 1640.0 | Gibbon |
| 1652.9 | Kearney |
| 1657.9 | Frisco-Boston sign, 1733 mi. each way |
| 1662.3 | Odessa |
| 1668.9 | Elm Creek |
| 1679.2 | Overton |
| 1683.1 | Lexington |
| 1701.4 | Cozad |
| 1706.6 | Willow Island |
| 1711.2 | Gothenburg |
| 1760.4 | North Platte, change from Central to Mountain time |
| 1780.9 | Sutherland |
| 1813.7 | Ogallala |
| 1833.8 | Bigspring |
| 1854.9 | Chappell |
| 1879.2 | Lodgepole |
| 1897.4 | Sidney |
| 1935.5 | Kimball |

miles through Ohio at $9000 per mile?

**44.** What will be the cost of construction of the highway 158.4 miles through the state of Indiana at $9000 per mile?

**45.** What will be the cost of constructing 152.8 miles of the highway through Illinois at $7000 per mile?

**46.** Find the cost of construction of the highway 380.1 miles through the state of Iowa at $6800 per mile.

**47.** What will be the cost of the Lincoln Highway through Nebraska 489.2 miles at $6000 per mile?

**48.** How long will it take an automobile to make the trip from New York to Chicago Heights (see mileage table) if it averages 20 miles per hour for 10 hours a day?

**49.** How long will it take an automobile party to make the trip from Chicago Heights to Salt Lake City (see p. 152) if it travels an average of 19.5 miles per hour and 8 hours per day?

| Route and Mileage | |
|---|---|
| 1947.5 | Bushnell |
| 1991.5 | Archer, **Wyo.** |
| 2009.0 | Cheyenne |
| 2027.8 | Buford |
| 2058.9 | Laramie |
| 2100.5 | Arlington |
| 2126.9 | Fisherville |
| 2147.9 | Fort Fred Steele |
| 2163.3 | Rawlins |
| 2205.0 | Wamsutter |
| 2221.6 | Tipton |
| 2250.8 | Point of Rocks |
| 2276.7 | Rock Springs |
| 2291.6 | Green River |
| 2326.0 | Granger |
| 2361.4 | Ft. Bridger |
| 2396.6 | Evanston |
| 2401.3 | State Line |
| 2406.7 | Wasatch, **Utah** |
| 2414.3 | Castle Rock, Ogden, change from Mountain to Pacific time. |
| 2479.0 | Salt Lake City |
| 2519.5 | Grantsville |
| 2624.9 | Fish Springs |
| 2670.4 | Ibapah |
| 2695.4 | Tippett, **Nev.** |
| 2752.9 | McGill |
| 2764.9 | Ely |
| 2841.6 | Eureka |
| 2957.4 | Alpine |
| 2991.4 | Frenchman's Station |
| 3026.5 | Fallon |
| 3043.9 | Truckee Dam |
| 3065.1 | Wadsworth |
| 3098.6 | Reno |
| 3133.5 | Truckee, **Cal.** |
| 3143.3 | Summit |
| 3196.6 | Colfax |
| 3223.0 | Rocklin |
| 3252.6 | Sacramento |
| 3305.0 | Stockton |
| 3382.6 | Oakland |
| 3388.6 | San Francisco |

**50.** How long will it require to make the trip from Omaha to San Francisco, traveling at the average rate of 22.4 miles per hour and $8\frac{1}{2}$ hours per day?

**51.** How long will be required for a car to run from San Francisco to New York with an average rate of 20 miles per hour and 9 hours per day?

**52.** If 1 gallon of gasoline will drive a car 16 miles, how much gasoline will it require to make the trip from San Francisco to New York?

**53.** If 1 gallon of gasoline will drive a car 21 miles, how much will the gasoline cost for a journey from New York to San Francisco at the price of 22 ¢ per gallon?

# BUILDING PROBLEMS

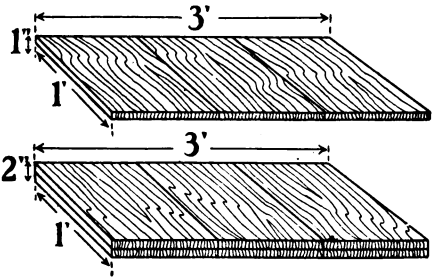
## LUMBER MEASURE

For the measure of lumber the board foot is the unit.

The **board foot** is **one square foot** of board one inch or less in thickness.

If the board is 2 inches in thickness, it contains twice as many board feet as a board of the same length and width which is 1 inch or less in thickness.

Boards and dimension stuffs are sold by the thousand (M); shingles by the thousand shingles; laths by the thousand laths.




1. How much surface is there in a board 1 in. thick, 1 ft. wide, and 3 ft. long?

SOLUTION. — (1 × 3) sq. ft. = 3 sq. ft.

2. How many board feet are there in a board 2 in. thick, 1 ft. wide, and 3 ft. long?

SOLUTION. — (2 × 1 × 3) board feet = 6 board feet.

3. How many board feet are there in a board 1 in. thick, 6 in. ($\frac{1}{2}$ ft.) wide, and 8 ft. long?

SOLUTION. — ($\frac{1}{2}$ × 8) board feet = 4 board feet.

4. How many board feet are there in a board 1 in. thick, 6 in. wide, and 16 ft. long?

**5.** How many feet of lumber are there in a board 2 in. × 9 in. × 16 ft.?

SOLUTION. — 9 in. = $\frac{9}{12}$ ft., or $\frac{3}{4}$ ft.

(2 × $\frac{3}{4}$ × 16) bd. ft. = 24 board feet.

**6.** How many board feet are there in a board 2 in. thick, 4 in. wide, and 12 ft. long?

**7.** How many board feet are there in a board 1 in. × 8 in. × 16 ft.?

**8.** How much lumber is there in 18 pieces 2 in. × 4 in. × 14 ft.?

SOLUTION. — By cancellation:

$$\frac{\overset{3}{\cancel{18}} \times 14 \times 4 \times 2}{\underset{6}{\cancel{12}}} \text{ bd. ft.} = 3 \times 14 \times 4 \text{ bd. ft.} = 168 \text{ board feet.}$$

The method here used is to find the total length by multiplying $18 \times 14$; then find the board feet by multiplying by $\frac{4}{12}$, the width in feet, and by 2 for the thickness; the result is the board feet in 18 pieces $2'' \times 4'' \times 14'$.

Find the number of board feet in the following:

**9.** 20 pieces $2'' \times 4'' \times 12'$

**10.** 24 pieces $2'' \times 6'' \times 12'$

**11.** 12 pieces $2'' \times 8'' \times 12'$

**12.** 14 pieces $2'' \times 10'' \times 12'$

**13.** 16 pieces $1'' \times 8'' \times 14'$

**14.** 20 pieces $4'' \times 6'' \times 16'$

**15.** 60 pieces $4'' \times 10'' \times 16'$

**16.** 70 pieces $3'' \times 12'' \times 16'$

**17.** 50 pieces $8'' \times 8'' \times 20'$

**18.** 100 pieces $2'' \times 14'' \times 14'$

**19.** 25 pieces $4'' \times 9'' \times 14'$

**20.** 40 pieces $1'' \times 16'' \times 12'$

**21.** 10 pieces $1'' \times 14'' \times 14'$

**22.** 12 pieces $2'' \times 10'' \times 14'$

**23.** 24 pieces $4'' \times 4'' \times 10'$

**24.** 50 pieces $2'' \times 4'' \times 10'$

**25.** 100 pieces $1'' \times 12'' \times 12'$

**26.** 15 pieces $2'' \times 4'' \times 16'$

**27.** 28 pieces $6'' \times 6'' \times 18'$

**28.** 42 pieces $2'' \times 14'' \times 18'$

**29.** 82 pieces $6'' \times 12'' \times 18'$

**30.** 44 pieces $1'' \times 10'' \times 16'$

**31.** 30 pieces $2'' \times 14'' \times 16'$

**32.** 60 pieces $2'' \times 8'' \times 14'$

LUMBER MEASUREMENT TABLE

Pupils should be taught to use tabulated figures before leaving the subject.

| INCHES | 10′ | 12′ | 14′ | 16′ | 18′ |
|---|---|---|---|---|---|
| 2 × 4 | 7 | 8 | 9 | 11 | 12 |
| 2 × 6 | 10 | 12 | 14 | 16 | 18 |
| 2 × 8 | 13 | 16 | 19 | 21 | 24 |
| 2 × 10 | 17 | 20 | 23 | 27 | 30 |
| 2 × 12 | 20 | 24 | 28 | 32 | 36 |
| 2 × 14 | 23 | 28 | 33 | 37 | 42 |
| 3 × 4 | 10 | 12 | 14 | 16 | 18 |
| 3 × 6 | 15 | 18 | 21 | 24 | 27 |
| 3 × 8 | 20 | 24 | 28 | 32 | 36 |
| 3 × 10 | 25 | 30 | 35 | 40 | 45 |
| 3 × 12 | 30 | 36 | 42 | 48 | 54 |
| 3 × 14 | 35 | 42 | 49 | 56 | 63 |
| 4 × 4 | 13 | 16 | 19 | 21 | 24 |
| 4 × 6 | 20 | 24 | 28 | 32 | 36 |
| 6 × 6 | 30 | 36 | 42 | 48 | 54 |
| 8 × 8 | 53 | 64 | 75 | 85 | 96 |
| 10 × 10 | 83 | 100 | 117 | 133 | 150 |
| 12 × 12 | 120 | 144 | 168 | 192 | 216 |

NOTE. — In each of the following examples, the numbers connected by × represent inches, and the number preceded by the dash — represents feet.

**33.** Find the number of board feet in 4 pcs. 2 × 8 — 12.

SOLUTION. — By reference to the table 1 pc. 2″ × 8″ × 12′ = 16 bd. ft.
4 pcs. 2″ × 8″ × 12′ = 4 × 16 bd. ft. = 64 bd. ft.

**34.** Find the number of board feet in 32 pcs. 2 × 6 — 16.

**35.** Find the number of board feet in 24 pcs. 2 × 8 — 12.

**36.** How many feet are there in 16 pcs. 2 × 10 — 18?

**37.** What is the cost of 16 pcs. 2 × 14 — 14 at $34 per M?

38. Find the cost of 20 pcs. 4 × 4 — 16 at $36 per M.

39. Find the cost of 8 pcs. 4 × 6 — 18 at $35 per M.

40. Find the cost of 4 sills, each 8 × 8 — 18, at $34.50 per M.

41. Find the cost of 2 pcs. 12 × 12 — 18 at $30 per M.

42. Find the cost of 8 pcs. 10 × 10 — 14 at $30 per M.

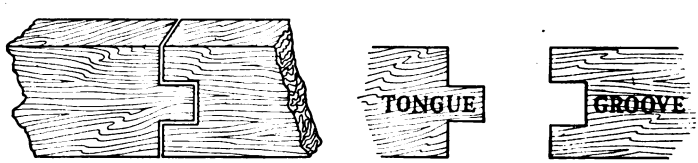
### Bill for Granary

43. Figure the following bill of materials required for a granary 14′ × 10′. Find its cost.

| | | |
|---|---|---|
| 2 sills 4 × 6 – 14 | at | $34.00 per M. |
| 13 floor joists 2 × 12 – 10 | at | 34.00 per M. |
| 22 studding 2 × 6 – 8 | at | 34.00 per M. |
| 22 studding 2 × 6 – 10 | at | 34.00 per M. |
| 13 rafters 2 × 4 – 12 | at | 34.00 per M. |
| 486 ft. drop siding | at | 36.00 per M. |
| 180 ft. sheathing | at | 28.00 per M. |
| 100 ft. finish | at | 40.00 per M. |
| 168 ft. flooring | at | 45.00 per M. |
| 1 roll rubberoid roofing | at | 2.50 |
| 20 lb. nails | @ | .04 |
| Labor, 22 hr. | @ | .35 |
| Labor, 22 hr. | @ | .20 |

## CARPENTRY, PLASTERING, PAINTING, MASONRY, ETC.

**Flooring lumber**, which is **tongued** and **grooved** or, as it is called, **matched**, bears a waste, since lumber dealers figure the full width before it is matched. Builders usually make an allowance of $\frac{1}{6}$ for waste.



1. How many feet of flooring are required to cover a floor 14′ 6″ × 16′ 9″?

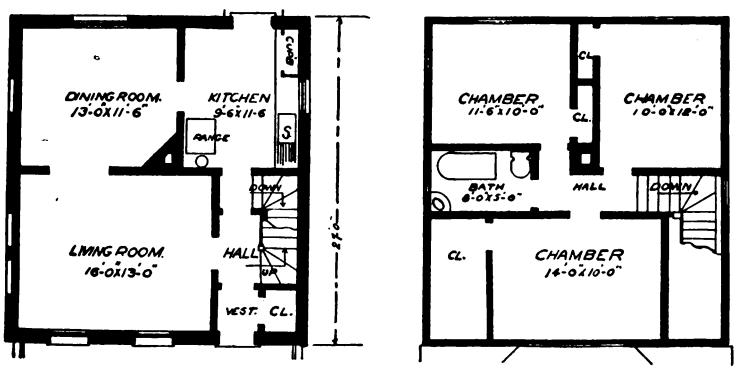
SOLUTION. — $14' 6'' = 14\frac{1}{2}' = \frac{29'}{2}$; $16' 9'' = 16\frac{3}{4}' = \frac{67'}{4}$.

$\frac{29}{2} \times \frac{67}{4} \times \frac{3}{\frac{6}{5}}$ (allowing $\frac{1}{5}$ for waste) $= \frac{5829}{20}$, 291.45, or 292, number of board feet.

2. How many feet of maple flooring will it require to lay a floor 14′ × 17′ 9″?

3. Find the cost of a hardwood floor 12′ × 14′ at $58 per M.

4. Find the cost of an oak floor for a bathroom 8′ × 9′ 8″ at $67 per M.




5. Find the cost of flooring the living room in the diagram. Flooring costs $58 per M; it requires 10 lb. of nails at $.05 per pound; the carpenter charges $4 per day and can lay 400 sq. ft. of floor per day.

6. Find the cost of flooring the dining room, the cost of materials and labor being the same as in problem 5.

7. Find the cost of flooring chambers and kitchen; prices same as in problem 5, but 22 lb. of nails being required.

**Shingles** are estimated to have an average width of 4 in. They are put up in bunches containing 250. It is usual to lay shingles 4 in. to the weather, but this depends upon the steepness of the roof. If the roof is steep, they may be laid $4\frac{1}{2}$ in. or even $5\frac{1}{2}$ in. to the weather. Making due allowance for waste, the rule for shingles is:

**4 in. to the weather, 1000 shingles to the square (100 sq. ft.).**
**$4\frac{1}{2}$ in. to the weather, 900 shingles to the square.**
**5 in. to the weather, 800 shingles to the square.**
**$5\frac{1}{2}$ in. to the weather, 700 shingles to the square.**

8. How many shingles are required to cover a roof which is 50 ft. long and 30 ft. wide on each side, the shingles being laid 4 in. to the weather?

SOLUTION. — $\frac{2 \times 50 \times 30}{100}$ squares = 30 squares.

$\frac{2}{}$

30 × 1000 shingles = 30,000 shingles.

9. How much will the shingles (4 in. to weather) cost for a roof 40 ft. × 20 ft. on each side, at \$3.50 per M?

10. How much will it cost for labor and materials to shingle a barn, the roof of which is 60 ft. long by 20 ft. wide on each side, with shingles $4\frac{1}{2}$ in. to the weather, the carpenter being able to lay 2000 shingles per day, and charging \$3.50 per day. 5 lb. of nails at 6¢ per pound are required for each 1000 shingles, and shingles are priced at \$2.25 per thousand.

**Laths** are $1\frac{1}{2}$ in. wide and 4 ft. long; **16** laths are estimated to a **square yard**; 10 lb. of 3*d* lath nails are estimated to 100 sq. yd. of lathing. Laths are put up in bundles of 50.

**11.** Measure the schoolroom and compute the number of laths required to lath it.

**12.** Compute the number of laths and the quantity of nails necessary to lath the walls and ceiling (9 ft. high) of the living room in the diagram on p. 157, deducting 14 sq. yd. for openings.

**13.** Find the cost of lathing the living room of the plan if laths are 35¢ a bundle, and nails 6¢ a pound, and a carpenter charges $3.50 a day and can put on 80 sq. yd. in one day. Deduct 14 sq. yd. for openings.

**14.** Find the cost of lathing the dining room and the kitchen (9 ft. high), deducting 24 sq. yd. for openings; prices and conditions according to problem 13.

**Plastering.** — **15.** A room is 22 ft. long, 14 ft. wide, and 9 ft. high. It has 4 windows, 4 ft. by 6 ft., and 2 doors, 3 ft. by 7 ft. Find the cost of plastering the room at 46¢ per square yard. Deduct for openings.

SOLUTION

$2 \times (14 + 22)$ ft. $= 72$ ft., perimeter (outer boundary of the figure).
$9 \times 72$ sq. ft. $= 648$ sq. ft. in walls.
$14 \times 22$ sq. ft. $= 308$ sq. ft. in ceiling.
$648$ sq. ft. $+ 308$ sq. ft. $= 956$ sq. ft., in walls and ceiling.
$4 \times (4 \times 6)$ sq. ft. $= 96$ sq. ft. in 4 windows.
$2 \times (3 \times 7)$ sq. ft. $= 42$ sq. ft. in 2 doors.
$96$ sq. ft. $+ 42$ sq. ft. $= 138$ sq. ft. to deduct.
$956$ sq. ft. $- 138$ sq. ft. $= 818$ sq. ft., net area.
$818 \div 9 = 90\frac{8}{9}$, number of square yards.
$90\frac{8}{9} \times \$.46 = \$41.81$, cost of plastering.

**16.** Find the cost, at 50¢ a square yard, of plastering the living room in the plan shown on p. 157, which has 4 windows, 3 ft. by 6 ft., 1 door, 3 ft. by 7 ft., and 1 door, 5 ft. by 7 ft.; the ceiling is 9 ft. high. Deduct for openings.

**17.** Find the cost, at 50¢ a square yard, of plastering the 2 smaller chambers in the plan on p. 157; height of ceiling 9 ft. Deduct for 3 windows, each 3 ft. by 6 ft., and 2 doors, each 3 ft. by 7 ft.

**18.** Measure the schoolroom, measure and deduct for all openings, and find the cost of plastering it at 45¢ per square yard.

**Floor Covering.** — Linoleum is usually 2 yd. wide; ingrain carpets are 36 in. wide; other carpets are 27 in. wide.

**19.** Find the number of yards of Wilton carpet necessary to carpet a room 21 ft. long by 15 ft. wide.

SOLUTION. — 15 ft. ÷ 2¼ ft. (27 in.) = 6⅔, or 7, number of strips.
7 × 21 ft. = 147 ft.
147 ft. ÷ 3 ft. = 49, number of yards.

NOTE. — A fraction of a yard is counted one yard. The amount of waste depends upon the pattern.

**20.** Find the number of yards of Wilton carpet required to cover a floor 18 ft. long, 14 ft. 6 in. wide.

**21.** Find the cost of carpeting a room 14 ft. long by 12 ft. 6 in. wide with Axminster carpet at $1.35 per yard.

**22.** How much will it cost to cover a kitchen floor 12 ft. long by 10 ft. wide with linoleum at $1.85 per square yard? The linoleum is to be laid with the least possible waste. Will it be better to lay it lengthwise or crosswise?

**23.** How much will it cost to cover a kitchen 18 ft. × 12 ft. with linoleum at $2.15 per square yard?

**24.** What is the size of a rug necessary to cover the floor of the living room in the plan on p. 157, the rug to be large enough to come within 1 ft. of the wall on all sides? Make a diagram in your field book.

**25.** Make a diagram and show the size of a rug necessary to cover a floor 13 ft. long by 11 ft. wide, the rug to come within 1 ft. of the wall on every side. How many yards of carpet 27 in. wide does it contain?

**Papering.** — Wall paper is put up in rolls **24 ft. long** and double rolls **48 ft. long.** Figured paper is **18 in. wide**; ingrain **30 in. wide.**

In estimating the number of rolls of paper required for a room, it is customary to deduct the total width of doors and windows from the perimeter of the room to be papered; the net perimeter divided by $1\frac{1}{2}$ ft., the width of roll, will give the number of widths required. The parts about the doors and windows are papered with the ends of the rolls.

*To ascertain the number of strips in a roll, divide the length of a roll by the length of a strip.*

*To find the number of rolls necessary, divide the total number of strips needed by the number of strips that can be cut from one roll.*

**26.** How many rolls of paper are required to paper a room 18 ft. long, 16 ft. wide, and 9 ft. high, baseboard 8 in., deducting for 3 windows, each 3 ft. by 6 ft., and 2 doors each 3 ft. by 7 ft.?

SOLUTION

$2 \times (18 \text{ ft.} + 16 \text{ ft.}) = 68$ ft., perimeter.

$5 \times 3$ ft. $= 15$ ft. to deduct for doors and windows.

$68$ ft. $- 15$ ft. $= 53$ ft., net perimeter.

$53$ ft. $\div \frac{3}{2}$ ft. $= 35\frac{1}{3}$, or 36, number of strips.

9 ft. = height of room; deducting $\frac{3}{4}$ ft. for baseboard, $8\frac{1}{4}$ ft. = height.

$8\frac{1}{4}$ ft. = length of strip.

24 ft. $\div 8\frac{1}{4}$ ft. $= 2\frac{2}{11}$, or 2, number of whole strips.

(It will be noticed that the fraction of waste in this instance is very large, and it would be a saving to use double rolls.)

36 strips $\div$ 2 strips $= 18$, number of rolls.

Ceiling:

16 ft. ÷ 1½ ft. = 10⅔, number of strips, or 11 whole strips.

24 ft. (length of roll) ÷ 18 ft. (length of ceiling strip) = 1⅓, number of strips, or 1 whole strip.

11 strips ÷ 1 strip = 11, number of rolls.

18 rolls + 11 rolls = 29 rolls.

NOTE. — It will be observed that the waste in papering the ceiling by having the strips run the long way of the room is very great. By using double rolls and having the strips run the short way of the ceiling, it will require 4 double rolls for the ceiling, which is equivalent to 8 single rolls, thus effecting a considerable saving.

**27.** Calculate the number of double rolls of paper required for the room in problem 26, running the strips the short way of the ceiling.

**28.** Find the number of single rolls required to paper a room 14 ft. long, 12 ft. wide, and 8½ ft. high. Deduct for 1 door, 3 ft. by 7 ft., and 2 windows, 3 ft. by 6 ft.

**29.** Find the cost of papering a bedroom 10 ft. by 12 ft. with paper worth $1.60 per double roll. Height of ceiling 9 ft. Deduct for 3 windows, each 3 ft. by 6 ft., and 2 doors, each 3 ft. by 7 ft.

**30.** Find the number of single rolls necessary to paper a room 20 ft. long, 14 ft. wide, and 8 ft. 4 in. high. Deduct 15 ft.

**Painting and Calcimining.** — Estimates for painting and calcimining are made by the square yard and, unless a special contract is made, no deduction is made for openings.

**31.** Find the cost of decorating the walls and ceiling of the dining room in the plan on p. 157 (9 ft. high) with water colors at 6¢ per square yard.

**32.** How much will it cost to tint the side walls of the living room in the plan on p. 157 at 22¢ per square yard?

**Masonry.** — Bricks are usually 8 in. long, 4 in. wide, and 2 in. thick, although there is an appreciable difference in the size of pressed bricks. Common bricks generally sell for \$7 to \$10 per M, while pressed bricks are used for surfacing and cost from \$15 to \$40 per M.

NOTE. — Masons commonly estimate **22½ bricks to the cubic foot** of wall; about ¼ of the space is filled with the mortar. **4½ bricks** laid flat cover **a square foot.** In estimating material corners are usually counted once, but in estimating labor twice.

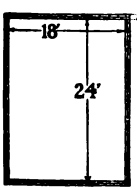
A mason with a tender will lay about 3000 common and 800 pressed bricks in one day. Masons receive 50¢ to 70¢ per hour. Helpers or tenders are paid 20¢ to 35¢ per hour.

| WIDTH OF WALL | NO. OF BRICKS PER SQUARE FOOT OF WALL SURFACE |
|---|---|
| 8 in. | 15 |
| 13 in. | 22½ |
| 17 in. | 30 |
| 22 in. | 37½ |

**33.** How much will a mason earn in 26 days, working 8 hours per day at 60¢ per hour?

**34.** How much will a mason's tender earn in 26 days, working 8 hours per day at 30¢ per hour?

**35.** How many bricks will a mason lay in 26 days if he averages 3000 per day?



BASEMENT

**36.** Find the number of bricks necessary to build the basement represented in the accompanying plan; the walls are 8 in. thick and 8 ft. high.

**37.** Find the number of bricks required to build the wall 13 in. thick.

**38.** How much will the bricks in problem 37 cost at \$8 per M? How much will it cost to build the wall at \$12 per M laid?

**Stone Masonry.** — A **perch** of stone masonry is 16½ ft. long, 1½ ft. wide, and 1 ft. high or **24¾ cu. ft.**

**39.** How many perches are there in a wall 74 ft. long, 16 in. wide, and 5 ft. high?

**40.** How many perches of stone are there in the basement represented in the plan on p. 163 if the wall is 12 in. thick and 8 ft. high?

**41.** How many perches of stone are there in the outside walls of a dwelling house, including basement and one story, the size of the house being 36 ft. by 36 ft., the walls being 18 ft. high and 14 in. in thickness. No deduction is made for openings.

**42.** How many perches of stone are there in a retaining wall 400 ft. long and 12 ft. high, the width of the wall being 24 in.?

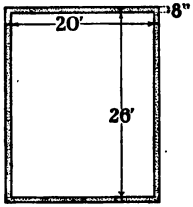
**Cement.** — This may be termed the age of cement. The facility with which it is used, the reasonableness of cost, and the many uses to which it is put give it unusual value. It is used for buildings, retaining walls, dams, bridges, aqueducts, sidewalks, paving, silos, cisterns, reservoirs, tanks, sewer pipes, drainage pipes, tunnels, and many other purposes. The following data were gathered from the actual cost determined by the construction of the Hill River reservoir of Quincy, Massachusetts.

COST OF CUBIC YARD

| | | | | |
|---|---|---|---|---|
| Portland cement | 1.07 bbl. | @ | $2.23 = | $2.386 |
| Sand | .44 cu. yd. | @ | 1.13 = | .497 |
| Crushed stone | .88 cu. yd. | @ | 1.13 = | .994 |
| Lumber forms at $20 per M | | | | .154 |
| Labor on forms | | | | .214 |
| Mixing and placing | | | | .927 |
| | | | | $5.17½ |

NOTE. — In problems on pages 165 to 168, make no deductions for corners.

**43.** At $5.17 a cubic yard, how much will it cost to construct a cement foundation for a building 26 ft. long and 20 ft. wide with walls 8 in. thick and $7\frac{1}{2}$ ft. high?




**44.** With the cost of cement $5.17 per cubic yard, how much will it cost to construct a retaining wall 100 ft. long and 9 ft. high, the wall to be 60 in. wide at the bottom and 8 in. wide at the top?

**45.** How much will it cost, at $5.17 per cubic yard, to build a curb about a corner lot 75 ft. wide and 150 ft. deep, the curb to be 16 in. deep and 6 in. wide?

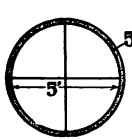
SOLUTION. — 75 ft. + 150 ft., = 225 ft., entire length of curb.
$(225 \times 1\frac{1}{3} \times \frac{1}{2})$ cu. ft. = 150 cu. ft.
150 cu. ft. ÷ 27 cu. ft. = $5\frac{5}{9}$, number of cubic yards.
Cost of 1 cu. yd. = $5.17.
Cost of $5\frac{5}{9}$ cu. yd. = $5\frac{5}{9} \times \$5.17 = \$28.72$.

**46.** Find the cost of constructing a curb in front of a lot 50 ft. wide, the curb to be 14 in. deep and 7 in. wide.

**47.** Find the cost of laying the cement floor of a pergola 36 ft. long and 12 ft. wide, the floor to be 6 in. thick.

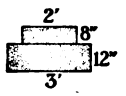
**48.** Find the cost of constructing a series of 6 steps, each step 12 ft. long, 14 in. wide, and 8 in. thick.

**49.** How many cubic yards of concrete will it require to construct 1000 ft. of sewer, the inside diameter being 5 ft., the concrete $5\frac{1}{2}$ in. thick?




NOTE. — The outer surface of the sewer pipe forms a cylindrical space whose diameter is 5 ft. 11 in. or $5\frac{11}{12}$ ft.; the inner surface forms a cylindrical space whose diameter is 5 ft. The difference between the volumes of these two cylinders (see p. 228) is the volume of the concrete (27 cu. ft. = 1 cu. yd.).

**50.** Find the cost of constructing the foundation of a public building according to the accompanying plans.



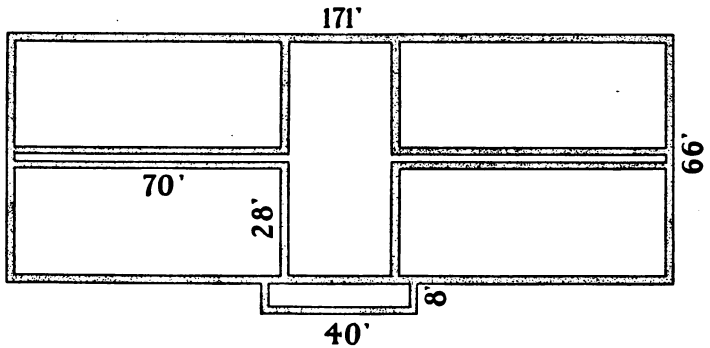

NOTE. — The small cross section shows that the lower part of the foundation is 3 ft. wide and 12 in. deep, and the upper part, 2 ft. wide and 8 in. deep.

SOLUTION. — Perimeter = 922 ft. (No deduction for corners.)

Area of cross section = $(3 \times 1\frac{1}{2})$ sq. ft. + $(2 \times \frac{8}{12})$ sq. ft. = $4\frac{1}{3}$ sq. ft.

$(922 \times 4\frac{1}{3}) \div 27 = 147.975$, number of cubic yards.

$147.975 \times \$5.17 = \$765.03$.




**Sidewalk Construction.** — The cost of sidewalk varies with the cost of materials. The following is an average computed from statistics collected in many different states.

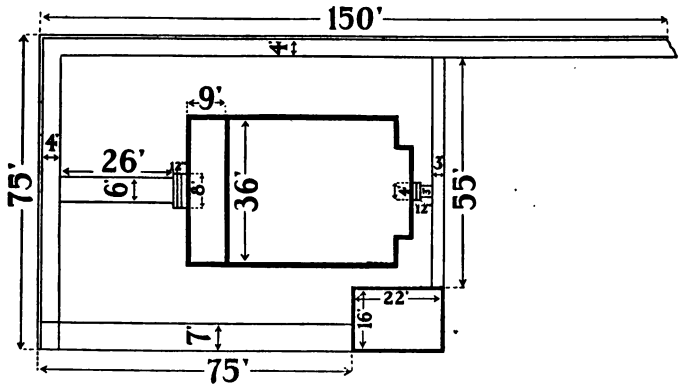
COST PER SQUARE FOOT

| | |
|---|---|
| Sand | 1.25 cents |
| Portland cement | 3.75 cents |
| Labor | 2.33 cents |
| Incidentals | 0.52 cents |
| | 7.85 cents |

**51.** How much will it cost to construct a sidewalk 4 ft. wide, along a 50-foot building lot, and what profit does the contractor make at 11 ¢ per square foot?

**52.** A owns a corner lot 50 ft. wide and 150 ft. deep; he is compelled to construct a sidewalk along the two street sides 4 ft. wide. What is the cost at $10\frac{3}{4}¢$ per square foot? Make diagram in field book.

**53.** Find the cost of walks and curbs according to the accompanying plans.

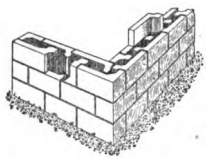



NOTE. — Calculate cost of curb and steps at $ 5.17 per cubic yard, and cost of sidewalks, etc., at $ .0785 per square foot.

1. Curb 150 ft. + 75 ft., 14 in. deep and 5 in. wide.
2. Sidewalk 150 ft. on one side and 75 ft. on the other, 4 ft. wide.
3. Front walk to house 26 ft. long, 6 ft. wide.
4. Three steps 8 ft. long, 12 in. wide, and 8 in. thick.
5. Sidewalk to rear door and garage, 55 ft. long and 3 ft. wide, with approach 3 ft. by 3 ft.
6. Two steps to rear door 4 ft. long, 12 in. wide, and 8 in. thick.
7. Porch floor 36 ft. long, 9 ft. wide.
8. Driveway to garage 75 ft. long, 7 ft. wide.
9. Floor of garage 16 ft. long, 22 ft. wide.

**Concrete Blocks.** — The denuding of our forests and the excessive price of lumber make it necessary to find other materials for house building. More permanent forms of construc-

tion, less fire risk, and greater comfort are now being sought. In portions of the country where sand and gravel are accessible, cement-block construction is becoming popular. There are many forms of concrete blocks, but the illustrations here given represent the two-piece insulated wall and hollow-block systems now in common use.



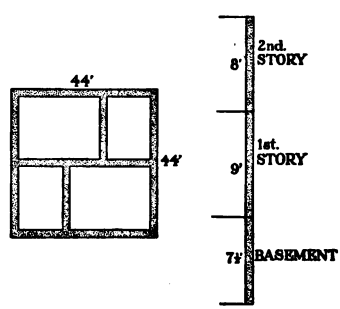
COST PER 100 SQ. FT. OF WALL SURFACE

| | | |
|---|---|---|
| Cement, 2½ bbl. | @ $2.25 | $5.63 |
| Sand and gravel, 2 cu. yd. | @ 1.00 | 2.00 |
| Labor in making | | 4.00 |
| | | $11.63 |

$11.63 + $5 per 100 sq. ft. for setting = $16.63, cost per 100 sq. ft. 200 blocks required for 100 sq. ft. of wall.

**54.** What will be the cost of constructing a basement wall of concrete blocks, the basement being 32 ft. long and 26 ft. wide, with a cross partition in each direction, the cost being 20¢ per square foot of wall surface, and the wall 7½ ft. high?

**55.** How much will it cost to build the walls of a block-house according to the accompanying plans, at 18¢ per square foot of wall surface?




The basement has two cross walls; above the basement the outside walls only are to be built; the house is 44′ × 44′. The height of basement is 7½ ft., of first story, 9 ft., and of second story, 8 ft.

**56.** Find the cost of constructing a cement-block retaining wall, 3′ high and 150′ long, at $.1662 per square foot of wall surface.

**Cost of Silo.** — The following data show the actual cost of building a silo 20 ft. in diameter and 34½ ft. deep, holding 228 T.[1]

**57.** Find the cost of excavating 4 feet deep and laying wall:

| | |
|---|---|
| 35 hours @ $.30 | $10.50 |
| 70 hours @ $.15 | 10.50 |
| 2000 bricks at $7.25 per M | 14.50 |
| 2 barrels cement @ $2 | 4.00 |
| 2 barrels lime @ $.77½ | 1.55 |
| Total | $41.05 |

**58.** Find the cost of the superstructure:

| | |
|---|---|
| 139 pieces 2″ × 4″ × 16′ at $20 per M | |
| 252 pieces ½″ × 6″ × 16′ at $14 per M | |
| Doors, 20″ × 30″ | $23.00 |
| 3100 laths at $4.50 per M | |
| 11 barrels cement @ $2 | |
| 6 cubic yards of sand @ $1.25 | |
| Carpenters, 67 hours @ $.30 | |
| Labor, 148 hours @ $.15 | |
| Plastering, 28 hours @ $.40 | |
| Tender, 35 hours @ $.15 | |
| Total | |

**59.** Find the cost of sheathing:

| |
|---|
| 7 hoops, requiring 84 pieces ½″ × 6″ × 16′ at $30 per M |
| 672 feet at $14 per M |
| 61 pieces 1″ × 12″ × 16′ at $24 per M |
| 61 pieces 1″ × 12″ × 14′ at $24 per M |

[1] From "The Garden and Farm Almanac," published by Doubleday Page and Company.

61 battens $\frac{1}{2}''$ × 3″ × 16′ (244 bd. ft.), at $22 per M
61 battens $\frac{1}{2}''$ × 3″ × 14′ (214 bd. ft.), at $22 per M
65 feet $2\frac{1}{2}''$ water table at $3 per C . . . . . _____
Total . . . . . .

**60.** Find the cost of the roof:

18 pieces 2″ × 4″ × 14′ at $19 per M . . . . .
3 pieces 2″ × 4″ × 24′ at $19 per M . . . . .
4000 shingles at $3.20 per M . . . . . .
35 roof boards 1″ × 6″ × 16′ at $16 per M . . .
Cornice, 5 pieces 1″ × 12″ × 16′ at $24 per M . .
Ornamental post in center $.90 . . . . . _____
Total . . . . . .

**61.** Find the cost of the chute:

5 pieces 2″ × 4″ × 14′ at $19 per M . . . . .
12 pieces 1″ × 12″ × 16′ at $24 per M . . . . _____
Total . . . . . .

**62.** Find the cost of the carpenter's work on sheathing of silo and chute:

24 hours @ $.30 . . . . . .
120 hours @ $.25 . . . . . _____
Total . . . . . .

**63.** Find the cost of the hardware:

50 pounds 8*d* common nails @ $.03 . . . . .
2 pounds 10*d* common nails @ $.05 . . . . .
8 pounds 3*d* cut nails @ $.04 . . . . . .
6 pounds 6*d* cut nails @ $.04 . . . . . .
4 pounds shingle nails @ $.04 . . . . . .
2 pounds long finishing nails @ $.05 . . . . .
63 square feet $\frac{1}{4}$-inch mesh wire netting @ $.05$\frac{1}{2}$ . _____
Total . . . . . .

**64.** Find the cost of the painting:

| | | |
|---|---|---|
| Priming coat: | 9 gallons oil @ $.50 . . . . . | |
| | 29 pounds yellow ochre @ $.05 . . | |
| | 25 hours labor @ $.15 . . . . | |
| Painting and labor, 2 coats . . . . . | | $25.00 |
| Total . . . . . | | |

**65.** Find the total cost of the silo as follows:

| | |
|---|---|
| Foundation . . . . . | |
| Superstructure . . . . . | |
| Sheathing . . . . . | |
| Roof . . . . . | |
| Chute . . . . . | |
| Carpenter's work . . . . . | |
| Hardware . . . . . | |
| Wire netting . . . . . | $2.20 |
| Painting . . . . . | |
| Total . . . . . | |

**66.** If the silo holds 228 tons of ensilage, what is the cost of the silo per ton of its capacity?

# GENERAL BUSINESS PROBLEMS

## TAXATION

1. Who is your local assessor and how is he selected?

2. At what time of year does he find the value of the property in your locality?

3. Name the collector or treasurer to whom the taxpayers of your community pay their taxes.

NOTE. — In computing taxes the principles of percentage are used.

4. If A's assessment is on a valuation of $1000 and the rate is 15 mills on the dollar, or .015, what tax does he pay?

SOLUTION. — .015 of $1000 = $15.

5. If a man's property is valued at $2600, what are his taxes at 27 mills on the dollar, or .027?

6. What is the amount of a man's tax whose real property is valued at $3500 and personal property at $700, if the rate of taxation is 32 mills on the dollar, or .032?

7. What is the assessed valuation of your school district? of your county? of your state?

8. What is the rate of taxation for school, for township, and for county purposes?

9. What amount of money is to be raised for school purposes? for all other purposes? for all purposes?

**10.** School District No. 35 of Buffalo County has a valuation as follows:

| | |
|---|---|
| Real estate | $34,968.00 |
| Personal | 10,785.00 |
| Corporation | 41.00 |

Its assessment levy is 15 mills for school purposes. How much will be raised for school purposes?

**11.** District No. 35 supports eight months' school and pays the teacher $55 per month. How much does this leave for books, fuel, apparatus, and repairs?

**12.** District No. 11 of Buffalo County, Nebraska, has a valuation of $118,235. Its levy is 14.5 mills. What will be the income for the support of the school?

**13.** District No. 11 employs two teachers for nine months at $55 and $60 per month. After paying salaries, what amount is left for the other running expenses of the school?

**14.** District No. 11, on a valuation of $118,235, pays 7.80 mills for state, 9.6 mills for county, 4 mills for township purposes, and 14.5 mills for school tax. What is the amount raised for each purpose? What is the total tax paid by the district?

**15.** What is the amount of tax to be paid by a man in District No. 11 if his assessment is based on 80 acres of land worth $100 per acre, assessed on one fourth of the value, his personal property being assessed at $600?

**16.** Gibbon district has a valuation of $290,776, and its estimated needs amount to $7968.67. How many mills must be levied in order to meet the needs of the school?

**17.** The city of Gibbon, on a valuation of $290,776, pays a state tax of 7.80 mills, a county tax of 9.6 mills, a township tax of 5 mills, and a school levy of 30.5 mills. How much does it pay into each fund?

**18.** School District No. 2 levies 25 mills for general school purposes and 8 mills bond levy. What is its total valuation if it raises $9900?

SUGGESTION. — $9900 is .033 of what amount?

**19.** A city has a valuation of $675,642; its estimated needs are $28,000. What is the necessary levy?

**20.** Buffalo County, Nebraska, has an assessed valuation as follows:

| | |
|---|---|
| Real estate | $4,671,257.00 |
| Personal property | 2,949,048.60 |

Its tax levies are as follows: a tax of 7.80 mills is levied for state purposes. How much does Buffalo County pay into the state treasury if all is collected?

Find the tax on:

**21.** $1800 valuation at 23 mills.

**22.** $3600 valuation at .023.

**23.** $400 valuation at 35 mills.

**24.** $1350 valuation at 40 mills.

**25.** $12,500 valuation at 28 mills.

**26.** $10,600 valuation at .029.

**27.** $6500 valuation at .033.

**28.** $940 valuation at .035.

**29.** $1500 valuation at .042.

**30.** $15,600 valuation at .024.

**31.** $50,000 valuation at .038.

**32.** $14,400 valuation at .024.

**33.** $65,690 valuation at .035.

## THE BANK ACCOUNT

A **bank** is an institution, authorized by the Federal or state government to receive, lend, exchange, or issue money.

A **check** is a written order on a bank by a depositor, directing the payment of a specified sum of money.

Some of the advantages of a bank account are:

1. Payment by check insures a receipt for the money paid.

2. Payment by check is a businesslike way of doing business and gives a commercial standing not otherwise attainable.

3. The check-book stub furnishes a record from which the account may be posted.

4. Payment by check saves time. A check may be mailed, whereas a long journey might be necessary to make payment in currency.

5. Safety; a check being drawn in favor of the party for whom it is intended must bear his indorsement before it will be paid by the bank.

6. The bank pass book forms a monthly balance of cash in bank.

There are two forms of deposit; one, the time deposit, for which a certificate is drawn which states that the holder has deposited so much money for a stated length of time at a certain rate of interest; the other is money deposited subject to check and constitutes the bank account. When money is deposited in a bank subject to check, the receiving teller makes a deposit ticket, which goes to the bookkeeper who enters it to the depositor's account. The deposit is entered also in the depositor's pass book to his credit.

1. Rule a deposit ticket, enter the following deposits and total them: currency, $25; gold, $20; silver, $14.85; check on First National Bank of Hastings, $85; draft on Corn

DEPOSIT TICKET

**The Farmers' State Bank**

DEPOSITED BY

*Kearney, Neb.* 191 .

Items on outside points are credited subject to final cash payment.

| | $ | CT. |
|---|---|---|
| Currency | | |
| Gold | | |
| Silver | | |
| Checks | | |
| Checks | | |
| Checks | | |
| Checks | | |
| Checks | | |
| Checks | | |
| Checks | | |

Exchange Bank, $168.50; check on Farmers' Bank, $50; draft on Columbia National Bank, $47.25.

**2.** Rule a deposit ticket, enter and foot the following: currency, $110; gold, $50; silver, $4.35; check, $2.86; check, $9.75; check, $15.75; check, $11.25; check, $21.80; check, $14.15.

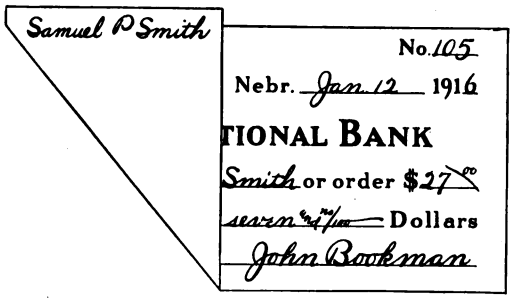
**3.** List the following items and total them: currency, $75; gold, $15; check, $3.40; check, $5.60; check, $24; check, $6.65; check, $36.40; check, $1.85.

When the depositor opens a bank account, the bank issues to him a check book for use when he wishes to draw money from his account. The usual form of check is as follows:

| | |
|---|---|
| No. 104 | $45 00 No. 104 |
| Date Jan 11 1916 | Kearney, Nebr Jan 11 1916 |
| Order of | CENTRAL NATIONAL BANK |
| Leslie Peebles | Pay to Leslie Peebles or order |
| $45 00 | Forty-five 00/100 Dollars |
| | John Bookman |

BANK CHECK

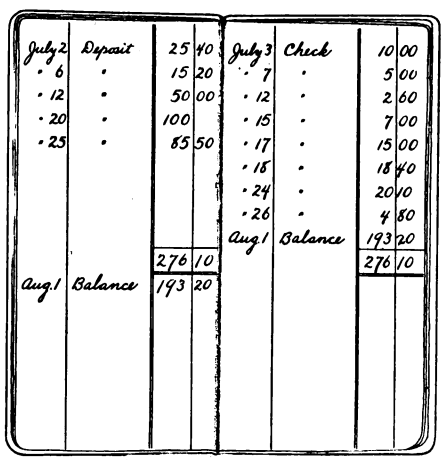
When a check is drawn in favor of any person, it is necessary for such person to indorse or sign his name on the back of the note.




CHECK INDORSED

### THE PASS BOOK

A small book, known as the pass book, in which the deposits forming the bank account and also the checks drawn against it are entered, is given the depositor when he opens his account with the bank.



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| July 2 | Deposit | 25 | 40 | July 3 | Check | 10 | 00 |
| " 6 | " | 15 | 20 | " 7 | " | 5 | 00 |
| " 12 | " | 50 | 00 | " 12 | " | 2 | 60 |
| " 20 | " | 100 | | " 15 | " | 7 | 00 |
| " 25 | " | 85 | 50 | " 17 | " | 15 | 00 |
| | | | | " 18 | " | 18 | 40 |
| | | | | " 24 | " | 20 | 10 |
| | | | | " 26 | " | 4 | 80 |
| | | | | Aug. 1 | Balance | 193 | 20 |
| | | 276 | 10 | | | 276 | 10 |
| Aug. 1 | Balance | 193 | 20 | | | | |

PASS BOOK

Rule pass book, enter the following deposits and checks, and balance the account:

**Deposits**: July 2, $25.40; July 6, $15.20; July 12, $50; July 20, $100; July 25, $85.50.

**Checks**: July 3, $10; July 7, $5; July 12, $2.60; July

15, $7; July 17, $15; July 18, $18.40; July 24, $20.10; July 26, $4.80.

List and total the following deposits, and enter them on the debit side of the pass book. Enter the checks on the credit side:

1. Deposited Jan. 1: currency, $60; silver, $9.70; check, $5; check, $15; check, $20.80; check, $6.40.

2. Deposited Jan. 8: currency, $45; gold, $10; silver, $4.65; check, $8.25; check, $12.20; bank draft, $26.50.

3. Rule a blank check and fill it out for $60 in favor of your teacher. Enter it in your pass book, dated Jan. 9.

4. Rule a check and fill it out in favor of John Doe for $5.60; date it Jan. 10; enter it on the credit side of your pass book.

5. Deposited Jan. 15: currency, $20; silver, $3.85; check, $4.20; check, $6.90; check, $11.45.

6. Draw a check in favor of Rogers & Co. for $16.85, dated Jan. 16, and enter it on the credit side of your pass book.

7. Deposited Jan. 25: currency, $15; gold, $5; silver, $3.35; check, $5.25.

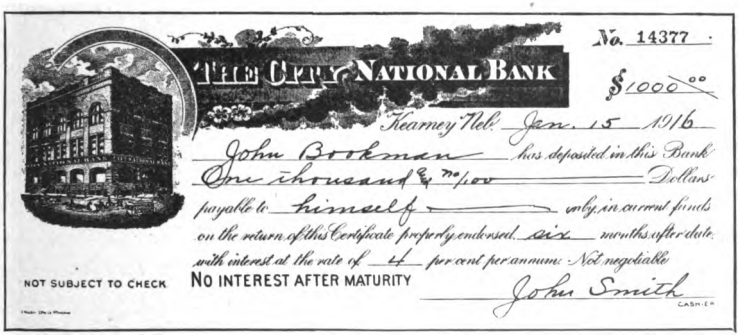
8. Rule a check and fill it out in favor of William Jones for $26; date the check Jan. 27 and enter it on the credit side of your pass book.

9. Deposited Jan. 29: currency, $30; silver, $8.45; check, $6.90.

10. Study carefully the illustration of the pass book; total the debits and credits resulting from the transactions in problems 2 to 9, and find the amount of money in the bank account on Jan. 31.

## Time Deposits

Occasionally patrons of banks have what is known as "idle money," which they do not expect to use or invest for a definite period of time, such as 3, 4, 6, 9, or 12 months. The bank, knowing that such money will not be withdrawn, feels greater security in lending it at a profit and often pays interest at 2%, 3%, or even 4% on such a deposit. This enables the owner of the money to realize a reasonable income on surplus funds.




1. Find the interest and the amount of a time deposit of $100,000 deposited for 6 mo. at 4%.

2. Find the interest and the amount of $475 deposited for 3 mo. at 3%.

3. Find the amount of a $1000 deposit at the end of a year if it is deposited for 3 mo. at 4% and redeposited at the end of each succeeding 3 mo., with accumulated interest.

4. Find the amount of a time deposit of $10,000 for 6 mo. at $3\frac{1}{2}$%.

5. Find the interest due on a time deposit of $25,000 for 3 mo. at $2\frac{1}{2}$%.

## INSURANCE

**Insurance** is an agreement by one party, for a consideration, to indemnify another party for losses or damage arising from stipulated causes.

The **insurance company** is the party agreeing to indemnify against loss or damage. The contract is called the **policy**.

The **premium** is the amount paid for the insurance, and is a certain per cent of the amount insured.

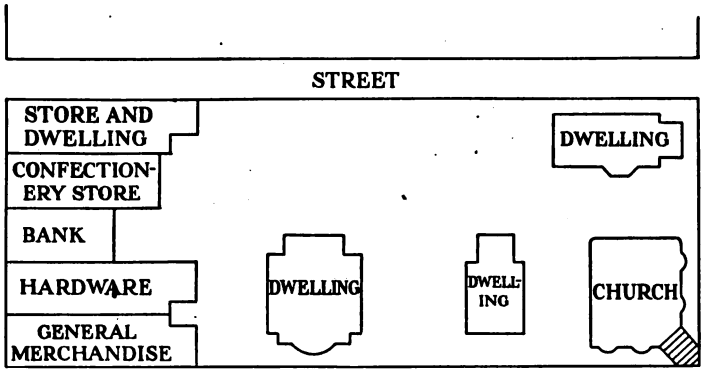
The **term** is the period covered by the policy, usually 1, 3, or 5 years.

**What the Policy Contains.** — The policy in an insurance contract, although there are numerous conditions recited therein, always contains the following principal elements:

1. A description of the property insured.
2. The amount for which the insurance policy is given.
3. The length of time it is to run.
4. The amount of premium.

In case the property insured is a building, the policy contains the description of its location, the location of the nearest buildings, the materials from which they are constructed, and how the building is lighted and heated. There are usually some restrictions against explosives, etc.

The rates of insurance companies vary with the surroundings of the property insured. Frame buildings usually require a higher rate than buildings constructed of brick and stone. A much higher rate is charged for the insurance of a building surrounded by combustible buildings. In other words, the security of a building reduces the cost of insurance. Insurance companies usually hold in their headquarters plots showing location and surroundings of property insured.




A Plan of an Insurance District

Insurance companies keep on hand a detailed statement, showing all the conditions of property insured and the day on which the policy expires. Policies are generally written to expire at 12 o'clock noon by standard time. Agents of companies usually notify the insured of the expiration of the policy some time before such expiration.

There are two general classes of insurance, **property insurance** and **personal insurance.**

### PROPERTY INSURANCE

There are many kinds of insurance and a great variety of risks. The farmer insures his property against loss by storms, wind, and hail; the manufacturer against boiler explosions; the banker against burglary losses. Buildings, merchandise, and personal property are insured against loss by fire and storm. Losses at sea are covered by what is termed marine insurance. Transit insurance is insurance against accident in transit either by land or sea.

Find the premium on each of the following policies:

| | Face of Policy | | Kind of Building | Description of Building | Rate of Insurance per $100 for 3 Yr. | No. of Years |
|---|---|---|---|---|---|---|
| | Building | Contents | | | | |
| 1. | $11,500 | $8000 | Store | Brick; iron-clad roof | $ .95 | 3 |
| 2. | 3,600 | 750 | Dwelling | Frame | 1.20 | 3 |
| 3. | 2,400 | 800 | Dwelling | Frame | 1.25 | 3 |
| 4. | 5,000 | 8000 | Store | Frame | 1.35 | 3 |
| 5. | 1,500 | 600 | Dwelling | Frame | 1.30 | 3 |

6. A frame dwelling valued at $3850 carries $2400 insurance, on a 1-year policy at 40¢ per $100. Find the premium.

7. A frame dwelling valued at $5660 is insured for $\frac{3}{4}$ of its value. Find the cost of insuring it for 3 years at $1.20 per $100 for the 3-year term.

8. A brick store building valued at $10,000 is insured for 70% of its value on a 3-year policy at $1\frac{1}{4}$% for the 3-year term. Find the cost of insurance.

9. A frame dwelling valued at $4800 is insured for $\frac{5}{8}$ of its value at $1\frac{1}{2}$% for the 3-year term. Find the cost of insurance.

10. A property owner carries the following annual insurance: on dwelling, $2500; contents of dwelling, $1000; fire insurance, $1.20 per $100 for 3 years; tornado insurance on house, $2200 @ 75¢ per $100 for 3 years. Find the cost of his insurance.

11. A church is insured against fire for $6000 at 95¢ per $100 for the 3-year term, and against tornado for $5000 at 70¢ per $100 for the 3-year term. Find the cost of insurance.

What is the premium for insuring against loss by fire for one year on the following property:

12. $2000 at 70¢ per $100; contents, $5000 at 80¢ per $100?

13. $3200 at 65¢ per $100; contents, $9000 at 75¢ per $100?

14. $5600 at $1.15 per $100; contents, $20,000 at $1.15 per $100?

15. $7000 at $1.20 per $100; contents, $15,000 at $1.35 per $100?

16. $8000 at 90¢ per $100; contents, $32,000 at $1.10 per $100?

17. $1600 at 40¢ per $100; contents, $1100 at 40¢ per $100?

18. $4000 at 60¢ per $100; contents, $1800 at 60¢ per $100?

19. $3600 at 70¢ per $100; contents, $2200 at 70¢ per $100?

20. $6200 at $1.05 per $100; contents, $3000 at $1.05 per $100?

21. $2500 at 65¢ per $100; contents, $800 at 65¢ per $100?

## PERSONAL INSURANCE

**Personal insurance** includes insurance for life, accident, and sickness.

Life insurance policies may be divided into three general classes: **term policies, whole-life policies, endowment policies.**

**Term policies** cease at the expiration of the period for which the policy is written, and the amount is paid only in case of the death of the insured during the term.

EXPECTANCY OF LIFE

| COMPLETED AGE | EXPECTATION IN YEARS |
|---|---|
| 20 | 41.49 |
| 21 | 40.79 |
| 22 | 40.09 |
| 23 | 39.39 |
| 24 | 38.68 |
| 25 | 37.89 |
| 26 | 37.27 |
| 27 | 36.56 |
| 28 | 35.86 |
| 29 | 35.15 |
| 30 | 34.43 |
| 31 | 33.72 |
| 32 | 33.01 |
| 33 | 32.30 |
| 34 | 31.58 |
| 35 | 30.87 |
| 36 | 30.15 |
| 37 | 29.44 |
| 38 | 28.72 |
| 39 | 28.00 |
| 40 | 27.28 |
| 41 | 26.56 |
| 42 | 25.84 |
| 43 | 25.12 |
| 44 | 24.40 |
| 45 | 23.69 |
| 46 | 22.97 |
| 47 | 22.27 |
| 48 | 21.56 |
| 49 | 20.87 |
| 50 | 20.18 |
| 51 | 19.50 |
| 52 | 18.82 |
| 53 | 18.16 |
| 54 | 17.50 |
| 55 | 16.86 |
| 56 | 16.22 |
| 57 | 15.59 |
| 58 | 14.97 |
| 59 | 14.37 |
| 60 | 13.77 |
| 61 | 13.18 |
| 62 | 12.61 |
| 63 | 12.05 |
| 64 | 11.51 |
| 65 | 10.97 |
| 66 | 10.46 |
| 67 | 9.96 |
| 68 | 9.47 |
| 69 | 9.00 |
| 70 | 8.57 |

In **whole-life policies** the premiums are paid annually during the life of the insured, or for a term of years. In this form of policy the sum named is paid to the beneficiary upon the death of the insured. When the premiums are paid for a term of years, as 10, 15, 20, or 25, the policy becomes **paid up** for life after the specified payments have been made.

In **endowment policies** the sum named is paid at the close of the period, 10, 15, 20, or 25 years. In case of death before the expiration of such term the sum named in the policy is paid to the beneficiary.

Life insurance has become one of the substantial business elements in our national life. Actuaries have by experience and calculation become so accurate that chance is eliminated and life insurance has become one of the well-established business principles of the age from the standpoint of both the insurer and the insured.

The **beneficiary** is the party named in the policy.

The **premium** is the consideration paid the insurance company for carrying the policy.

For the purpose of paying death losses and maturing policies the law requires that a portion of every premium be set aside and properly invested.

The table of expectancy given herewith is the basis from which actuaries figure life insurance rates. The table is used by all companies and the rates established for various companies are therefore practically uniform.

The table on p. 184 shows that a person who has reached the age of 20 may be expected to live 41.49 years.

What is the expectancy of a person who has reached the age of 30? What is the expectancy of a person who has reached the age of 40? What is the expectancy of a person who has reached the age of 60?

It will be noticed that as the age increases the expectancy decreases, consequently the risk increases and the premium must increase.

FIVE-YEAR TERM PREMIUMS FOR $1000

| AGE | PREMIUM |
|---|---|
| 20 | $ 11.60 |
| 21 | 11.60 |
| 22 | 11.70 |
| 23 | 11.80 |
| 24 | 11.90 |
| 25 | 12.00 |
| 26 | 12.10 |
| 27 | 12.20 |
| 28 | 12.30 |
| 29 | 12.50 |
| 30 | 12.60 |
| 31 | 12.70 |
| 32 | 12.90 |
| 33 | 13.10 |
| 34 | 13.30 |
| 35 | 13.50 |
| 36 | 13.70 |
| 37 | 14.00 |
| 38 | 14.30 |
| 39 | 14.60 |
| 40 | 15.00 |
| 41 | 15.40 |
| 42 | 15.80 |
| 43 | 16.30 |
| 44 | 16.90 |
| 45 | 17.60 |
| 46 | 18.30 |
| 47 | 19.20 |
| 48 | 20.10 |
| 49 | 21.30 |
| 50 | 22.50 |

**1.** What is the annual premium on a five-year term policy of a person who has reached the age of 23?

**2.** What is the annual premium on a five-year term policy of a person who has reached the age of 35?

**3.** Find the annual premium on a five-year term policy for $1000 of a person whose age is 41.

**4.** Find the total cost of a term policy for $5000 for five years of a person who has reached the age of 28.

**5.** What sum will be paid in 5 yr. on a five-year term policy for $3000, the insured taking out the policy at the age of 33?

**6.** Find the total cost of a five-year term policy for $10,000 of a person who has reached the age of 48.

**7.** A man at the age of 40 took out a five-year term policy for $8000. He died at the age of 43. How much did the amount paid to his heirs exceed the premiums he had paid?

| 35 LIFE. 20 payments PREMIUM. $36.70 a year | | | | | |
|---|---|---|---|---|---|
| YR. | LOAN | CASH | PAID UP | EXTENSION | |
| | | | | Yr. | Day |
| 3 | $ 46 | $ 49 | $ 112 | 5 | 237 |
| 4 | 71 | 75 | 165 | 8 | 168 |
| 5 | 95 | 100 | 219 | 11 | 54 |
| 6 | 120 | 127 | 272 | 13 | 208 |
| 7 | 147 | 155 | 325 | 15 | 248 |
| 8 | 173 | 183 | 377 | 17 | 178 |
| 9 | 202 | 213 | 430 | 19 | 12 |
| 10 | 242 | 255 | 507 | 21 | 81 |
| 11 | 271 | 286 | 557 | 22 | 93 |
| 12 | 301 | 317 | 606 | 23 | 64 |
| 13 | 332 | 350 | 655 | 24 | 8 |
| 14 | 363 | 383 | 704 | 24 | 307 |
| 15 | 397 | 418 | 753 | 25 | 249 |
| 16 | 431 | 454 | 802 | 26 | 220 |
| 17 | 466 | 491 | 852 | 27 | 247 |
| 18 | 502 | 529 | 901 | 29 | 9 |
| 19 | 539 | 568 | 950 | 31 | 25 |
| 20 | 587 | 609 | 1000 | Paid up | |

The accompanying table shows the loan, cash, and paid-up values of a 20-payment life policy for $1000 taken at the age of 35. It is based on the American Experience Table of Mortality and is in large measure a policy which is uniform with all companies.

In 10 years $367 is paid in; the policy then has a loan value of $242; a cash value of $255, or a paid-up value of $507 for 21 years and 81 days. At the close of the 20 years the policy has a loan value of $587, a cash value of $609, and a paid-up policy value of $1000 for life.

**8.** What was the loan value of the policy after 5 years? the cash value? the paid-up value?

**9.** If a man takes a 20-payment life policy for $10,000 at the age of 35 and surrenders it for its cash value after 10 years, how much does he lose?

**10.** At the age of 35 Mr. Watt took out a 20-payment life policy for $5000. He died at the age of 45. How much did the amount received by his heirs exceed the premiums?

**11.** How much can a man borrow at the age of 50 on a 20-payment life policy for $1000 taken at the age of 35?

**12.** From the accompanying table find the annual premium on a 20-year life policy for $1000 taken at the age of 25. How much will have been paid in at maturity?

**13.** What is the annual premium on a $3000 policy written at the age of 30? How much will have been paid in at maturity?

**14.** What is the annual premium on a $5000 policy written at the age of 33? Find the cost at maturity.

**15.** A 20-year life policy written at the age of 35 requires an annual premium of $36.70. What will be the amount of this premium deposited annually for twenty years at 3% compound interest?

NOTE. — The amount of $1 deposited annually at compound interest at 3 % for 20 years is $27.676.

**16.** Find the annual premium on a $7000 20-year life policy, written at the age of 25. Find the amount of the annual payments at 3% compound interest.

**17.** Find the annual premium on a 20-year life policy for $7000 written at the age of 40 and the amount of the annual payments at 3% compound interest.

RATES OF 20-PAYMENT LIFE

| AGE | PREMIUM |
|---|---|
| 20 | $28.10 |
| 21 | 28.50 |
| 22 | 29.00 |
| 23 | 29.40 |
| 24 | 29.90 |
| 25 | 30.40 |
| 26 | 30.90 |
| 27 | 31.50 |
| 28 | 32.10 |
| 29 | 32.60 |
| 30 | 33.20 |
| 31 | 33.90 |
| 32 | 34.50 |
| 33 | 35.20 |
| 34 | 35.90 |
| 35 | 36.70 |
| 36 | 37.50 |
| 37 | 38.30 |
| 38 | 39.10 |
| 39 | 40.00 |
| 40 | 41.00 |
| 41 | 41.90 |

**18.** At the age of 37 Mr. Thomas took out a 20-payment life policy for $5000. What was the total amount of his premiums for 20 years?

**19.** Find the annual premium on a twenty-year life policy for $20,000 written at the age of 21. What will be the amount of the annual payments at 3% compound interest?

**20.** What is the annual premium on a 20-year life policy for $2000 written at the age of 27, and how much has been paid in at maturity, including compound interest at 3 %?

**35** ENDOWMENT. $1000. 20 years
PREMIUM. $50.00

| YR. | LOAN | CASH | PAID UP | EXTENSION | | |
|---|---|---|---|---|---|---|
| | | | | Yr. | Da. | End't |
| 3 | $ 77 | $ 82 | $130 | 9 | 244 | $ 0 |
| 4 | 114 | 121 | 186 | 13 | 320 | 0 |
| 5 | 153 | 162 | 243 | 15 | | 49 |
| 6 | 193 | 204 | 299 | 14 | | 132 |
| 7 | 235 | 248 | 354 | 13 | | 212 |
| 8 | 279 | 294 | 409 | 12 | | 288 |
| 9 | 323 | 341 | 462 | 11 | | 362 |
| 10 | 386 | 407 | 538 | 10 | | 460 |
| 11 | 433 | 456 | 588 | 9 | | 525 |
| 12 | 482 | 508 | 636 | 8 | | 587 |
| 13 | 532 | 561 | 684 | 7 | | 647 |
| 14 | 585 | 616 | 731 | 6 | | 704 |
| 15 | 640 | 674 | 778 | 5 | | 759 |
| 16 | 696 | 733 | 824 | 4 | | 811 |
| 17 | 756 | 796 | 869 | 3 | | 862 |
| 18 | 817 | 861 | 913 | 2 | | 910 |
| 19 | 881 | 928 | 957 | 1 | | 946 |
| 20 | | 1000 | | | | 1000 |

**21.** What is the loan value for the 12th year on a 20-year endowment policy for $2000, written at the age of 35? the cash value? the paid-up value?

**22.** Find the annual premium and the entire cost of a 20-year endowment policy for $10,000, written at the age of 35?

**23.** What is the total cost of a 20-year endowment policy for $3000, written at the age of 35?

## THE MARKET

**Market Quotations.** — Newspapers contain a record of the **market quotations** of the day, which interest both producers and consumers. These quotations are obtained from actual sales of commodities in the principal market centers.

A **bear** is a broker who operates for declining prices, and a **bull** one who operates for rising prices.

**The Board of Trade.** — Some of the principal cities of the world and most of the larger cities of the United States support associations of business men for the purpose of regulating trade and furthering commercial interests. To these associations are applied such names as "Chamber of Commerce," "Board of Trade," "Produce Exchange," or "Stock Exchange."

**Chicago Board of Trade.** — The principal board of trade of the United States devoted to the sale of grain and provisions is in Chicago. Its members buy and sell *on the floor* of this exchange the larger portion of the grain and provisions of the Mississippi Valley and the West.

**New York Stock Exchange.** — The New York Stock Exchange regulates prices in certain commodities, especially in investments, cotton, and many imported articles.

**Live Stock Markets of the West** are South Omaha, St. Louis, Kansas City, St. Joseph, and Sioux City.

**Sales and Values.** — The sales in these markets determine the price of such commodities for the United States and in some cases for the world. Provisions, grains, live stock, cotton, and stocks and bonds are bought and sold on the Board of Trade or Exchange for present or for future delivery. Sales made for immediate delivery are said to be **cash grain**, etc. Sales made for future delivery are called **futures**. The usual time for future delivery is in May, July, September, and December.

Note the market quotations given in the daily newspapers under Commodities and Live Stock. In many instances the quotations on grain, provisions, and other commodities include the prices at which the market opened, at which it closed, and also the high and low points reached during the day. The markets often fluctuate with every hour. If the conditions for growing crops, etc., are favorable, prices tend to decline, and if unfavorable, prices tend to advance.

The **grading** of grains is agreed upon by an established authority as a basis of comparison for buyer and seller. The quality is determined by the size, color, and fullness of the kernel, together with the weight, dryness, and freedom from dirt. According to the nearness or remoteness of grains from this standard, we have No. 1, No. 2, No. 3, and No. 4. No. 1 is the best quality, while No. 4 is the poorest, and prices range according to these standards.

It will be noticed that the prices of live stock vary according to size, kind, and condition compared with fixed standards which regulate buying and selling.

NOTE. — Teacher or pupils should bring into the class daily papers from the trade centers showing current market quotations. If studied properly, explanations of terms and conditions will not be found difficult. Discussions based on such quotations will stimulate interest.

1. A shipper delivered to the Chicago market a carload of cattle weighing 28,000 lb. They sold on the January 26 market as "prime fed" at $9.25 per hundred. The shipper paid freight 36.67 cents per hundred and 2 % for commission and yardage. Find the net proceeds of the shipment.

2. A Nebraska stock feeder shipped 4 loads of cattle to the South Omaha market, the 4 loads weighing 98,000 lb. They sold as "native beef" at $7.50 per hundred. Allowing for freight at 13.17 cents per hundred and $2\frac{1}{4}$ % for commission and yardage, find the proceeds.

3. Find the proceeds from a carload of hogs weighing 21,000 lb., which sold as "top" on the St. Joseph market January 26 for $8.50 per hundred; the freight charges were 25 ¢ per hundred, commission $2\frac{1}{2}$ %.

4. Find the proceeds from the shipment of one car of sheep weighing 17,000 lb., freight costing 37.67 cents per hundred, if the shipment sold on the St. Louis market as "native muttons" at $5.50 per hundred.

5. If the Chicago price of wheat No. 2 red is 97 ¢ per bushel, the freight from nearest market 17 ¢ per hundred, and the local dealer makes a profit of $1\frac{1}{4}$ ¢ per bushel, what would be the price to the farmer?

SOLUTION. — 1 bu. of wheat, or 60 lb., costs $\frac{60}{100}$ of 17 ¢ or 10.2 ¢ freight.

10.2 ¢ + 1.25 ¢ = 11.45 ¢, the difference between the Chicago price and the farmer's price.

97 ¢ − 11.45 ¢ = 85.55 ¢.

6. If the July price of wheat is $94\frac{1}{8}¢$ and the freight from the nearest station is $21¢$ per hundred, and the local elevator charges $3\frac{1}{2}¢$ per bushel for handling and commission, what should the farmer receive for his wheat?

7. If the price of corn No. 3 yellow is $63\frac{1}{2}¢$ in Chicago and the freight from the nearest station is $17¢$ per hundred, how much ought the farmer to receive if he allows $3¢$ per bushel for handling? (56 lb. = 1 bu. corn.)

8. A farmer ships a carload of wheat weighing 45,000 lb. to the Chicago market and sells it at $96\frac{1}{2}¢$ a bushel; he pays $23¢$ per hundred for freight and $1\frac{3}{4}¢$ per bushel for handling. How much does he realize on the shipment?

9. A farmer ships 48,000 lb. of wheat to market and sells it at $97¢$ a bushel. He pays $19¢$ per hundred freight and allows $4¢$ per bushel for commission and for handling. How much does he realize on the shipment?

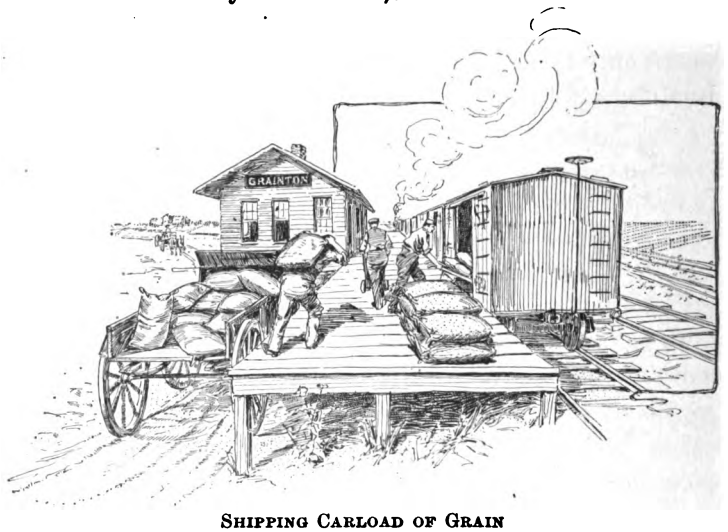
10. Oats No. 3 white are quoted at $39\frac{1}{4}¢$ a bushel on the Chicago market January 24. How much should a farmer realize on a shipment of 1000 bu. if commissions and elevator service amount to $6¢$ per bushel and the freight is $30¢$ per hundred? (32 lb. = 1 bu. oats.)

11. A farmer has 1000 bu. of wheat No. 2 red to sell. The December market is $80\frac{3}{4}¢$ per bushel, and the May market is $86\frac{1}{4}¢$. Will he gain or lose by selling December 1 rather than May 1? Freight 16.6¢ per hundred; commission $3¢$ per bushel; shrinkage 1%; money worth 6%.

NOTE. — Freight and commission in December are on 1000 bu.; in May on 990 bu.

12. If the price of wheat in Chicago is $91\frac{1}{4}¢$ per bushel, the freight rate from the nearest point to Chicago is $11¢$ per hundred, and commission and handling amount to $6¢$ per bushel, what will be the net proceeds of a crop of 1465 bushels?

**13.** A grain dealer buys 12,000 bu. of corn at 48¢ per bushel, holds it 90 da., and sells it at 62¢ per bushel on the Chicago market, paying 11¢ per hundred for freight, $45 insurance, and $\frac{1}{2}\%$ commission. What is his profit on the transaction if money is worth 6%?




SHIPPING CARLOAD OF GRAIN

**14.** W. H. Jones shipped a minimum carload of wheat, 30,000 lb., which sold on the Chicago market at $95\frac{7}{8}$¢ per bushel; freight charges 25.6¢ per hundred; elevator and commission $4\frac{1}{8}$¢ per bushel. Find the net proceeds.

**15.** An Iowa farmer shipped a maximum car, 66,000 lb. of shelled corn, which sold on the Chicago market at $63\frac{1}{2}$¢ per bushel; he paid 15.9¢ per hundred for freight; commissions and other expenses $3\frac{5}{8}$¢ per bushel. How much did the sale net him per bushel and for the carload?

**16.** A Kansas farmer shipped a carload of 55,000 lb. of wheat to the Chicago market; it was sold at $97\frac{3}{8}$¢ per

bushel; he paid 25.6¢ per hundred for freight; other expenses including commissions $4\frac{1}{8}$¢ per bushel. Find the net profit on the shipment.

**17.** A Dakota farmer shipped a carload of 45,000 lb. of wheat to the Chicago market, for which he received 97¢ per bushel; his freight was 25.6¢ per hundred; commissions, elevators, etc., $4\frac{1}{4}$¢ per bushel. Find the net proceeds of the shipment and the price per bushel.

**18.** An Illinois farmer shipped a car of 58,000 lb. of shelled corn, which sold for $66\frac{1}{2}$¢ per bushel; he paid 13.3¢ per hundred pounds for freight, and $4\frac{3}{8}$¢ per bushel for elevators and commissions. Find the net proceeds.

For the purpose of affording a clearer understanding of the marketing of the vast crops which are produced in the United States, we are, through the courtesy of Mr. J. C. F. Merrill, Secretary of the Board of Trade of the city of Chicago, presenting a number of actual transactions in the marketing of grain.

No. 7163 CHICAGO, ILL. Nov. 24, 1915

SOLD 10/15 SALE BY ROSENBAUM BROTHERS

Shipped from Guernsey, Ia. FOR ACCOUNT OF Kenneth Elevator Co. Brooklyn, Ia.

| | | | |
|---|---|---|---|
| Car No. 124340 | 1478½ bu 3 mixed corn @ 73½ JM | | 1086 88 |
| 11⅝ Freight | 95.23 | Insurance, | |
| Inspection, | .50 | Cartage, | |
| Switching, | | Car Service | |
| Weighing, | .35 | Interest, 1.71 | |
| Commission | 7.39 | Recording Fee | |
| | | Drft 550-16da | 105 18 |
| E. & O. E. | | Net Proceeds | 981 70 |

**19.** In the shipment of 1478 bu. 42 lb. of No. 3 mixed corn, by Kenneth Elevator Company, Brooklyn, Iowa, to Rosenbaum Bros., Chicago, find the net proceeds per bushel. (56 lb. = 1 bu. corn.)

**20.** In the shipment of the Deal Grain Company, Cowden, Ill., to Rosenbaum Bros., Chicago, 1165 bu. 10 lb. No. 2 red wheat at $1.15, find the net proceeds per bushel and the cost per bushel for marketing. (60 lb. = 1 bu. wheat.)

No. 7350 CHICAGO, ILL. Nov. 24, 1915

SOLD 11/11 SALE BY ROSENBAUM BROTHERS

Shipped from Cowden, Ill. FOR ACCOUNT OF Deal Grain Co Cowden, Ill.

| | | |
|---|---|---|
| Car No 194705 1165 10 lbs 2 Red Wheat @ 1.15 | | 1339 94 |
| 8 Freight, 55.98 | | |
| Inspection, .50 | | |
| Switching, | | |
| Weighing, .35 | | |
| Commission 11.65 | | |
| Insurance, | | |
| Cartage, | | |
| Car Service | | |
| Interest, 1.55 | | |
| Recording Fee | | |
| Draft 1150-7da. | | 69 98 |
| Net Proceeds | | 1269 96 |

E. & O. E.

**21.** On November 24, 1915, Rosenbaum Bros. of the Board of Trade, Chicago, made the following statement to Sampson and Burns: Albert Lea, Minnesota, 1969 bu. 2 lb. of No. 4 white oats @ 44½ ¢, billing over N. W. R. R. The charges were as follows: freight, $91.36; inspection, 50 ¢; weighing, 30 ¢; commission, $9.85; interest, $1.60. Find the net proceeds and the net price per bushel. (32 lb. = 1 bu. oats.)

**22.** November 24, 1915, Rosenbaum Bros. made the following statement to Arthur Morrison, Monmouth, Ill.: Shipment No. 7331, 2553 bu. and 4 lb. standard oats at 47 ¢;

charges as follows: freight, $69.45; inspection, 50¢; weighing, 30¢; commission, $12.77; interest, $1.49. Find the net proceeds, and the net price per bushel.

23. November 24, 1915, Rosenbaum Bros. rendered the following account to Chapman & Co., Meckling, South Dakota: Shipment No. 7333, 1274 bu. and 6 lb. No. 2 yellow corn at 74¾¢; charges: $149.84, freight; 50¢, inspection; 35¢, weighing; $6.37, commission; 81¢, interest. Find the net proceeds, and the net price per bushel.

24. Sales by J. H. DOLE & COMPANY, Chicago

For account of FARMERS GRAIN COMPANY

No. 2 hard wheat, 1534 bu. 50 lb. @ $1.14½

CHARGES

| | |
|---|---|
| Freight, 92,090 lb. at $.139 per 100 lb. | $128.01 |
| Interest, 10 da. at 6 % | 2.93 |
| Weighing | .35 |
| Inspection | .50 |
| Commission | 15.34 |

Find the net proceeds and the net price per bushel.

25. Sales by J. H. DOLE & COMPANY, Chicago

For account of FARMERS GRAIN COMPANY

No. 3 barley, 1295 bu. 20 lb. @ $.68

CHARGES

| | |
|---|---|
| Freight, 62,180 lb. at $.12½ per 100 lb. | $77.73 |
| Interest, 14 da. @ 6% | 2.06 |
| Weighing | .30 |
| Inspection | .50 |
| Commission | 12.95 |

Find the net proceeds and the net price per bushel. (48 lb. = 1 bu. barley.)

**26.** Sales by J. H. DOLE & COMPANY, Chicago

For account of FARMERS GRAIN COMPANY

No. 4 barley, 1261 bu. 42 lb. @ $.67½

CHARGES

| | |
|---|---|
| Freight, 60,570 lb. at $.12½ per 100 lb. | $75.71 |
| Weighing | .30 |
| Inspection | .50 |
| Commission | 12.61 |

Interest charged to monthly account.

Find the net proceeds and the net price per bushel.

**27.** A farmer sold 5 loads of wheat at 72¢ per bushel. Fill out in your field book a scale ticket, enter net weight, number of bushels and amount, and find the proceeds of the sale.

SCALE TICKET

| GROSS WEIGHT IN POUNDS | WEIGHT OF WAGON (LB.) | NET WEIGHT | NUMBER OF BUSHELS | AMOUNT @ 72¢ |
|---|---|---|---|---|
| 3080 | 1200 | | | |
| 3240 | 1320 | | | |
| 3250 | 1280 | | | |
| 3010 | 1280 | | | |
| 3260 | 1320 | | | |
| | | | | |

NOTE. — The student should prove this work. The sum of the second and third columns should equal the first column; the fourth column multiplied by 60 should equal the third column; the fourth column multiplied by the price per bushel should equal the fifth column.

**28.** Make a scale ticket for and find the proceeds of:

6 loads of shelled corn: gross weight 2750 lb., 3110 lb., 3050 lb., 3200 lb., 3670 lb., and 3100 lb. The wagon in each instance weighs 1310 lb.; price of corn 55¢ per bushel.

**29.** A farmer has 1000 bu. of No. 2 red wheat to sell. The December Chicago market is $80\frac{5}{8}¢$; the May market is $90\frac{1}{2}¢$; it costs $16¢$ per 100 lb. for transportation; the shrinkage in holding for May is 1% and money is worth 6%. Does he gain or lose by an immediate selling, and how much?

**30.** What month in the table shows the most shrinkage?

NOTE. — The per cents given in the table represent the total shrinkage of ear corn up to each month recorded; that is, until April the shrinkage is 12.8 %. The table represents the average of 8 years' testing at the Iowa Experiment Station.

Allow 6 % interest in the following problems.

SHRINKAGE OF EAR CORN

| | |
|---|---|
| November | 5.2% |
| December | 6.9 |
| January | 7.5 |
| February | 7.8 |
| March | 9.7 |
| April | 12.8 |
| May | 14.7 |
| June | 16.3 |
| July | 17.3 |
| August | 17.8 |
| September | 18.2 |
| October | 18.2 |

**31.** Which is more profitable, and how much, for a farmer to sell his corn on Dec. 1 at $46¢$ or on May 1 at $52¢$ per bushel?

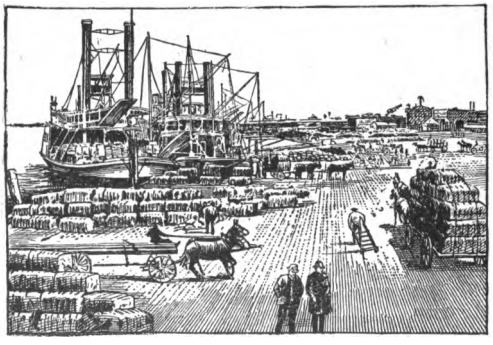
**32.** A farmer raises 3250 bu. of corn for market. Is it more profitable for him to sell it at $47¢$ per bushel on Dec. 1 or at $51¢$ per bushel on Feb. 1? how much more profitable?

**33.** Which is the more profitable, for a farmer to sell 1700 bu. of corn weighing 73 lb. per bushel (ear corn), on Dec. 1 at $50¢$ per bushel, or to sell on Feb. 1 at $52¢$, 70 lb. to the bushel? how much more profitable?

**34.** An Iowa farmer ships a carload of 48,000 lb. of shelled corn No. 3 yellow to the Chicago market, and sells it at $63\frac{1}{2}¢$ per bushel. He pays $12.9¢$ per hundred freight and $4¢$ per bushel for commission and handling. Find the net proceeds and the price per bushel. (56 lb. = 1 bu. shelled corn.)

### Cotton Market

In a certain year 14,969,000 bales (500 lb. each) represented the world's supply of cotton. Of this the United States produced 12,860,000 bales, the East Indies 945,000 bales, while other countries produced 1,164,000 bales. During the year the American export to Europe was 8,198,222 bales. Relative to the manufacture of cotton materials, it is of interest to note the number of spindles in operation in the various countries engaged in such work. In one year Great Britain had 55,600,000 spindles in operation; the European continent 39,000,000; the United States, 27,780,000; the East Indies, 5,900,000; showing that out of a total of 128,280,000 spindles in operation, the United States had but 27,780,000. It is not difficult, therefore, to determine that probably the greatest cotton market of the world and the place at which the price is fixed is Liverpool, England.



Loading Steamer with Cotton

A large quantity of the cotton grown in the United States is carried from the plantation to the Gulf ports for export. Among these ports are Galveston, New Orleans, and Mobile. Brunswick, Savannah, Charleston, Wilmington, and Norfolk are also great cotton centers.

From the statistics published by the Department of Agriculture it may be interesting to note that the average railway rate from the local shipping point to all ports is 40¢ per hundred pounds; and also that the average ocean freight rate from the United States to Liverpool is 32¢ per hundred pounds. The government estimates also that the average charge of delivering the cotton from the grower to the railroad is 16¢ per hundred pounds.

**35.** By reference to the Liverpool market we find that *good middling* cotton is quoted at 7.38*d.* per pound. On

that basis find the value in United States money of a bale (500 lb.) of cotton.

SOLUTION. — 7.38*d.* = price of 1 lb. of cotton.
1*d.* = $.02027.
7.38*d.* = 7.38 × $.02027 = $.1496.
Value of 500 lb. cotton = 500 × $.1496 = $74.80.

**36.** The cotton market in Liverpool on January 24 showed middling 7.10*d.* Find the value in United States money of a bale of cotton (500 lb.).

**37.** On January 24 there were 7000 bales of cotton (500 lb. each) sold on the Liverpool market. At 7.38*d.* per pound, what was the amount in United States money of the total sales?

**38.** If the 7000 bales were shipped from United States ports and the ocean freight rates averaged 32¢ per hundred, what was the cost of transportation?

**39.** If a cotton planter raises 18 bales of cotton, averaging 500 lb., classified as *middling fair*, worth 7.72*d.* per pound, what will be the net proceeds to him if the transportation charges from the plantation to the station amount to 16¢ per hundred, the freight rate from the station to the port 40¢ per hundred, and the ocean freight rate 32¢ per hundred, with insurance and terminal charges including commission at 60¢ per hundred?

**40.** What is the difference between the New York and the Liverpool cost of 11 bales of cotton averaging 500 lb., worth 12.90¢ in New York and 7.10*d.* in Liverpool?

**41.** Find the net proceeds of a shipment of 100 bales of cotton (500 lb. each) from New Orleans to Liverpool, Liverpool quotation 6.86*d.*, transportation and terminal charges, including marine insurance, $5.15 per bale.

# TESTS FOR KNOWLEDGE AND ACCURACY

### Group I

1. The terms of a bill for $879.60 are 40%, 20%, and 5% off. Find the net amount of the bill.

2. Find the amount a merchant will save on bills for $49,260 by taking advantage of a 2% discount for cash.

3. An article is purchased for $38. At what price must it be sold to gain 25%?

4. Find the price for which a watch costing $20 must be sold in order to gain 35%.

5. Find the per cent of gain on an article bought for $.60 and sold for $.85.

### Group II

1. A butcher buys meat at 18¢ a pound. Find his per cent of gain if he sells it for 24¢ a pound.

2. Find the interest on the following note:

*$265.00* *Windsor, Ill., Feb. 1, 1916.*

*Sixty days after date, for value received, I promise to pay to James Wilson*

*Two hundred sixty-five $\frac{00}{100}$ Dollars with interest at the rate of 6% from date until paid.*

*William K. Jones.*

3. Find the term of interest on a note given Dec. 11, 1915, and paid March 20, 1916.

4. What is the interest on a note for $1240 given May 3, 1915, and paid June 12, 1916, at 6%?

5. Carry out the extensions and find the net proceeds on the following account sales:

Los Angeles, Cal., Feb. 1, 1916.

*Sold for the account of* E. P. FLINT
Delta, Utah

*By* R. H. Keim

| | | | | |
|---|---|---|---|---|
| 1916 | | | | |
| Jan. | 15 | 36,000 lb. red chaff wheat at $1.36¼ per hundred pounds . . . . . | | |
| | | 24,000 lb. of barley at $1.12½ per hundred pounds . . . . . | | |
| Jan. | 27 | Freight paid | | |
| | | on wheat . . . . . | $61.20 | |
| | | on barley . . . . . | 38.80 | |
| | | Commission 1½ % | | |

## Group III

1. Find the commission at 2% and the net proceeds on a sale of 34 tons of alfalfa hay at $13.75 per ton.

2. Find the amount of a man's taxes on a property valuation of $3600 at the rate of 35 mills on the dollar.

3. A district desires to raise $645 for school purposes on a district valuation of $43,000. What rate must be levied in order to produce the amount?

4. What is the tariff on $25,000 worth of woolens at 35%?

5. What is the amount in the bank account of William Sims after the following transactions?

Deposited, Feb. 1: currency, $95; gold, $20; checks amounting to $57.60.

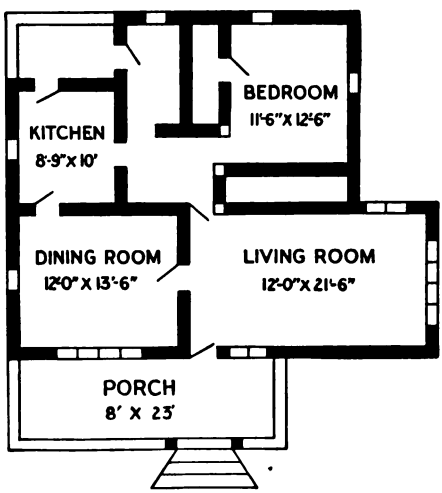
Deposited Feb. 15: currency, $35; gold, $5; checks, $33.

Deposited Feb. 20: currency, $15; checks, $17.80.

Checks were drawn for board and room, $20; laundry, $2.15; life insurance, $20.22; merchandise, $34.60.

### Group IV

1. Find the cost of flooring the porch shown in this plan with yellow pine at $40 per M.




2. Find the cost of oak flooring for the living room at $60 per thousand.

3. If one carpenter can lay 400 sq. ft. of oak flooring in 1 day, how much will it cost for labor to floor the 4 rooms and porch at $4 per day?

4. How much will it cost to lay an 8-inch brick foundation for the house at $12 per M, there being a cross wall in each direction? Allow $187\frac{3}{4}'$ for total length of outside walls and cross walls. The walls are $7\frac{1}{2}$ ft. high.

5. What will be the cost of oiling and varnishing the floors of the 4 rooms and the porch, at 26¢ per square yard?

### Group V

1. Find the cost of tinting the walls and the ceiling of the living room (8′ high) at 6¢ per square yard; no deduction for openings.

2. Find the cost of painting the floor of the porch two coats at 30¢ per square yard.

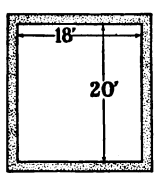
3. Find the cost of papering the dining room (8′ high) with paper worth $1.60 per double roll.

4. Find the cost of covering the floor of the kitchen with linoleum at $1.65 per square yard.

5. Find the cost of painting the exterior walls of a house at 28¢ per square yard if the outside measurements are 32 ft. by 32 ft. and 18 ft. high.

### Group VI

1. Make a diagram showing the size of the dining-room floor represented on page 202 and of a rug which covers the floor within 1 ft. of the wall on all sides.




2. How much will it cost to cement the floor of the basement shown in the accompanying plan at $12\frac{1}{2}$¢ per square foot?

3. Find the number of shingles required to shingle the two sides of a roof, each side being 30 ft. long and 16 ft. wide, with shingles laid 4 in. to the weather.

4. What will be the cost of building a sidewalk 100 ft. long and 5 ft. wide at $11\frac{1}{2}$¢ per square foot?

5. How much will it cost to construct 14 concrete bridge piles 18 in. in diameter and 21 ft. long if labor and material amount to $6.821 per cubic yard?

# HOUSEHOLD ECONOMICS

TABLE OF MEASURES AND WEIGHTS

| | |
|---|---|
| 2 cups | = 1 pint |
| 1 pint of milk or water | = 1 lb. |
| 10 eggs (average) | = 1 lb. |
| 4 cups of flour = 1 quart | = 1 lb. |
| 2 cups solid butter | = 1 lb. |
| 2 cups granulated sugar | = 1 lb. |
| 3 cups meal | = 1 lb. |
| 2 tablespoons of sugar | = 1 oz. |
| 2 tablespoons of coffee | = 1 oz. |
| 4 tablespoons of flour | = 1 oz. |
| 2 tablespoons of butter | = 1 oz. |

1. If flour is worth \$1.15 a sack of 50 lb., what is the value of 1 lb. or 1 qt.?

2. If sugar sells at 17 lb. for \$1, what is the value of 2 cups of granulated sugar?

3. What is the value of 1 tablespoon of sugar when sugar sells at 17 lb. for \$1?

4. If coffee is worth 40¢ per pound, what is the value of 2 tablespoonfuls?

5. If milk sells at 7¢ per quart, what is the value of one cup?

6. At 24¢ per pound, find the cost of 2 eggs.

7. If a pound of butter costs 32¢, what is the value of 1 tablespoonful of butter?

**8.** Find the cost of the following recipe for milk bread:

| | | |
|---|---|---|
| 2 cups of milk | at | $ .07 per quart |
| 2 tablespoons of butter | at | .32 per pound |
| 1 tablespoon of sugar | at | .05¼ per pound |
| 1 yeast cake | at | .02 |
| 6 cups of flour | at | 2.40 per hundredweight |
| 1½ teaspoons of salt (Disregard cost.) | | |

**9.** Find the cost of the following recipe for shortcake:

| | | |
|---|---|---|
| 1 cup of flour | at | $2.40 per hundredweight |
| 1 teaspoon of baking powder | at | .005 |
| 4 tablespoons of butter | at | .30 per pound |
| ½ cup of milk | at | .07 per quart |
| ½ teaspoon of salt (Disregard cost.) | | |

**10.** Find the cost of the following recipe for doughnuts:

| | | |
|---|---|---|
| 2 eggs | at | $ .22 per dozen |
| 1 cup of milk | at | .07 per quart |
| 1 cup of granulated sugar | at | .05 per pound |
| 3 pints of flour | at | 2.25 per hundredweight |
| 1 tablespoon of baking powder | at | .01 |

**11.** A church society in a city of the Middle West gave luncheons to their commercial club at 35¢ per plate. The following list is a fair sample of the cost for 35 plates, there being no expense for labor or fuel. Find the total cost.

| | |
|---|---|
| Meat | $2.00 |
| Potatoes, 1 pk. | .20 |
| Coffee, ½ lb. | .20 |
| Cream | .10 |
| Milk, 2 qt. | .14 |
| Corn, 3 cans | .30 |
| Pickles | .15 |
| Dessert | .75 |
| Sugar | .10 |
| Butter, 2 lb. | .60 |
| Bread, 4 loaves | .30 |
| Incidentals | .10 |

**12.** Find the cost of each plate, to the fraction of a cent.

**13.** Find the profit of the luncheon to the society.

**14.** Find the profit on each plate.

**15.** With this luncheon as a basis, find the cost of such a luncheon to a family of 5.

**16.** Find the cost of such a luncheon served daily to a family of 5 for 30 days.

**17.** If breakfast, luncheon, and dinner average 14¢ each per plate, what would be the cost of meals for 30 days to a family of 5?

EDIBLE ORGANIC NUTRIENTS AND FUEL VALUE

| FOOD | PROTEIN PER CENT | FAT PER CENT | CARBOHYDRATES PER CENT | FUEL VALUE PER POUND CALORIES |
|---|---|---|---|---|
| Wheat bread | 9.1 | 1.6 | 53.3 | 1199 |
| Graham bread | 8.9 | 1.8 | 52.1 | 1189 |
| Whole-wheat bread | 9.7 | .9 | 49.7 | 1113 |
| Butter | 1.0 | 85.0 | | 3491 |
| Irish potatoes | 2.2 | .1 | 18.4 | 378 |
| Sweet potatoes | 1.8 | .7 | 27.4 | 558 |
| Whole milk | 3.3 | 4.0 | 5.0 | 314 |
| Cream | 2.5 | 18.5 | 4.5 | 865 |
| American cream cheese | 25.9 | 33.7 | 2.4 | 1890 |
| Ham, fresh, lean | 25.0 | 14.4 | | 1042 |
| Beefsteak, porterhouse | 21.9 | 20.4 | | 1230 |
| Beef roast | 22.3 | 28.6 | | 1576 |
| Beef, hind quarter, lean | 20.0 | 13.4 | | 907 |
| Beefsteak, round | 18.4 | 12.2 | | 694 |
| Bacon, smoked | 10.5 | 64.8 | | 2840 |
| Cocoa | 21.6 | 28.9 | 37.7 | 2258 |
| Eggs | 13.4 | 10.5 | | 672 |
| Fowls | 19.3 | 16.3 | | 1017 |
| Hominy | 8.3 | .6 | 79.0 | 1609 |
| Oatmeal | 16.1 | 7.2 | 67.5 | 1811 |
| Macaroni | 13.4 | .9 | 74.1 | 1625 |

**18.** How much protein is there in 2 lb. porterhouse steak?

SOLUTION.—100 lb. porterhouse steak contain 21.9 lb. protein.

1 lb. porterhouse steak contains $\frac{1}{100}$ of 21.9 lb. = .219 lb. protein.

2 lb. porterhouse steak contain 2 × .219 lb. = .438 lb. protein.

**19.** How much fat is there in 2 lb. of porterhouse steak?

**20.** If 10 eggs weigh one pound, how much protein is provided in 2 eggs? how much fat?

**21.** Find the amount of nutritive elements in a 5-pound beef roast.

**22.** Find the total amount of protein, carbohydrates, and fat in the following:

5 lb. beef roast.
½ lb. butter.
2 5-ounce loaves of wheat bread.
4 lb. of Irish potatoes.
1 lb. of hominy.
½ lb. of cream.

**23.** What is the difference in the amount of protein obtained from 7 lb. each of round steak and fresh ham?

**24.** What is the difference in the amount of fat in a pound of cream and a pound of whole milk?

**25.** Compare the amount of protein, fat, and carbohydrates in one bushel (60 lb.) of Irish potatoes and one bushel (55 lb.) of sweet potatoes.

**26.** Find the difference in digestible nutrients in 50 lb. of oatmeal and 50 lb. of wheat bread.

**27.** Find the difference in amount of protein between ¼ lb. of porterhouse steak and 2 eggs.

**28.** What is the difference in amount of fat in 3 eggs and ¼ lb. of fresh ham?

**29.** If a man requires .24 lb. of protein per day, how long will 12 lb. of beef (round) supply his need?

**30.** If a man requires 1.14 lb. of carbohydrates per day, how long will 12 lb. of oatmeal supply his need?

**31.** If a man requires 1.14 lb. of carbohydrates per day, find the quantity of wheat bread and Irish potatoes that will supply the need if 1 lb. of bread furnishes .533 lb. and 1 lb. of potatoes .184 lb.

**32.** If a man requires 1.14 lb. of carbohydrates in one day, how nearly will this requirement be met by 2 16-ounce loaves of wheat bread and 3 pt. of whole milk?

**33.** If a man requires .24 lb. protein per day, how nearly will 2 16-ounce loaves of wheat bread and 3 pt. of whole milk supply the need?

**34.** If .11 lb. of fat is required for a man's rations for one day, how nearly will 2 16-ounce loaves of wheat bread and 3 pt. of whole milk supply his need?

**35.** Find the nutrients in $\frac{1}{2}$ lb. of oatmeal and a quart of whole milk.

**36.** Find the nutrients in $\frac{1}{2}$ lb. of oatmeal and a quart of cream.

The **nutritive ratio** is the ratio of protein to carbohydrates $+ 2\frac{1}{4}$ times fat. The standard ratio is about 1:5.

NOTE. — The fat must be multiplied by $2\frac{1}{4}$ to express it in terms of carbohydrates, because when oxidized in the body a pound of fat yields $2\frac{1}{4}$ times as many calories or heat units as a pound of carbohydrates.

**37.** Find the nutritive ratio of Irish potatoes, which contain 2.2% protein, .1% fat, and 18.4% carbohydrates.

SOLUTION. — $18.4 + 2\frac{1}{4} \times .1 = 18.625$.

$2.2 : 18.625 = 1 : 8.4$.

**38.** Find the nutritive ratio of apples, which contain .4 % protein, .5 % fat, and 14.2 % carbohydrates.

**39.** Find the nutritive ratio of smoked bacon, which contains 10.5 % protein, 64.8 % fat, and no carbohydrates.

**40.** Find the nutritive ratio of graham bread, which contains 8.9 % protein, 1.8 % fat, and 52.1 % carbohydrates.

**41.** Find the nutritive ratio of one 16-ounce loaf of wheat bread and a pound of porterhouse steak.

**42.** Find the nutritive ratio of one 16-ounce loaf of wheat bread and $\frac{1}{4}$ lb. of butter.

**43.** Find the nutritive ratio of 1 lb. of fresh ham and 1 lb. of Irish potatoes.

**44.** Find the nutritive ratio of apple pie, which contains 3.1 % protein, 9.8 % fat, and 42.8 % carbohydrates.

HOURLY OUTGO OF ENERGY FROM THE HUMAN BODY

| AVERAGE WEIGHT 154 LB. | CALORIES |
|---|---|
| Sleeping . . . . . | 65 |
| Sitting up . . . . . | 100 |
| Light exercise . . . . . | 170 |
| Moderate exercise . . . | 190 |
| Severe exercise . . . . | 450 |

The energy required for a man of known occupation is easily determined.

**45.** How many calories are required for a period of 8 hr. by a sleeping man who weighs 180 lb.?

SOLUTION. $\frac{180}{154} \times 8 \times 65$ calories $= 607\frac{1}{11}$ calories, or 608 calories.

**46.** How many calories are required for a period of 8 hr. by a man weighing 154 lb. at light exercise? at moderate exercise?

**47.** How many calories will be required per day by a man who weighs 170 lb., sleeping 8 hr., working (moderate exercise) 8 hr., and recreation (light exercise) 8 hr.?

**48.** How many calories are required by a man who weighs 168 lb., working at severe exercise 8 hr.?

**49.** How many calories are required by a man who weighs 154 lb., sleeping 9 hr., working (moderate exercise) 10 hr., and at light exercise 5 hr.?

**50.** How many calories will be supplied by $\frac{1}{2}$ lb. of porterhouse steak, 12 oz. of wheat bread, $\frac{3}{4}$ lb. of Irish potatoes, $\frac{1}{8}$ lb. butter, and $\frac{1}{4}$ lb. of prunes? (1 lb. of prunes produces 1368 calories.)

**51.** How many calories are produced by a 16-ounce loaf of wheat bread and 1 qt. of whole milk?

**52.** How many calories are produced by $\frac{1}{2}$ lb. of fresh ham, $\frac{1}{8}$ lb. of oatmeal, 8 oz. of graham bread, 1 pt. of whole milk, and a 7-ounce orange? (1 lb. orange produces 233 calories.)

**53.** How many calories are produced by 3 eggs if 10 eggs weigh 1 lb.?

**54.** How many calories are produced by $\frac{1}{4}$ lb. of roast beef, 4 oz. of wheat bread, and 1 oz. of butter?

**55.** How many handkerchiefs 12 in. square can be cut from 1 yd. of linen 36 in. wide? What is the cost of the linen required for each handkerchief at 75¢ per yard?

**56.** How many centerpieces 18 in. square can be cut from a square yard of linen, and what will be the cost of each if linen, 1 yd. wide, costs 85¢ per yard?

**57.** How many yards of pillowcase tubing are required to make 6 cases $31\frac{1}{4}$ in. long finished, allowing $4\frac{3}{4}$ in. for hem and seam? What will be the cost of the 6 cases at 22¢ per yard?

**58.** A lady made a luncheon set of solid crochet, using No. 3 crochet cotton. The 8 plate doilies required $1\frac{3}{4}$ spools each; the 8 tumbler doilies required $\frac{3}{4}$ spool each, and the centerpiece 12 spools. How much did the material cost her at 2 spools for 25¢? How much might she have saved by buying all but the last 2 spools by the box at 10¢ per spool, there being 10 spools in a box?

**59.** How much can be saved by buying a whole ham, weighing 16 lb., at 18¢ per pound, instead of buying the same ham sliced at 27¢ per pound?

**60.** If 12 tons of hard coal are required for a season, how much is saved by buying it early at $9.75 per ton instead of buying it as needed at $10.50? What is the per cent of saving?

**61.** If 20 tons of bituminous coal are required for a season, how much is saved by buying the entire quantity early at $6.75 per ton instead of paying $7.50 per ton as used?

**62.** How much is saved per 100 lb. by buying sugar in 100-pound sacks at $4.75 per sack instead of buying it in small quantities at 17 lb. for $1?

**63.** How many yards of sheeting will be required to make 6 sheets $2\frac{5}{6}$ yd. long finished, allowing 6 in. per sheet for hems?

**64.** What per cent is saved in buying corn at 3 cans for 25¢ if a single can costs 10¢? What per cent is saved in buying a dozen cans for 90¢ instead of 3 cans for 25¢?

**65.** A family of 2 adults and 3 children on a salary of $800 per year spent 45% for food, 15% for rental, 10% for operating expenses, 10% for clothes, and 20% for human interest items. Find the amount spent for each item.

**66.** A family with a salary of $1000 spent 28% for food, 20% for rent, 10% for operating expenses, 15% for clothes, 20% for cultural items, and saved the balance. Find the amount spent for each item and the amount saved.

**67.** A family whose income was $2000 spent the following per cent for various items: 25% for food, 20% for rent, 15% for operating expenses, 20% for clothes, 12% for higher life materials, and saved 8%. Find the amount of each item.

**68.** A family of 2 adults and 3 children whose combined annual income was $950 spent 20% for food, 22% for rent, 18% for operating expenses, 15% for clothing, 10% for church and charity, 5% for books, and saved the balance. Find the amount spent for each item and the annual saving.

**69.** A family whose income was $2400 spent 25% for food, 20% for rent, 15% for operating expenses, and 15% for clothing. The balance went to charity and savings. Find the amount of each item.

**70.** A family of 2 adults and 4 children whose annual income was $1800 spent 22% for food, 10% for taxes, repairs, and improvements, 20% for clothing, 20% for fuel, operating expenses, etc., 10% for church, charity, etc., 8% for cultural materials, and saved 10%. Find the amounts in these various items.

**71.** A family whose income was $5000 a year spent 20% for food, 15% for rent, 20% for clothes, and 45% for miscellaneous expenses. Find the amount of each item.

## HOUSEHOLD ACCOUNTS

1. In the following account find:

(*a*) The total expense for each day.
(*b*) The total expense for each item for the week.
(*c*) The total expense for the week.
(*d*) The per cent of the total expense paid for food.
(*e*) The per cent of the total expense paid for clothing.
(*f*) The per cent of the total paid for operating expenses.
(*g*) The per cent of the amount paid all together for culture, church, charity, health, and amusements.

HOUSEHOLD EXPENSE (Weekly)

| | Mon. | Tues. | Wed. | Thurs. | Fri. | Sat. | Sun. | Total |
|---|---|---|---|---|---|---|---|---|
| Provisions: | | | | | | | | |
| Grocer | .80 | .20 | | .65 | .15 | 1.20 | | |
| Butcher | | .30 | .40 | .20 | .50 | .95 | | |
| Clothing | | | 2.00 | | | 1.75 | | |
| Operating expenses: | | | | | | | | |
| Fuel | | 13.00 | | | | | | |
| Help | | 1.00 | | | 1.00 | | | |
| Laundry | | | .20 | | | .60 | | |
| Lighting | | | .40 | | | | | |
| Telephones, etc. | | | | | 1.50 | | | |
| Cultural items | .01 | .03 | .01 | .01 | .01 | .25 | .05 | |
| Church and charity | | | | | | | 1.25 | |
| Health | | | | | | | | |
| Amusements | | | .50 | | .45 | | | |
| Total | | | | | | | | |

2. In the following account find:

(*a*) The total expense for each month of the quarter.
(*b*) The total expense for each item for the quarter.
(*c*) The total expense for the quarter.

| Household Expense (Quarterly) | | | | |
|---|---|---|---|---|
| | Jan. | Feb. | Mar. | Total |
| Provisions: | | | | |
| Grocer | 12.00 | 9.50 | 11.35 | |
| Butcher | 9.40 | 7.10 | 9.00 | |
| Clothing | 15.00 | 13.50 | 12.80 | |
| Operating expenses: | | | | |
| Fuel | 35.00 | | | |
| Help | 8.00 | 10.00 | 7.50 | |
| Laundry | 4.70 | 6.80 | 4.60 | |
| Lighting | 2.20 | 2.05 | 2.35 | |
| Telephones, etc. | 1.50 | | | |
| Cultural items | 1.48 | 1.25 | 1.45 | |
| Church and charity | 8.25 | 6.00 | 7.15 | |
| Health | | 2.00 | | |
| Amusements | 3.80 | 2.15 | 1.75 | |
| Total | | | | |

## THE COST OF LIVING

Average Food Cost per Workingman's Family, U. S. Bureau of Labor

| Year | North Atlantic Division | South Atlantic Division | North Central Division | South Central Division | Western Division | United States |
|---|---|---|---|---|---|---|
| 1903 | $356 | $312 | $339 | $321 | $323 | $330.20 |
| 1904 | 362 | 313 | 341 | 323 | 329 | 333.60 |
| 1905 | 360 | 315 | 342 | 324 | 329 | 334.00 |
| 1906 | 373 | 327 | 354 | 334 | 338 | 345.20 |
| 1907 | 388 | 343 | 370 | 349 | 358 | 361.60 |
| 1908 | 396 | 353 | 386 | 367 | 364 | 373.20 |
| 1909 | 411 | 375 | 409 | 392 | 386 | 394.60 |
| 1910 | 423 | 404 | 432 | 418 | 408 | 417.00 |
| 1911 | 422 | 389 | 424 | 419 | 409 | 412.60 |
| 1912 | 466 | 417 | 463 | 441 | 429 | 443.20 |
| 1913 | 489 | 439 | 493 | 467 | 465 | 470.60 |

1. How much greater was the food cost for 1913 than for 1903 in each of the divisions?

2. What was the per cent of increase from 1903 to 1913 in each of the divisions?

3. Which division showed the least increase in food cost per family from 1903 to 1913?

4. Which division showed the greatest increase from 1903 to 1913?

5. What was the per cent of increase for the United States from 1903 to 1908?

6. What was the average per cent of increase in the United States from 1903 to 1913?

7. What was the per cent of increase for the United States from 1908 to 1913?

TABLE OF RELATIVE PRICES

| ITEM | 1900 | 1910 |
|---|---|---|
| Farm products | 109.5 | 164.6 |
| Food, etc. | 104.2 | 128.7 |
| Clothes and clothing | 106.8 | 123.7 |
| Fuel and lighting | 120.9 | 125.4 |
| Metals and implements | 120.5 | 128.5 |
| Lumber and building materials | 115.7 | 153.2 |
| Drugs and chemicals | 115.7 | 117.0 |
| Household goods | 106.1 | 111.6 |
| Miscellaneous articles | 109.8 | 133.1 |

NOTE. — A relative price of any article is the per cent which the price of that article at a certain date is of its price at another period, selected as the base on which prices are represented as 100. The base used in this table is the average price from 1890–1899.

8. What was the average per cent of increase from 1900 to 1910 on all the articles mentioned in the table on p. 215?

9. Using this average per cent of increase, find the increase from 1900–1910 in the cost of living for a family whose yearly expenses in 1900 amounted to $760.

10. A family of 3 adults and 3 children found that they could live on the following weekly allowances. Find their saving out of a salary of $1200 per year:

| | |
|---|---|
| Rent | $3.50 |
| Car fares | 2.00 |
| Groceries | 5.00 |
| Meat | 1.00 |
| Milk | .50 |
| Fuel and lights | 3.00 |
| Washing | 1.00 |
| Clothing | 3.00 |
| Charity and amusements | 1.00 |

11. By keeping a carefully itemized account of expenditures a family found the yearly expenses as follows. On a salary of $1000 per year what saving did they effect?

| | |
|---|---|
| Rent | $216.00 |
| Groceries, meats, and milk | 157.46 |
| Clothing | 87.45 |
| Fuel | 60.50 |
| Car fares | 24.00 |
| Lighting | 26.81 |
| Amusements and charity | 59.10 |
| Laundry | 23.40 |

12. A clerk on a salary of $75 per month, who owned his house, found that the monthly expenses of himself and his wife were as follows. How did his account stand at the end of that month?

| | |
|---|---|
| Building and loan | $ 5.00 |
| Food | 25.00 |
| Electric lights | 2.00 |
| Clothing | 18.75 |
| Laundry | 2.50 |
| Fuel and water | 6.00 |
| Insurance | 2.00 |
| Dental work and medicine | 3.00 |

**13.** A family having an income of $720 per year found their expense account distributed as follows. How much was the saving?

| | |
|---|---|
| Taxes and fire insurance | $ 52.00 |
| Life and accident insurance | 80.00 |
| Groceries and provisions | 180.00 |
| Fuel, light, and water | 87.50 |
| Telephone | 18.00 |
| Repairs on house | 21.75 |
| Furniture, etc. | 23.25 |
| Traveling | 30.00 |
| Clothing | 75.00 |
| Medicine and doctors | 28.00 |
| Charity and amusements | 63.00 |
| Laundry and incidentals | 30.00 |
| Papers and magazines | 11.00 |
| Books | 8.00 |

**14.** Best native cattle sold on the Chicago market in 1900 at $6.35 per 100 lb., and in 1913 at $9.70. Find the per cent of increase in price.

**15.** Beef sold in 1900 at $11 per barrel, and in 1913 at $19 per barrel. Find the per cent of increase in price.

**16.** Hogs, prime, sold on the Chicago market in 1900 at $4.90 per 100 lb. and in 1913 at $8. Find the per cent of increase.

**17.** Pork, new mess, sold for $10.50 per barrel in 1900, and for $23.25 per barrel in 1913. Find the per cent of increase in the price of pork from 1900 to 1913.

**18.** Wheat No. 2 red sold on the Chicago market in 1900 at $.75125 per bushel in the elevator, and in 1913 at $.98. Find the per cent of increase in the price of wheat from 1900 to 1913.

**19.** Flour brought $3.40 per barrel in 1900 and $4.15 in 1913. Find the per cent of increase in price.

**20.** Smoked hams brought $.0975 per pound in 1900 and $.16 in 1913. Find the per cent of increase.

**21.** Bacon sold at $.0625 per pound in 1900, and at $.125 in 1913. What was the per cent of increase?

**22.** Butter brought 25¢ per pound in 1900, and 32¢ in 1913. What was the per cent of increase?

**23.** Potatoes sold in 1900 at $1.50 per 180 lb., and in 1913 at $2.10. Find the per cent of increase.

**24.** During 1900 choice cheese sold at $.1275 per pound, while in 1913 it sold at $.155. Find the per cent of increase in the selling price.

**25.** Western lard sold in 1900 at $.0615 per pound, and in 1913 at $.107. Find the per cent of increase.

**26.** Milk sold in 1900 at $.03775 per quart, while in 1913 the price was $.0505. Find the per cent of increase.

**27.** In 1900 cotton sheeting sold at $.0575 per yard, while in 1913 it brought $.08. What was the per cent of increase in price?

**28.** In 1900 fresh eggs sold at $.19 per dozen in New York, and in 1913 at $.38. What was the per cent of increase in price?

**29.** The price of corn in 1900 was \$.40 per bushel; in 1913 it was \$.80. Find the per cent of increase in thirteen years.

**30.** The accompanying table of increases in the prices of foodstuffs compares the prices of 1912 with the average price of the period between 1890 and 1899. Find the average per cent of increase. Write table in field book.

| | Per Cent of Increase |
|---|---|
| Granulated sugar | 8.8 |
| Wheat flour | 32.9 |
| Milk | 35.6 |
| Butter (creamery) | 47.4 |
| Sirloin steak | 53.0 |
| Lard (pure) | 54.3 |
| Rib roast | 55.5 |
| Hens | 58.5 |
| Corn meal | 60.3 |
| Eggs | 62.5 |
| Potatoes | 68.2 |
| Round steak | 74.3 |
| Pork chops | 87.8 |
| Bacon | 99.0 |
| Average | |

**31.** The average yearly cost of food for a workingman's family in the North Atlantic States between 1890 and 1899 was \$313.20. Using the average per cent of increase found in problem 30, ascertain the cost in 1912.

**32.** The average cost of food in the South Atlantic States during the same period was \$298.64. Using the average per cent of increase of prices found in problem 30, find the cost of food in 1912.

**33.** The average cost of food per family during the same period, for the entire United States, was \$288. Find the cost under the increased prices of 1912.

**34.** The commissioner's report shows that in the above investigation the average was 5.31 persons to a family. Find the average cost of food per person between 1890 and 1899 if the cost per family was \$288; also the average cost in 1912.

**35.** The average earnings of these families during the period was $891.19. Applying the same increase to the earnings as to the foodstuffs, find the average earnings in 1912.

**36.** In problem 10, p. 216, with six in the family, what was the average cost of living for one year?

**37.** In problem 11, with but two persons in the family, what was the cost per person for the year?

The Massachusetts Labor Bureau published statistics showing the average income, expenditures, and savings of various classes. A few of the figures relating to salaried persons and professional men are herewith given:

| | Income | Expenditure | Savings |
|---|---|---|---|
| Bankers and brokers | $7726 | $5338 | $2388 |
| Lawyers | 4169 | 2685 | 1484 |
| Physicians | 3907 | 3190 | 717 |
| Railroad officials | 3441 | 3190 | 251 |
| Superintendents mfg. companies | 3262 | 2533 | 729 |
| Clergymen | 3150 | 2581 | 569 |
| Professors | 2878 | 2335 | 543 |
| Steamboat officials | 2529 | 1926 | 603 |
| Express officials | 1906 | 1647 | 259 |

Note. — It is stated that 30 out of every 100 acknowledged that they had saved nothing.

**38.** Find in each case, in the above table, the per cent of savings to income.

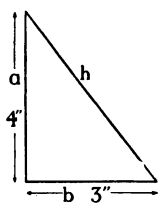
**39.** Which class effected the largest per cent of savings? the least per cent?

# MENSURATION

## PLANE FIGURES

### The Solution of the Right Triangle

A **right triangle**, as shown in the figure, has one right angle. The hypotenuse is the side opposite the right angle.



Right Triangle

**1.** With extreme care draw a right triangle with a base of 3 inches and an altitude of 4 inches.

**2.** Measure the hypotenuse carefully and square its length.

**3.** Square both base and altitude and add the results.

**4.** Compare the square of the hypotenuse with the sum of the squares of the other two sides.

**5.** Draw a large right triangle and denote its sides as in the figure.

**6.** Measure side $a$ and square it.

**7.** Measure side $b$ and square it.

**8.** Measure the hypotenuse ($h$) and square it.

*The square of the hypotenuse of a right triangle equals the sum of the squares of the other two sides.*

**9.** Find the hypotenuse of a right triangle whose sides are 8 in. and 6 in.

Solution. — $(8^2 + 6^2) = (64 + 36) = 100$, square of hypotenuse. Since the square of the hypotenuse = 100, the hypotenuse = $\sqrt{100} = 10$. *Ans.* 10 in.

**10.** If the hypotenuse of a right triangle is 10 in. and one side is 8 in., find the other side.

SOLUTION. — $(10^2) = 100$; $(8^2) = 64$; $100 - 64 = 36$; $\sqrt{36} = 6$. *Ans.* 6 in. in other side.

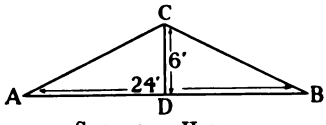
Find the missing side of the following right triangles:

**11.** Base 5 ft.; alt. 12 ft. **13.** Hyp. 5 ft.; base 3 ft.

**12.** Base 20 in.; alt. 15 in. **14.** Hyp. 15 ft.; alt. 9 ft.

## APPLICATION OF THE RIGHT TRIANGLE

**Pitch** is a term used in building and is arithmetically expressed by dividing the height of a roof by its span.




SPAN AND HEIGHT

In the figure, $AB$ is the span and $CD$ is the height. If the span is 24 ft. and the height 6 ft., the pitch is $\frac{1}{4}$.

If the span is 36 ft., what is the height of a roof if the pitch is $\frac{1}{3}$? if the pitch is $\frac{1}{4}$?

If the span is 16 ft., what is the height if the pitch is $\frac{1}{2}$? If the span is 12 ft. and the height 8 ft., what is the pitch?

**15.** Draw a figure representing a roof with a $\frac{1}{4}$ pitch and compute the length of the rafter required; that is, the length of the hypotenuse.

**16.** Draw the diagram of a roof with a $\frac{1}{3}$ pitch and compute the length of the rafter which projects over the side wall 14 in.

**17.** Find the length of a rafter which projects over the side 15 in. if the span is 30 ft. and the height is 10 ft.

## AREAS OF TRIANGLES AND QUADRILATERALS

**Formula for area of a parallelogram.**

If $A$ represents area, $b$ base, and $h$ altitude, interpret the following formula for the area of a rectangle or of any parallelogram. FORMULA. — $A = bh$

**To compute the area of a triangle.**

The accompanying diagram shows that the diagonal divides the parallelogram into two equal triangles. Therefore the area of each triangle equals one half the area of the parallelogram or $\frac{1}{2}\,bh$.

PARALLELOGRAM

*The area of a triangle equals one half the product of its base and altitude.*

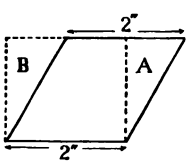
NOTE. — By the product of lines is meant the product of the *numbers* that measure them when *expressed in like units.*

Find the area of the following triangles:

| | BASE | ALTITUDE | | BASE | ALTITUDE |
|---|---|---|---|---|---|
| **18.** | 30 in. | 10 in. | **21.** | $14\frac{1}{2}$ ft. | 3 ft. |
| **19.** | 12 ft. | 4 ft. | **22.** | 2 ft. | 6 in. |
| **20.** | 15 ft. | 9 ft. | **23.** | 3 ft. | 4 in. |

A **rhombus** is an equilateral parallelogram whose angles are not right angles.

**To compute the area of a rhombus.**



RHOMBUS

**24.** Cut from a piece of paper a rhombus whose sides are 2 inches. Cut the right triangle *A* from the right of the rhombus, as shown in the figure. Apply the two parts of the figure with triangle *A* located on the left, as indicated by *B*.

**25.** Observe that the figure is now a rectangle, but contains the same area. Hence,

*The area of a rhomboid equals the product of its base and altitude.*

**26.** Draw a rhombus, note its exact measurements, and compute its area.

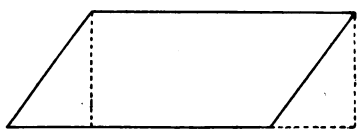
Find the area of the following rhombuses:

| | Base | Altitude | | Base | Altitude |
|---|---|---|---|---|---|
| 27. | 16 in. | 4 in. | 29. | 4 ft. | 8 in. |
| 28. | 10 ft. | 5 ft. | 30. | $6\frac{1}{4}$ in. | $3\frac{1}{8}$ in. |

A **rhomboid** is a parallelogram the adjoining sides of which are not equal to each other and which contains no right angles.

**To compute the area of a rhomboid.**

31. Cut from paper a figure similar to the one below; remove the right triangle from the left of the rhomboid and apply the two figures in such a manner that the triangle removed from the left will fall where the dotted triangle lies at the right.



Rhomboid

32. It is observed that the figure thus formed is a parallelogram. Hence,

*The area of a rhomboid equals the product of the base by the altitude.*

33. Draw a rhomboid and measure it carefully; record the measurements and compute the area.

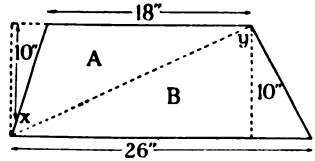
Find the area of the following rhomboids:

| | Base | Altitude | | Base | Altitude |
|---|---|---|---|---|---|
| 34. | 12 ft. | 3 ft. | 36. | $8\frac{1}{2}$ ft. | 4 ft. |
| 35. | 14 in. | 5 in. | 37. | 5 ft. 4 in. | 2 ft. |

A **trapezoid** is a plane four-sided figure, having only two sides parallel.

**To compute the area of a trapezoid.**

**38.** Notice that the trapezoid is divided by the dotted line $xy$ into two triangles, the base of one being 18 in. with an altitude of 10 in.; the base of the other, 26 in. with the same altitude.



TRAPEZOID

**39.** What is the area of the triangle $A$?

**40.** What is the area of triangle $B$?

**41.** It is observed that the sum of the two areas equals the area of the trapezoid.

*The area of a trapezoid equals one half the product of its altitude and the sum of its bases.*

Find the area of the following trapezoids:

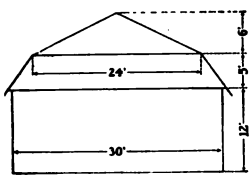


FIG. 1

| | BASES | ALTITUDE |
|---|---|---|
| **42.** | 20 ft., 16 ft. | 5 ft. |
| **43.** | 10 in., 8 in. | 8 in. |
| **44.** | 6 ft. 6 in., 4 ft. | 3 in. |
| **45.** | $5\frac{1}{4}$ ft., 3 ft. | 3 ft. |

**46.** Find the area of the end of the building represented in Fig. 1 and the cost of painting it at 22¢ per square yard.

**47.** Figure 2 represents a canal which flows at the rate of 1 mile per hour. Find the number of cubic feet of water that will pass a head gate in 10 hours.

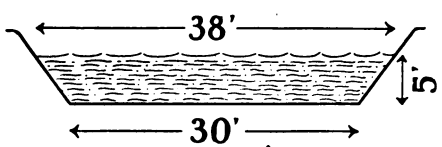


FIG. 2

SUGGESTION. — $\frac{(38+30)\times 5}{2} \times 52{,}800$ cu. ft. = ?

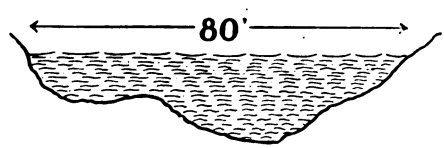



FIG. 3

**48.** Figure 3 represents a stream which has been sounded at six points in its width with the following record: 4 ft., 6 ft., 12 ft., 10 ft., 7 ft., and 2 ft. It flows at the rate of 2 miles per hour. How many cubic feet of water will pass a given point in 1 hour?

NOTE. — Average the soundings.

**49.** Figure 4 shows a cross section of a cast-iron beam 18 inches in length. Determine the weight.

NOTE. — 1 cu. ft. of cast iron weighs 450 lb.

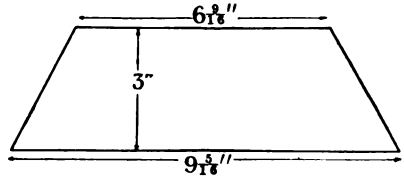
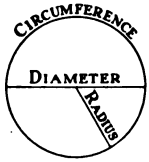



FIG. 4

## CIRCLES

A **circle** is a plane figure bounded by a curved line, every point of which is equally distant from a point within called the **center**.




The **circumference** of a circle is the curved line that bounds it.

The **diameter** of a circle is a straight line passing through the center and terminating at both ends in the circumference.

The **radius** of a circle is a straight line extending from the center to the circumference. It is one half of the diameter.

The ratio of the circumference to the diameter is about **3.1416**, or less exactly $3\frac{1}{7}$.

The symbol for this ratio is $\pi$. The symbol for the circumference is $C$; for the diameter, $d$; for the radius, $r$; and for the area, $A$.

**To find the circumference of a circle.**

*Multiply the diameter by 3.1416.*

FORMULA.— $C = \pi d$.

**To find the area of a circle.**

*Multiply the square of the radius by 3.1416.*

FORMULA.— $A = \pi r^2$.

Find the circumferences and the areas of circles having the following diameters:

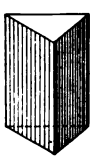
**50.** 10 ft. **52.** 50 ft. **54.** 44 ft. **56.** 100 ft. **58.** 10.4 in.
**51.** 12 in. **53.** 30 yd. **55.** 28 in. **57.** 200 yd. **59.** 30.6 ft.

## SOLIDS

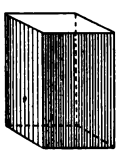
### PRISMS, CYLINDERS, PYRAMIDS, AND CONES

A **solid** is a figure having length, breadth, and thickness.

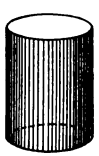
The **faces** of a solid are the surfaces that bound it.



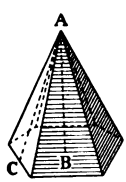
TRIANGULAR PRISM



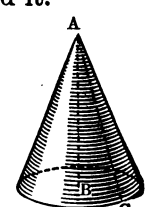
SQUARE PRISM



CYLINDER




PYRAMID




CONE

The **volume** of a solid is its contents in cubic units.

The **lateral surface** of a solid is the area of its faces, exclusive of its ends or bases.

A **prism** is a solid whose ends are equal and parallel polygons and whose sides are parallelograms.

NOTE. — Prisms take their names from the forms of their bases; as, *triangular*, *rectangular*, *square*, etc.

A **circular cylinder** is a solid bounded by a uniformly curved surface, and having for its ends equal and parallel circles.

NOTE. — In this book, "cylinder" means "circular cylinder."

The **altitude** of a prism or a cylinder is the perpendicular distance between its bases.

A **pyramid** is a solid whose base is a regular polygon and whose sides or faces are triangles meeting at a point called the **vertex**.

NOTE. — Pyramids, like prisms, take their names from the forms of their bases; as, *triangular*, *pentagonal*, etc.

A **cone** is a solid whose base is a circle and whose surface tapers uniformly to the vertex.

The **altitude** of a pyramid or a cone is the distance from the vertex to the center of the base. (*AB* in figures, p. 227.)

The **slant height of a pyramid** is the distance from the vertex to the middle of the base of one of its sides; the **slant height of a cone** is the distance from the vertex to any point in the circumference of the base. (*AC* in figures.)

**To find the lateral surface of a prism or of a cylinder.**

*Multiply the perimeter (or the circumference) of the base by the altitude.*

**To find the lateral surface of a pyramid or of a cone.**

*Multiply the perimeter (or the circumference) of the base by one half the slant height.*

**To find the volume of a prism or of a cylinder.**

*Multiply the area of the base by the altitude.*

**To find the volume of a pyramid or of a cone.**

*Multiply the area of the base by one third the altitude.*

Find the lateral surface of the following solids:

| | Perim. or Circum. of Base | Altitude | | Perim. or Circum. of Base | Slant Height |
|---|---|---|---|---|---|
| 60. | Prism, 10 ft. | 2 ft. | 62. | Pyramid, 25 ft. | 6 ft. |
| 61. | Cylinder, 21 ft. | 8 ft. | 63. | Cone, 15 ft. | 3 ft. |

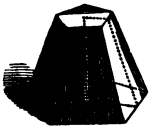
Find the volume of the following solids:

| | Area of Base | Altitude | | Area of Base | Altitude |
|---|---|---|---|---|---|
| 64. | Prism, 30 sq. ft. | 8 ft. | 66. | Cone, 50 sq. in. | 18 in. |
| 65. | Cyl., 100 sq. in. | 20 in. | 67. | Pyr., 40 sq. ft. | 15 ft. |

## Frustums

As shown in the figures, the frustum of a pyramid or of a cone is the part that remains when the top is cut away by a plane parallel to the plane of the base.

A frustum is regular when the slant height is the same for all the faces and the size and shape of the faces are the same.



Frustum of Pyramid

Frustum of Cone

**To find the lateral surface of a regular frustum of a pyramid or of a cone.**

*Multiply the sum of the perimeters (or the circumferences) of the bases by one half the slant height.*

Represent perimeter or circumference of bases by $b_1$ and $b_2$, slant height by *s.h.* and lateral surface by *L.S.*

Formula.— $L.S. = b_1 + b_2 \times \frac{s.h.}{2}$.

**68.** Find the lateral surface of the frustum of a cone, the diameter of whose bases are 6 feet and 4 feet and whose slant height is 10 feet.

SOLUTION. — $(4 + 6) \times 3.1416$ ft. $= 31.416$ ft., sum of circumferences of two bases.

$(31.416 \times 1\frac{0}{2})$ sq. ft. $= 157.08$ sq. ft., lateral surface.

**69.** Find the lateral surface of a frustum of a regular hexagonal pyramid, the sides of whose bases are 11 in. and 5 in. and whose slant height is 7 in.

SUGGESTION. — $(66 + 30) \times \frac{7}{2}$ sq. in. $= ?$

**70.** Find the lateral surface of a frustum of a regular cone, the radii of whose bases are 4 ft. and 2 ft. and whose slant height is 8 ft.

**71.** Find the lateral area of the frustum of a regular cone, the radii of whose bases are 4 in. and 8 in. and whose slant height is 18 in.

**72.** Find the lateral surface of a frustum of a regular pentagonal pyramid, each side of the lower base being 12 in., of the upper base 8 in., and the slant height, 20 in.

**To find the volume of a frustum of a regular pyramid or of a cone.**

*To the sum of the areas of both bases add the square root of the product of these areas and multiply the result by one third of the altitude.*

Represent area of bases by $B_1$ and $B_2$, altitude by $h$, and volume by $V$.

FORMULA. — $$V = (B_1 + B_2 + \sqrt{B_1 \times B_2}) \times \frac{h}{3}.$$

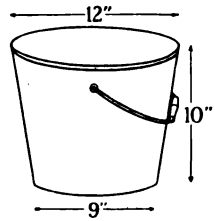
**73.** Find the volume of the frustum of a regular square pyramid, the areas of whose bases are 9 sq. ft. and 4 sq. ft. and whose altitude is 6 ft.

SOLUTION. — $(9 + 4 + \sqrt{9 \times 4}) \times \frac{6}{3} = (13 + 6) \times 2 = 38$, number of cubic feet in volume.

**74.** Find the volume of the frustum of a cone whose bases are 12 sq. in. and 9 sq. in. and whose altitude is 10 in.

**75.** How many gallons of water will a bucket hold whose upper diameter is 15 in., lower diameter 12 in., and depth 9 in.?

NOTE. — Carry decimals to three places.

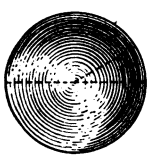



**76.** How many gallons of milk will the bucket in the accompanying figure hold?

**77.** Find the number of gallons of cream a churn will hold whose upper diameter is 8 in., whose lower diameter is 12 in., and whose altitude is 16 in.

## THE SPHERE

A **sphere** is a solid all points of whose surface are equidistant from a point within called the center.



The **surface** is its boundary of uniform curvature.

The **diameter** of a sphere is a straight line passing through the center of the sphere and terminating in the surface at two points.

The **radius** of a sphere is a straight line from the center to the surface.

A **great circle** of a sphere is a circle whose plane passes through the center of the sphere.

The **circumference** of a sphere is the circumference of one of its great circles. It is the greatest distance around it.

**To find the surface of a sphere.**

*Multiply the square of the diameter by 3.1416.*

FORMULA. — $A = \pi d^2$.

**To find the volume of a sphere.**

*Multiply the cube of the radius by $\frac{4}{3} \times 3.1416$.*

FORMULA.— $V = \frac{4}{3}\pi r^3$.

**78.** Find the surface of a sphere whose diameter is 12 in.

**79.** Find the volume of a sphere whose radius is 6 in.

**80.** Find the surface of a sphere whose radius is 10 in.

**81.** Find the volume of a sphere whose radius is 10 in.

**82.** Find the difference in volume of a sphere whose diameter is 8 in., and a cube whose dimension is 8 in.

**83.** Find the cost, at 15 ¢ a square foot, of gilding a sphere 10 in. in diameter.

**84.** Find the volume of a baseball 4 in. in diameter.

**85.** If the earth is regarded as a sphere about 7900 mi. in diameter, find its volume in cubic miles.

# MISCELLANEOUS APPLICATIONS

## SPECIFIC GRAVITY

The **specific gravity** of a substance is the ratio of its weight to the weight of an equal volume of water.

1. Explain why wood floats and why stone sinks in water.

2. Find the specific gravity of white pine.

SOLUTION. — A cubic foot of white pine weighs 34 lb. A cubic foot of water weighs $62\frac{1}{2}$ lb. The ratio of 34 to $62\frac{1}{2} = 34 : 62\frac{1}{2} = 34 \div 62\frac{1}{2} = .54$; therefore the specific gravity of white pine is .54.

3. Find the specific gravity of each of the substances mentioned in the following table :

TABLE OF SUBSTANCES WITH WEIGHT PER CUBIC FOOT

| SUBSTANCE | WEIGHT CU. FT. | SUBSTANCE | WEIGHT CU. FT. | SUBSTANCE | WEIGHT CU. FT. |
|---|---|---|---|---|---|
| Clay brick . . | 125 lb. | Gold . . | $1203\frac{5}{8}$ lb. | Sand . | $93\frac{3}{4}$ lb. |
| Plate glass . . | $172\frac{1}{2}$ lb. | Silver . . | $656\frac{1}{4}$ lb. | Granite | $173\frac{3}{4}$ lb. |
| Cast iron . . | 450 lb. | Petroleum . | 55 lb. | Cork . | 15 lb. |
| Copper . . . | $549\frac{1}{4}$ lb. | Butter . . | $58\frac{7}{8}$ lb. | Lead . | $709\frac{3}{8}$ lb. |

TABLE OF SPECIFIC GRAVITIES

| SUBSTANCE | SPEC. GRAV. | SUBSTANCE | SPEC. GRAV. | SUBSTANCE | SPEC. GRAV. |
|---|---|---|---|---|---|
| Mercury . . . | 14. | Honey . | 1.45 | Tar . . | 1.01 |
| Alcohol (pure) . | .80 | Zinc . . | 7.19 | Milk . | 1.03 |
| Oil of turpentine | .87 | Tin . . | 7.29 | Coal . . | 1.16 |
| | | | | Ice . . | .92 |

4. Find the weight of a cubic foot of each of the substances mentioned in the last table on p. 233.

5. A block of granite measures $5' \times 3' \times 2'$. What is its weight?

6. A block of coal measures $2' \times 2' \times 1'$. What is its weight?

7. A plate-glass window is $12' \times 6' \times \frac{3}{8}''$. What is its weight?

8. A bar of silver is 6′ long and $1\frac{3}{16}''$ in diameter. Find its weight.

9. A block of ice is $3' \times 2' \times 1\frac{1}{2}'$. What is its weight?

10. A rod of pure gold $1\frac{6}{16}''$ in diameter is 6′ long. What is its weight?

11. What is the weight of a copper bar having a volume of $\frac{3}{4}$ cu. ft.?

12. What is the weight of the petroleum filling a can whose inside diameter is 14″ and whose height is 18″?

13. What is the weight of a white pine plank 12 in. wide, 2 in. thick, and 16 ft. long?

14. What is the weight of the water filling a tank whose inside diameter is 8 ft. and whose height is 18 in.?

15. What is the weight of a bar of cast iron whose length is 12′, width 8″, and thickness 6″?

16. A block of wood displaces its own weight of water. What is its weight if it displaces 12 cu. ft. of water?

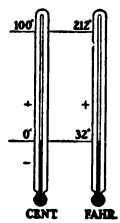
17. What is the weight of a bar of lead 1 in. square and 36 in. long?

18. How many cubic inches are there in a pound of butter?

19. How much will it cost to ship 60,000 common clay bricks at \$.30 per 100 lb., each brick being $8'' \times 4'' \times 2''$?

## TEMPERATURE

**Temperature** is generally measured by means of an instrument called a **thermometer**, which registers in degrees the expansion of a bulb of mercury, alcohol, etc. For such purposes there are two scales: (1) The **Fahrenheit thermometer**, used in our country in ordinary business, has for its starting point 0°, the temperature of a mixture of ice and salt. This has the ordinary freezing point at 32°, and the boiling point of water at sea level at 212°. (2) The **Centigrade thermometer** (*centum* = one hundred; *gradus* = degree) has a more scientific and logical arrangement. It establishes the freezing point at 0° and the boiling point at 100°.




NOTE. — Degrees above 0° on both systems are " + ", and those below are " − ".

**To change Fahrenheit to Centigrade.**

It will be observed in the figure that from freezing 0° C. to boiling 100° C. = 100°; and that from freezing 32° F. to boiling 212° F. = 180°.

$$180° \text{ F.} = 100° \text{ C.} \quad \therefore 1° \text{ F.} = \frac{100°}{180} = \frac{5°}{9} \text{ C.}$$

**1.** The temperature by Fahrenheit is registered 72°. What should it register by Centigrade?

SOLUTION. — 72° F. − 32° F. = 40° F. *above freezing.*

$$1° \text{ F.} = \frac{5°}{9} \text{ C.}$$

$$40° \text{ F.} = 40 \times \frac{5°}{9} \text{ C.} = 22.22° \text{ C.}$$

**2.** The thermometer registers 90° F. What will a Centigrade thermometer record?

3. $-15°$ F. corresponds to what temperature C.?

SOLUTION. — $-15°$ F. is $32° + 15°$, or $47°$ *below freezing.*

$$47 \times \frac{5°}{9} = 26.11° \text{ C. below freezing, or } -26.11° \text{ C.}$$

**To change Centigrade to Fahrenheit.**

4. $60°$ Centigrade corresponds to what temperature Fahrenheit?

SOLUTION. — $100°$ C. $= 180°$ F. $\therefore$ $1°$ C. $= \frac{180°}{100} = 1.8°$ F.

$60°$ C. $= (60 \times 1.8°$ F.$) + 32°$ F. $= 140°$ F.

Find corresponding temperatures:

| | | |
|---|---|---|
| 5. $+120°$ F. | 10. $-45°$ C. | 15. $-5°$ F. |
| 6. $-10°$ F. | 11. $+45°$ C. | 16. $+60°$ F. |
| 7. $+76°$ F. | 12. $+80°$ C. | 17. $+50°$ C. |
| 8. $+50°$ F. | 13. $+46°$ C. | 18. $+18°$ C. |
| 9. $-33°$ C. | 14. $+32°$ C. | 19. $+90°$ C. |

20. Express by Centigrade the melting point of lead, which is $630°$ F.

21. Express by Centigrade the melting point of silver, which is $+873°$ F.

22. Express by Centigrade the melting point of cast iron, which is $+2786°$ F.

23. Express by Fahrenheit the boiling point of alcohol, which is $+78°$ C.

24. Express by Fahrenheit the boiling point of ether, which is $+35°$ C.

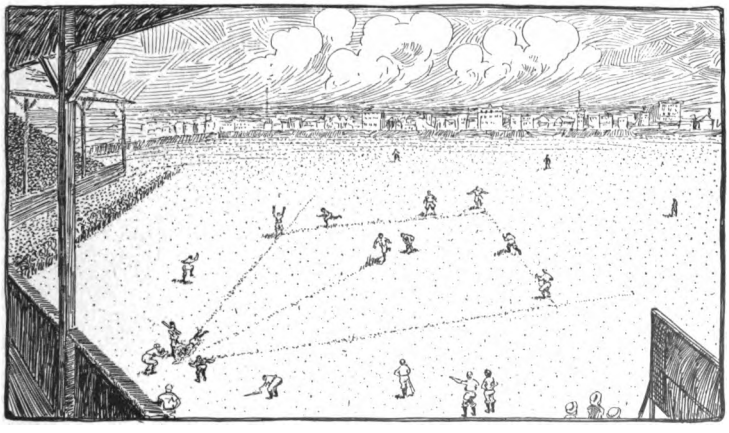
## BASEBALL PER CENTS

1. The New York Giants at the close of July stood as follows:

| | Played | Won | Lost | Per Cent |
|---|---|---|---|---|
| New York . . . . . | 86 | 51 | 35 | |

Find the club's per cent of games won.

Solution. — 51 games won out of 86 played = $\frac{51}{86}$ of 100 % = .593.



2. If a team plays 1 game and wins, what is its per cent of games won?

3. If a team plays 1 game and loses, what is its per cent of games lost?

4. If a team plays 2 games and wins 1 and loses 1, what is its per cent of games won?

5. If a team plays 4 games and loses 3 and wins 1, what is its per cent of games won?

6. On May 1 the American League team stood as follows. Find the per cent of games won by each team:

| Team | Played | Won | Lost | Per Cent |
|---|---|---|---|---|
| Detroit | 13 | 10 | 3 | |
| New York | 12 | 7 | 5 | |
| Boston | 12 | 7 | 5 | |
| Chicago | 11 | 6 | 5 | |
| Philadelphia | 10 | 5 | 5 | |
| St. Louis | 12 | 4 | 8 | |
| Cleveland | 12 | 4 | 8 | |
| Washington | 10 | 3 | 7 | |

**7.** On May 1 the National League teams stood as follows. Rule the table in your field book and enter the per cent of games won by each team.

| Team | Played | Won | Lost | Per Cent |
|---|---|---|---|---|
| Chicago | 13 | 8 | 5 | |
| Boston | 10 | 6 | 4 | |
| Philadelphia | 10 | 6 | 4 | |
| Cincinnati | 15 | 8 | 7 | |
| Pittsburgh | 12 | 6 | 6 | |
| New York | 10 | 4 | 6 | |
| Brooklyn | 10 | 4 | 6 | |
| St. Louis | 14 | 5 | 9 | |

**8.** At the close of the season the American League teams stood as follows. Rule the table in your field book and enter the per cent of games won by each team.

| Team | Played | Won | Lost | Per Cent |
|---|---|---|---|---|
| Detroit | 152 | 98 | 54 | |
| Philadelphia | 153 | 95 | 58 | |
| Boston | 151 | 88 | 63 | |
| Chicago | 152 | 78 | 74 | |
| New York | 151 | 74 | 77 | |
| Cleveland | 153 | 71 | 82 | |
| St. Louis | 150 | 61 | 89 | |
| Washington | 152 | 42 | 110 | |

9. Draw a plan in your field book and fill in batting averages in the per cent column of the following table:

SOLUTION TO FIRST. — 48 hits = $\frac{48}{122}$ of 100 % = .393.

BATTING AVERAGES OF SOME WESTERN LEAGUE PLAYERS

| PLAYERS | GAMES | AT BAT | HITS | PER CENT |
|---|---|---|---|---|
| Watson, St. Joseph . . . | 33 | 122 | 48 | |
| Middleton, Wichita . . . | 150 | 573 | 212 | |
| Elston, Denver . . . . . | 61 | 218 | 79 | |
| Pierce, Topeka . . . . . | 18 | 61 | 20 | |
| Clarke, Sioux City . . . | 145 | 526 | 187 | |
| Thompson, Omaha . . . | 160 | 608 | 202 | |
| McConnock, Lincoln . . . | 134 | 583 | 185 | |
| Hunter, Des Moines . . . | 161 | 639 | 198 | |

10. Make a plan in your field book and fill in per cents won of "Big Chief" Bender's Philadelphia record.

COMPLETE RECORD OF "CHIEF" BENDER'S PHILADELPHIA AMERICAN LEAGUE CAREER

| YEAR | GAMES | WON | LOST | PER CENT |
|---|---|---|---|---|
| 1903 . . . . . | 32 | 17 | 15 | |
| 1904 . . . . . | 21 | 10 | 11 | |
| 1905 . . . . . | 29 | 18 | 11 | |
| 1906 . . . . . | 25 | 15 | 10 | |
| 1907 . . . . . | 24 | 16 | 8 | |
| 1908 . . . . . | 17 | 8 | 9 | |
| 1909 . . . . . | 26 | 18 | 8 | |
| 1910 . . . . . | 28 | 23 | 5 | |
| 1911 . . . . . | 22 | 17 | 5 | |
| 1912 . . . . . | 21 | 13 | 8 | |
| 1913 . . . . . | 28 | 19 | 9 | |
| Total . . . . . | | | | |

# TESTS FOR ACCURACY AND SPEED

The teacher, knowing the proficiency of the pupils, should establish an average time in which they are to solve each group of examples and should deduct a reasonable per cent for each minute overtime required by the pupil. These problems are for drill purposes to assist in making the fundamentals automatic, and, if skillfully used, will result in increased efficiency.

**Group I**

**1.** Add vertically, then add horizontally; add both sets of results. If the results are the same, the solution is correct.

| | | | | | |
|---|---|---|---|---|---|
| 16 | 34 | 45 | 34 | 43 | 45 = ? |
| 67 | 87 | 98 | 71 | 22 | 33 = ? |
| 34 | 54 | 23 | 43 | 54 | 35 = ? |
| 81 | 17 | 16 | 22 | 54 | 34 = ? |
| 43 | 34 | 23 | 44 | 55 | 98 = ? |
| 37 | 26 | 84 | 74 | 36 | 54 = ? |
| | | | | | = ? |

**2.** Add: 2637
4678
4785
3674
3674
4789
5678
4683
2864
1040

**3.** Divide 6.006 by .0042.

**4.** If a watch ticks in seconds, how many times will it tick in one day?

**5.** Multiply .2386 by .0024.

**6.** $16\frac{3}{4} \times 11\frac{1}{4} \div 22 =$ what number expressed decimally?

**7.** From 98,763 take 12,367.
From 86,704 take 23,674.
From 632.9 take .87696.
From 123.0006 take .00345.
From .346723 take .00034.

8. How many acres are there in a field $96\frac{1}{4}$ rd. long and $54\frac{3}{4}$ rd. wide?

9. List and add the following deposits: currency, \$50.40; gold, \$5; silver, \$7.35; checks, \$23, \$4.50, \$7.25, \$16.80, \$12.50, \$20.50.

10. Change 256 pints to bushels.

**Group II**

1. Find the cost of paving a court 30 ft. long and 24 ft. wide with cement at 14¢ per square foot.

2. Add:

| |
|---|
| \$2680.45 |
| 4763.56 |
| 9483.56 |
| 4367.25 |
| 3046.06 |
| 4376.54 |
| 3476.00 |
| 5847.40 |
| 4587.30 |
| 1236.55 |

3. Find the cost of 26,420 lb. of coal at \$7.50 per ton.

4. Find the cost of 36,000 lb. of alfalfa at \$12.85 per ton.

5. Divide 7120 by .0356.

6. A boat moves 17 ft. 6 in. at one stroke. How many miles will it move in 10,500 strokes?

7. Find the proceeds of the following farm produce:

| | |
|---|---|
| 212 bu. of apples | at \$1.35 per bushel. |
| 120 bu. of plums | at \$1.40 per bushel. |
| 132 bu. of peaches | at \$1.25 per bushel. |
| 100 bu. of cherries | at \$1.85 per bushel. |
| 218 bu. of pears | at \$1.60 per bushel. |

8. Simplify the expression:

$$\frac{\frac{2}{9}}{\frac{1}{2} \text{ of } \frac{1}{4}} \div \frac{\frac{3}{4} \text{ of } \frac{1}{2}}{5\frac{1}{4}}.$$

9. Find the prime factors of 1008.

10. In a mixture of 64 gal. of alcohol and 16 gal. of water, what is the per cent of water? What is the per cent of alcohol?

**Group III**

1. A stock company paid $76,215,014 dividends in 1914, and $68,776,540 in 1915. Find the per cent of decrease in dividends.

2. As reported by the director of the mint and the United States Geological Survey, the production of gold in the United States for twenty years was:

| | | | |
|---|---|---|---|
| 1894 | $182,509,283 | 1904 | $349,088,293 |
| 1895 | 198,995,741 | 1905 | 378,411,054 |
| 1896 | 211,242,081 | 1906 | 405,551,022 |
| 1897 | 237,833,984 | 1907 | 411,294,458 |
| 1898 | 287,372,833 | 1908 | 443,434,527 |
| 1899 | 311,505,947 | 1909 | 459,927,482 |
| 1900 | 258,829,703 | 1910 | 454,213,649 |
| 1901 | 260,877,429 | 1911 | 459,377,300 |
| 1902 | 298,812,493 | 1912 | 474,333,268 |
| 1903 | 329,475,401 | 1913 | 463,312,673 |

Find the total production for 20 years, the average production per year, and the per cent of increase between 1894 and 1913.

3. An emery wheel is 10 in. in diameter. How many revolutions per minute are necessary in order that the speed may be 5000 ft. per minute?

4. How many square feet of felt are necessary to cover the outside of a cylinder whose diameter is 33 in. and whose length is 50 in.?

SUGGESTION. — Multiply 50 in. by the circumference.

5. As reported by the director of the mint, the production of gold in the United States for 1912 and 1913 was as follows:

| | 1912 | 1913 |
|---|---|---|
| Alabama | $ 16,400 | $ 8,062 |
| Alaska | 17,196,600 | 14,783,512 |
| Arizona | 3,785,400 | 3,803,039 |
| California | 20,008,000 | 20,105,447 |
| Colorado | 18,741,200 | 18,420,031 |
| Georgia | 10,900 | 9,880 |
| Idaho | 1,401,700 | 1,366,605 |
| Maryland | 1,200 | |
| Montana | 3,707,900 | 3,078,202 |
| Nevada | 13,575,700 | 12,279,131 |
| New Mexico | 754,600 | 844,086 |
| North Carolina | 156,000 | 111,442 |
| Oregon | 759,700 | 1,370,987 |
| South Carolina | 15,400 | 1,985 |
| South Dakota | 7,823,700 | 7,197,498 |
| Tennessee | 11,500 | 7,711 |
| Texas | 2,200 | 120 |
| Utah | 4,312,600 | 3,400,103 |
| Virginia | 300 | 3,514 |
| Washington | 682,600 | 692,021 |
| Wyoming | 24,300 | 30,491 |
| Porto Rico | | 1,116 |
| Philippines | 461,600 | 787,039 |

Find the total production for each year and the per cent of decrease for 1913.

6. The first flight across the United States was made by C. P. Rogers in a Wright biplane. He left Sheepshead Bay, N.Y., September 7, 1911 and landed at Pasadena, California, November 5, 1911, a distance of 4231 miles. He was in the

air 4924 minutes. Compute the number of hours he was in the air and his speed per hour.

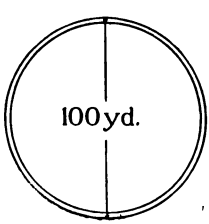
7. The receipt of live stock on the South Omaha market for the third week in January was as follows. Find the total number of cattle; of hogs; of sheep; of all animals.

| | Cattle | Hogs | Sheep |
|---|---|---|---|
| Official, Monday . . . | 6,310 | 5,695 | 16,411 |
| Official, Tuesday . . . | 5,922 | 10,219 | 8,174 |
| Official, Wednesday . . | 3,292 | 13,123 | 14,088 |
| Official, Thursday . . | 3,443 | 14,420 | 10,668 |
| Official, Friday . . . | 1,354 | 7,150 | 2,548 |
| Estimate, Saturday . . | 100 | 6,806 | 316 |

8. The piston of a steam engine is 18 in. in diameter, the mean effective pressure is 150 lb. to the square inch. Compute the total pressure of the piston in tons.

9. Water is flowing at the rate of 300 ft. per minute through a 16-inch pipe, into a rectangular reservoir 600 ft. long, 100 ft. wide, and 10 ft. deep. Compute the time required to fill it.

10. One day wheat No. 2 red was quoted at 5*s*. a bushel on the Liverpool market. Find its value in United States money. On the same day the same quality of wheat was quoted on the Chicago market at 93¢ a bushel. Find the difference in price. (1*s*. = $.2433.)




**Group IV**

1. A circular plot of ground 100 yd. in diameter is bordered by a walk 6 ft. wide. Compute the cost of laying the walk at 88¢ per square yard.

NOTE. — The area of the walk is the difference between the area of the outer and the inner circle.

2. A team plowing with a 14-inch plow travels 7 mi. in plowing 1 A. How far will it travel in one day if it plows $3\frac{3}{4}$ A.?

3. From the United States Statistical Abstract we find that the United States produced in one year cotton as follows. Find the total number of bales.

| | | | |
|---|---|---|---|
| North Carolina | 1,165,000 | Louisiana | 400,000 |
| South Carolina | 1,725,000 | Texas | 4,268,000 |
| Georgia | 2,820,000 | Arkansas | 945,000 |
| Florida | 95,000 | Tennessee | 455,000 |
| Alabama | 1,730,000 | All others | 1,215,000 |
| Mississippi | 1,225,000 | | |

4. If a team travels $5\frac{1}{8}$ mi. in plowing 1 A. with an 18-inch plow, how many miles will it travel in plowing 80 A.?

5. A Winchester bushel contains 2150.42 cu. in. How many cubic inches are there in a quart dry measure?

6. A gallon contains 231 cu. in. Find the number of cubic inches in a quart liquid measure.

7. Find the ratio of a quart liquid measure to a quart dry measure.

8. Compute the cost of lining an open rectangular tank with sheet lead, at $72\frac{1}{8}$ ¢ per square yard, if the length of the tank is 3 ft. 9 in., the width 2 ft. 10 in., and the depth 1 ft. 5 in.

9. Reduce to decimal fractions: $\frac{4}{1250}$, $26\frac{4}{125}$.

10. Find the least common multiple of 14, 15, 21, 30, 35, 45, and 63.

**Group V**

1. Compute the interest on the following note:

> *$650* *Springfield, Illinois, June 12, 1916*
>
> *Sixty days after date, for value received, I promise to pay to the order of the First National Bank*
>
> *Six hundred fifty and $\frac{no}{100}$ Dollars*
>
> *Payable at the First National Bank, Springfield, Illinois, with interest at the rate of 6 per cent per annum from date.*
>
> *Post Office, Aurora, Ill.* *John Mill*

2. A stockman shipped 4 cars of cattle to the Chicago market, the cars averaging 26,000 lb.; he paid freight at the rate of $.3667 per hundred; the shipment brought $8.60 per hundred. After paying 1% commission and yardage, what were the proceeds of the shipment?

3. From the Statistical Abstract of the United States Department of Labor, the cotton consumption of the world for one year was as follows. Find the total consumption.

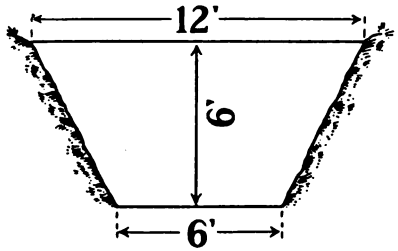
| | Bales |
|---|---|
| Great Britain | 4,160,000 |
| All other European countries | 5,720,000 |
| India | 1,600,000 |
| United States | 5,211,000 |
| All other countries | 1,788,000 |

4. At 35¢ per square yard, how much will it cost to plaster the walls and ceiling of a room 16 ft. long, 14 ft. wide, and 9 ft. high above the baseboard, deducting 76 sq. ft. for openings?

5. How many barrels of flour will a carload of wheat net, the wheat weighing 36,000 lb. and one bushel of wheat producing 42 lb. of flour? (196 lb. = 1 bbl. flour.)

6. If at Great Falls, Montana, the latest frost occurred May 15, and the earliest in the fall, September 15, what is the length of the season between frosts?

7. A contractor agrees to dig a ditch $3\frac{3}{4}$ mi. long, 12 ft. wide at the top, 6 ft. wide at the bottom, and 6 ft. deep. Find the cost of the ditch at $11\frac{1}{4}¢$ per cubic yard.




8. If the latest frost in the spring at New Orleans is February 15, and the earliest in the fall, November 15, what is the length of the season between frosts?

9. If the latest frost in the spring at Salt Lake City is April 15, and the earliest in the fall, September 15, what is the length of the season between frosts?

10. If pork costs $24 a barrel, what is the price per pound and at what price per pound must it be sold to allow 40% for transportation and profit? (200 lb. = 1 bbl. pork.)

**Group VI**

1. If cottonseed meal contains 37.2 lb. of protein to 100 lb., and 44.35 lb. of carbohydrates and fat, what is its nutritive ratio?

2. If 100 lb. of Kentucky blue-grass hay contains 4.8 lb. of protein, how much protein is there in 20 lb. of the blue-grass hay?

3. If skimmed milk contains 3.1 lb. of protein to 100 lb. and 5.5 lb. of carbohydrates and fat, what is its nutritive ratio?

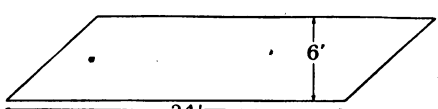
4. The quotations from the Liverpool market show wheat No. 2 red, western winter, 7*s*. 6*d*. a bushel. Find the price in United States equivalents. (1*s*. = $.2433; 1*d*. = $.02027.)

5. From the Statistical Abstract of the United States the following table is taken. Find the totals.

| | Children in U. S., Ages 5–18 | Number Enrolled in Schools | Average Daily Attendance |
|---|---|---|---|
| North Atlantic | 5,724,949 | 4,149,381 | 3,267,435 |
| South Atlantic | 3,635,763 | 2,550,107 | 1,695,438 |
| South Central | 5,506,456 | 3,745,902 | 2,419,190 |
| North Central | 7,849,643 | 5,902,639 | 4,447,917 |
| Western | 1,523,009 | 1,158,146 | 854,857 |

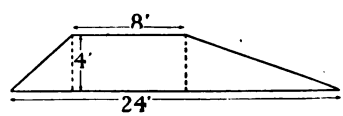
6. From problem 5 find the per cent of pupils enrolled in school.

7. From problem 5 find the per cent of attendance to pupils enrolled.




8. Find the area of this rhomboid, using the dimensions indicated in the figure.

9. Find the area of this trapezoid, using the dimensions indicated in the figure.




10. How many barrels of flour can be made from the yield of 20 acres of wheat at $22\frac{1}{2}$ bu. per acre, one bushel yielding 42 lb. of flour? (196 lb. = 1 bbl. flour.)

### Group VII

1. Find the interest of \$110 for 1 yr. at $3\frac{1}{2}\%$; the amount.

2. Multiply 12,345,679 by 9; by $9 \times 5$; by $9 \times 9$.

3. Find the amount of the following:

| | |
|---|---|
| 25 lb. sugar @ 7¢ | 60 lb. raisins @ $10\frac{1}{2}$¢ |
| 38 lb. tea @ 47¢ | 42 lb. currants @ 11¢ |
| 48 lb. coffee @ 48¢ | 12 lb. butter @ 35¢ |

4. A prediction of industrial accidents was made one year by an insurance company, based upon previous experience. Find the total number employed, the total number of fatal accidents, and the total per cent of accidents.

| | Employed | Fatal Accidents |
|---|---|---|
| Agricultural pursuits | 12,000,000 | 4,200 |
| Building | 1,500,000 | 1,875 |
| Coal mining | 750,000 | 2,625 |
| Draymen, teamsters, etc. | 686,000 | 686 |
| Electric light and power | 68,000 | 153 |
| Fisheries | 150,000 | 450 |
| Lumber industry | 531,000 | 797 |
| Manufacturing, general | 77,277,000 | 1,819 |
| Metal mining | 170,000 | 680 |
| Navigation | 150,000 | 450 |
| U. S. navy | 62,000 | 115 |
| Quarrying | 150,000 | 255 |
| Railroad employees | 1,750,000 | 4,200 |
| U. S. army | 73,000 | 109 |
| Street railway | 320,000 | 320 |
| Telephone, telegraph | 240,000 | 123 |
| Watchmen, policemen, foremen | 200,000 | 150 |
| All occupied females | 7,200,000 | 540 |
| All other occupations, males | 4,478,000 | 3,508 |

5. From the above figures, which occupation seems to present the greatest danger?

6. A garden 160 ft. long and 124 ft. wide is surrounded by a tight board fence 6 ft. high and 1 in. thick. Estimate the lumber cost at $35 per M.

7. An implement dealer received a commission of $16\frac{2}{3}\%$ for the sale of mowing and reaping machines. During the season he sold 9 mowing machines and 6 reaping machines; the mowing machines brought $65 and the reaping machines $140. His expenses amounted to $36. Find his profit.

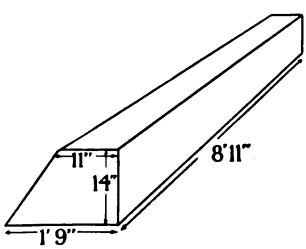
8. Find the weight on the foundation of a brick wall 14 in. wide, 36 ft. long, and 32 ft. high if 1 cu. ft. of wall weighs 125 lb.

9. Find the weight of 1 cu. yd. of sand. (1 cu. ft. sand weighs 98 lb.)

10. A speculator bought a piece of land for $1500 and sold it for $1749.40; he paid a commission of $2\%$ in each transaction. Find the per cent of his gain.

### Group VIII

1. At $1.40 per 100 lb., find the amount received from 40 A. of land yielding $23\frac{1}{2}$ bu. of wheat per acre.




2. Find the weight of a block of Italian marble whose dimensions are described in the figure. (1 cu. ft. of marble weighs 165 lb.)

3. Find the weight of a yellow pine sill 14 in. by 10 in. by 18 ft. (1 cu. ft. yellow pine weighs 34 lb.)

4. How many tons (2000 lb.) of coal will a bin hold that is 12 ft. long, 8 ft. high, and 8 ft. wide? (1 cu. ft. weighs 49 lb.)

5. How many tons of ice can be harvested from one quarter acre 14 in. thick? (1 cu. ft. of ice weighs 57½ lb.)

6. There were 506,453 teachers in the United States in one year; they were paid $401,397,747. What was the average salary received by each teacher?

7. In one year wheat No. 2 red sold for $.844 on the New York market. Ten years later the same grade was quoted at $.963. Find the per cent of increase during that time.

8. In one year corn No. 2 mixed sold on the New York market for $.453. The same quality was quoted ten years later at $.711. Find the per cent of increase during that time.

9. The capacity of a shoe factory is 2800 pairs a week of 6 days. How long will be required to fill an order for 16,500 pairs?

10. Add the following vertically, then horizontally; check by adding results:

| | | | |
|---|---|---|---|
| $3,546.10 | $1,876.20 | $2,103.40 | $—— |
| 1,024.05 | 3,465.50 | 8,123.60 | —— |
| 3,120.50 | 1,231.12 | 4,036.80 | —— |
| 5,430.80 | 2,314.20 | 9,210.40 | —— |
| 8,785.05 | 4,120.50 | 4,302.10 | —— |
| | | | $—— |

**Group IX**

1. Find the weight of a block of Vermont marble the cross section of which measures 9 in. by 14 in., if the length of the block is 7 ft.

2. Find the annual cost of a 20-payment life policy for $5000 written at the age of 23. (Premium $29.40 per annum per $1000.)

3. Reduce:

5 bu. 3 pk. 3 qt. to quarts.
1 rd. 5 yd. 2 ft. to feet.
7 da. 11 hr. 14 min. to minutes.

4. The valuation of a certain district is $38,500 and the levy is 17 mills. How much will it produce for school purposes?

5. Find the tax on the following:

| | |
|---|---|
| $13,500 at .0175 | $22,400 at .0115 |
| $5300 at .00875 | $34,000 at .0009 |

6. Find the amount of $2500 for 20 yr. at 4% compound interest.

SUGGESTION. — The amount of $1 for 20 yr. at 4% is $2.19.

7. Find the cost of 200 shares of Chicago and Northwestern Railway stock at 137⅞, with brokerage ⅛.

SUGGESTION. — The cost of 1 share = $137⅞ + $⅛, or $138.

8. If a cubic yard of concrete costs $ 5.216, what will be the cost of constructing a dam 100 ft. long, 10 ft. high, 12 ft. wide at the bottom, and 4 ft. wide at the top?

9. One year the value of all farm property in the United States, exclusive of Alaska and Hawaii, was $ 20,439,901,164. Ten years later the farm property had increased to $ 40,991,449,090. Find the per cent of increase.

10. One year the value of all farm property in the United States, exclusive of Alaska and Hawaii was $ 40,991,449,090, of which the land was valued at $28,475,674,169. What amount was invested in buildings, live stock, implements, and machinery?

### Group X

**1.** A man deposited during the month of March the following: March 2, currency, $100; gold, $20; silver, $7.15; checks to the amount of $36.45; March 15, currency, $52.25; March 25, currency, $40; silver, $11.50; checks to the amount of $3260. He checked against the account as follows: to the grocer, $24.35; rental, $38; fuel, $16; electric light, $5.80; gas, $3.40; and check for cash, $25. Balance the bank account at the close of the month and determine the amount on hand April 1.

**2.** Steel weighs 490 lb. to the cubic foot. Determine the weight of a steel beam made up of two sections each $\frac{5}{8}$ in. thick, 10 in. wide, and 14 ft. long and two sections each $\frac{5}{8}$ in. thick, 8 in. wide, and 14 ft. long.

**3.** The total weight of a $5 gold piece is 129 gr. It is 90 % gold. Find the amount of gold it contains.

**4.** A United States dime contains 38.58 gr. It is 90 % silver. Find the amount of silver it contains.

**5.** A United States silver dollar contains 412.5 gr. of silver and alloy combined. Its fineness is fixed at $\frac{9}{10}$ silver and $\frac{1}{10}$ alloy. Find the amount of silver contained in a silver dollar.

**6.** A gold eagle contains 258 gr. of gold, which is 90 % of its total weight. Find the amount of alloy it contains.

**7.** A United States nickel, or 5-cent piece, contains a total weight of 77.16 gr., 25 % of which is nickel. Find the amount of nickel it contains.

**8.** My house is valued at $10,000 and the furniture at $2800; I insure the whole at $\frac{3}{4}$ of the value at a rate of $\frac{3}{4}$ %. Find the premium.

9. Find the cost of excavating a cellar 16 ft. by 32 ft. and 6 ft. deep at 8¢ per cubic yard for the first two feet, 10¢ for the second two feet, 12 ¢ for the fifth foot, and 14 ¢ for the sixth foot.

10. A cubic foot of water weighs 62.5 lb.; a floating body displaces its own weight of water. How many cubic feet of water will be displaced by a ship and cargo weighing 600 T.?

**Group XI**

1. What is the rate of income from a 4% bond purchased at 80?

SUGGESTION.— The bond costs $800 and yields $40 a year.

2. If a baker's loaf weighs 9 oz. when wheat is worth 70¢ per bushel, how much should a loaf of the same price weigh when wheat is worth 90¢ per bushel?

3. If goods are marked to sell at 50% above cost, but are actually sold at 20% less than the marked price, at what per cent of the cost are they sold?

4. Find the cost of 20 shares of bank stock at 125. Find the rate of income it will yield on the investment if it pays 12% annual dividend.

SUGGESTION.— The cost of the stock is 20 × $125. The annual dividend is 12% of $2000.

5. Find the cost of 11,000 shares of Amalgamated Copper at $74\frac{1}{4}$, commission $\frac{1}{8}$.

6. Estimate the number of bricks it will require to construct a brick building 120 ft. long, 56 ft. wide, and three stories high; the first story being 14 ft. high with 22 in. walls, the second story 13 ft. high with 17 in. walls, and the third story 12 ft. high with 13 in. walls. Walls 13 in. thick extend 4 ft. above the third story. How much will it cost at $12 per 1000 in the wall?

Find the date of maturity and the amount of the following note :

7.

*$135.$\frac{75}{}$ Newton, Kansas, June 12, 1916.*

*Sixty days after date, for value received, I promise to pay to the order of First State Bank of Newton*

*One hundred thirty-five and $\frac{75}{100}$ Dollars.*

*Payable at First State Bank, Newton, Kansas, with interest at the rate of six per cent per annum from date.*

*P. O. Newton* *John Goodman.*

8. A merchant buys hats at $50 per dozen less 20 % and 15 %. He sells them at $5 each. What is his profit on each hat?

SUGGESTION. — 80 % of $50 = first remainder; 85 % of first remainder = net price of a dozen hats.

9. If a grocer buys apples at $4 per barrel, at what price must he sell them to gain 40 %?

10. A grocer sold sugar 16 lb. for $1; he paid $6 per 100 lb. less 20 %. What profit did he make per pound?

### Group XII

1. The estimated damage on a stock of goods which went through a fire was $16\frac{2}{3}$ %. The company carrying the insurance paid the owner $4500. What was the value of the stock if it was insured for full value?

2. Find the sum of $\frac{3}{4}$, $\frac{7}{8}$, $\frac{5}{6}$, and $\frac{11}{12}$.

3. Divide $\frac{3}{8}$ of $\frac{5}{6}$ by $\frac{1}{3}$ of $\frac{11}{16}$. Multiply the quotient by $\frac{11}{15}$.

4. Find the interest and the amount of the following note:

> $275.$^{00}$ Dallas, Texas, May 5, 1916.
>
> One year after date, for value received, I promise to pay to the order of Dallas State Bank of Dallas
>
> Two hundred seventy-five and $\frac{no}{100}$ Dollars.
>
> Payable at Dallas State Bank, Dallas, Texas, with interest at the rate of five per cent per annum from date.
>
> P. O. Dallas Joseph Mills.

5. A square platform contains 196 sq. ft. Find its dimensions.

6. A floor whose length is twice its width contains 800 sq. ft. Find its width and its length.

SUGGESTION. — Divide the floor into two squares of 400 sq. ft. each.

7. A rectangular field whose length equals four times its width contains 25,600 sq. rd. Find its dimensions.

8. A square pasture contains 900 sq. rd. Find its dimensions.

9. Find the square and the cube of .01, .02, .03, .04, .05, .06, .07, .08, .09, .10, .11, .12, .13, .14, .15, .16, .17, .18, .19, .20.

10. On a bill of goods two bids were received. One company bid $1260 with a discount of 30 %, 20 %, and 5 % off; the second bid for $1250 carried a discount of 25 %, 20 %, and 15 %. Which was the better bid?

### Group XIII

1. A merchant whose purchases amounted to $64,325 took advantage of an extra discount of 5 % by paying the first of the month. How much did he save?

2. What is the discount on a bill of one dozen Disston saws @ $22, 1 doz. plumber's hammers @ $19, 2 doz. lath hatchets @ $8.45; terms of discount 20 %, 15 %, and 10 %.

3. Find the date of maturity and the amount of the following note:

> $1500.00 Macon, Georgia, Jan. 15, 1916.
>
> Ninety days after date, for value received, I promise to pay to the order of Macon National Bank of Macon
>
> One thousand five hundred and $\frac{00}{100}$ Dollars.
>
> Payable at Macon National Bank, Macon, Georgia, with interest at the rate of six per cent per annum from date.
>
> P. O. Macon George Fowler.

4. Find the gross amount, the net amount, and the discount on a bill of 12 doz. chairs at $ 24 per dozen, 5 tables at $36 each, 2 roll-top desks at $ 72 each, and 80 yd. of carpet at $ 1.35 per yard. Discounts 20 % and 10 %.

5. In 1910 the population of the United States was 91,972,266; the land area was 2,973,890 sq. mi. What was the average population per square mile?

6. An auctioneer was paid 5 % of his sales, which amounted to $ 3850. What was his commission?

7. An agent sold 2200 lb. of poultry at 20¢ per pound and received 2% for his commission. What was the amount of his commission?

8. A collection agent collected 60% of a debt of $2500 and was paid 10% for collecting. What was his commission?

9. A commission merchant sold 1600 bu. of corn @ 62¢. His commission was 1½% and freight 21¢ per 100 lb. Find the net proceeds.

10. A farmer has 10 hogs weighing approximately 100 lb. each. If hogs are worth $7.80 per 100 lb., and 4 lb. of corn produce 1 lb. of fat, how much will the farmer's corn average him per bushel, if he feeds the hogs to an average weight of 320 lb. each?

**Group XIV**

1. Find the nutritive ratio of macaroni if it contains 13.4% protein, .9% fat, and 74.1% carbohydrates. (See page 208.)

2. Find the nutritive ratio of one portion of oatmeal which contains 16.1% protein, 7.2% fat, 67.5% carbohydrates, and ¼ portion of cream which contains 2.5% protein, 18.5% fat, and 4.5% carbohydrates.

3. How much is saved by buying flour in quantities of ten 50-pound sacks for $9.60 when single sacks sell for $1.15 each?

4. A family of 2 adults and 4 children have an income of $3000. They spend 20% for food, 18% for clothing, 15% for operating expenses, 5% for amusements, 5% for incidentals, 2% for health, 4% for books and magazines, and save the balance. Find the amount spent for each item and the amount saved.

5. A farmer in seeding used $1\frac{1}{4}$ bu. per acre, for which he paid \$1.10 per bushel. What was the cost of the seed? His grain averaged $21\frac{3}{4}$ bu. per acre, for which he received 87¢ per bushel. What were the gross receipts per acre? If the average cost per acre of raising the grain, including cost of seed, was \$9.72, find the net profit per acre.

6. Find the number of barrels and the weight of the water in a cistern 10 ft. deep and 7 ft. square at top and bottom. (231 cu. in. = 1 gal.; $31\frac{1}{2}$ gal. = 1 bbl.)

7. Find the discount and the net amount of a bill of lumber the gross amount of which is \$1200.75, discount $33\frac{1}{3}$ %, 25 %, and 5 %.

8. Find the net amount and the discount on a shipment of flour the gross amount of which is \$2340, discount 10 %, 5 %, and 2 %.

9. Find the solid contents of a cylinder whose base has a diameter of 2 in. and whose height is 8 in.

10. Find the capacity in gallons of a water pail whose diameter is uniformly 10 in. and whose height is 14 in.

### Group XV

1. How many gallons are there in a tank containing 71 qt. 1 pt. of water?

2. A 40-acre field in the form of a square is fenced with 4 strands of barbed wire. The posts are set 1 rd. apart and cost 30¢ each. The wire cost \$2.90 per 100 rd. The labor and other materials cost \$40. Find the cost of fencing the field.

3. A bankrupt paid 40 % on his debts. If his resources were \$12,000, what were his liabilities?

4. At \$5.50 a ton, how much would a farmer receive for a load of beets weighing 7820 lb. if the tare or dirt averaged 4.26 %?

5. The sugar beet crop in the North Platte Valley one season amounted to 382,763 T. If the average yield of beets was 12 T. per acre, how many acres did the farmers grow that season? At an average price of $5.66 per ton, how much did a sugar factory pay for this crop? How much did the farmers receive per acre for their crop?

6. One season the sugar factory at Scottsbluff, Nebraska, sliced 1900 T. of beets per day. It was in operation 134 days. How many tons of beets did it slice?

7. If a farmer obtains an average yield of beets amounting to 14.29 T. per acre, and the beets show an average sugar content of 16.3 %, how many pounds of sugar has the farmer grown per acre? If the sugar factory extracts 12.7 % sugar as a marketable product, how many pounds of marketable sugar per acre are produced on the above crop?

8. If a farmer receives $5.50 per ton for beets delivered direct from the field to the factory, what will be the value of his crop, averaging 15.17 T. per acre, on 80 A. of land?

9. I leased 60 A. of beet land, and agreed to pay as rent $\frac{1}{5}$ of the value of the beets produced and $\frac{1}{2}$ of the value of the tops produced. How much should I pay the owner per acre, if my crop of beets averaged 16.25 T. per acre, and were sold at $5.66 per ton, and the tops were worth 25¢ on each ton of beets produced?

10. A sugar factory turned out a total of 137,200 T. of beet pulp, and a feeder contracted to purchase 10 % of this total output. This he planned to feed to steers in a period of 140 days at the average rate of 98 lb. per head per day. How many steers would consume the pulp for which he has contracted?

# ONE HUNDRED PROFICIENCY QUESTIONS

1. Define arithmetic.

2. Name the fundamental operations.

3. What is meant by notation? by numeration?

4. Explain the principle governing the Arabic system of notation and numeration.

5. Explain the Roman system of notation.

6. Write the present year in Roman notation.

7. Distinguish between abstract and concrete numbers and give examples of each.

8. Explain why we begin at the units' column in addition.

9. Explain how the answer in subtraction may be verified.

10. Tell how to find the product when the multiplicand and the multiplier are given.

11. Write the multiplication table of 7's; of 8's; of 9's; of 12's.

12. When the product and one of two factors are given, how may the other factor be found?

13. Given the dividend and divisor, how can you find the quotient?

14. Given the quotient and the dividend, how can you find the divisor?

15. Given the quotient and the divisor, how can you find the dividend?

**16.** When you know the price of one article, how can you find the cost of a given number of these articles?

**17.** When you know the cost of a given number of articles, how can you find the price of one?

**18.** Given the cost and the gain, how can you find the selling price?

**19.** Given the selling price and the gain, how can you find the cost?

**20.** What is a denominate number? Give an example.

**21.** Write the table of linear measure and state for what it is used; the table of square measure.

**22.** Write the table of avoirdupois weight and state for what it is used; the tables of liquid and dry measures.

**23.** What measure is used in measuring ribbon? land? milk? beans? iron? corn? wheat? capacity of a silo?

**24.** What is the long ton and for what is it used?

**25.** What is the weight of a cubic foot of water?

**26.** State the weight of a barrel of flour.

**27.** State the weight of a barrel of beef.

**28.** What is the weight of a bushel of shelled corn? of corn in the ear? of wheat? of oats? of barley?

**29.** What is a fraction?

**30.** Distinguish between a common and a decimal fraction.

**31.** How do you add or subtract fractions with different denominators?

**32.** How do you reduce fractions to lowest terms?

**33.** How do you reduce an improper fraction to a whole or a mixed number?

**34.** How do you multiply a fraction by a fraction?

**35.** How do you divide a fraction by a fraction?

**36.** How can you find what part one number is of another?

**37.** How can a decimal be changed to a common fraction?

**38.** How can you change a common fraction to a decimal?

**39.** How many places to the right of the decimal are hundredths written? thousandths? ten-thousandths? millionths?

**40.** Give the rule for pointing off decimal places in multiplying decimals by decimals.

**41.** Give the rule for pointing off decimal places in dividing decimals by decimals.

**42.** If you know the cost of 100 articles, what is the shortest way of finding the price of one?

**43.** If you know the cost of 1000 articles, what is the shortest way of finding the price of one?

**44.** If you know the cost of a ton, what is the shortest way of finding the price of 1 pound?

**45.** What is ratio? Define the terms used. Form a problem illustrating ratio.

**46.** Define and illustrate proportion.

**47.** Name the standard time belts of the United States. In traveling across the continent from east to west, what change should you make in the time of your watch in passing from one time belt into another? in traveling from west to east?

**48.** Explain what is meant by the international date line.

**49.** Tell how you find any per cent of a number. Illustrate.

**50.** Tell how you find a number when a certain per cent of it is given. Illustrate.

**51.** Tell how you find what per cent one number is of another. Illustrate.

**52.** Knowing the cost and the selling price, how can you find the gain or the loss per cent?

**53.** Define and illustrate discount.

**54.** If you know the list price and a single rate of discount, how can you find the discount?

**55.** If you know the list price and a series of rates of discount, how can you find the net price?

**56.** Define insurance. Name different kinds of insurance.

**57.** If you know the amount of an insurance policy and the rate, how can you find the premium?

**58.** What is the purpose of taxation?

**59.** If you know the assessed valuation and the rate of taxation, how can you find the amount of tax?

**60.** What is interest and what elements enter into it?

**61.** If you know the principal, the rate, and the time, how can you find the interest? the amount?

**62.** Explain the difference between stocks and bonds.

**63.** What is a promissory note and when is a note negotiable?

**64.** Write a negotiable note payable to yourself and signed by John Doe.

**65.** What is compound interest? Illustrate the method of computing it.

**66.** What are duties and customs?

**67.** What is a power of a number? Illustrate.

**68.** What is a root of a number? Illustrate.

**69.** How many cubic inches are there in a bushel?

**70.** How many cubic inches are there in a gallon?

**71.** Define and draw a square; a rectangle.

**72.** Define and draw a circle; a radius; a diameter; a circumference.

**73.** Define and draw a triangle.

**74.** What is meant by the hypotenuse of a right triangle?

**75.** Define cube. Give illustration.

**76.** Define and illustrate prism; cylinder.

**77.** Define and illustrate pyramid; cone; frustum of a pyramid or of a cone.

**78.** If you know the length and the width of a floor, how can you find its area?

**79.** Given the length, the width, and the depth of a box, how can you find its cubical contents?

**80.** Knowing the area of a square, how can you find its side?

**81.** If you know the two sides of a right triangle, how can you find the hypotenuse?

**82.** If you know the hypotenuse and one side of a right triangle, how can you find the other side?

**83.** Given the base and the altitude of a triangle, how can you find its area?

**84.** If you know the two bases of a trapezoid and its altitude, how can you find its area?

**85.** If you know the base and the altitude of a rhomboid, how can you find its area?

**86.** Given the diameter of a circle, how can you find its circumference?

**87.** Given the radius of a circle, how can you find its area?

**88.** If you know the diameter of a sphere, how can you find its surface? its volume?

**89.** If you know the perimeter of the base and the altitude of a prism, how can you find its lateral surface?

**90.** If you know the circumference of the base and the altitude of a cylinder, how can you find its lateral surface?

**91.** If you know the perimeter of the base and the slant height of a pyramid, how can you find its lateral surface?

**92.** If you know the circumference of the base and the slant height of a cone, how can you find its lateral surface?

**93.** Knowing the area of the base and the altitude of a prism or of a cylinder, how can you find its volume?

**94.** If you know the area of the base and the altitude of a pyramid or of a cone, how can you find its volume?

**95.** Given the diameter of a sphere, how can you find its surface?

**96.** Given the radius of a sphere, how can you find its volume?

**97.** If you know the perimeters of the upper and lower bases of the frustum of a pyramid and its slant height, how can you find its lateral surface?

**98.** If you know the circumferences of the upper and lower bases of the frustum of a cone and its slant height, how can you find its lateral surface?

**99.** Given the areas of both bases of the frustum of a pyramid or of a cone and the altitude, how can you find its volume?

**100.** How can you change Fahrenheit temperature to Centigrade temperature? Centigrade to Fahrenheit?

# TABLES FOR REFERENCE

### Measures of Length

12 inches = 1 foot
3 feet = 1 yard
5½ yards = 1 rod
16½ feet = 1 rod
320 rods = 1 mile (statute)

A *nautical mile* (*knot*) = 6080.27 ft., or about 1.15 mi.

A *hand*, used in measuring the height of horses, = 4 in.; a *fathom*, used in measuring the depth of water, = 6 ft.; a *furlong* = ⅛ mi.

### Measures of Surface

144 square inches = 1 square foot
9 square feet = 1 square yard
30¼ square yards = 1 square rod
160 square rods = 1 acre
640 acres = 1 square mile
1 section = 1 mile square
1 acre = 43,560 square feet

An acre of land in the form of a square is nearly 209 ft. on a side.

A *square* of roofing or flooring equals 100 sq. ft.

### Measures of Volume

1728 cubic inches = 1 cubic foot
27 cubic feet = 1 cubic yard
128 cubic feet = 1 cord

A *cord of 4-foot wood* is a pile 8 ft. long and 4 ft. high, the sticks averaging 4 ft. in length.

### Liquid Measures

4 gills = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
31½ gallons = 1 barrel
63 gallons = 1 hogshead

1 gal. = 231 cu. in.; 1 cu. ft. = about 7½ gal. 1 gal. of water weighs about 8⅓ lb.; a cubic foot of water weighs about 62½ lb., or 1000 oz.

1 liquid quart contains 57.75 cu. in.

### Dry Measures

2 pints = 1 quart
8 quarts = 1 peck
4 pecks = 1 bushel

1 bu. (stricken) = 2150.42 cu. in., or about 1¼ cu. ft.

1 bu. (heaped) = 2747.71 cu. in., or nearly 1⅓ cu. ft.

The English imperial bushel = 2218.192 cu. in.

1 dry quart contains 67.2 cu. in.

### Counting Table

12 things = 1 dozen (doz.)
12 dozen = 1 gross (gro.)
12 gross = 1 great gross
20 things = 1 score

### Stationers' Table

24 sheets = 1 quire
20 quires = 1 ream

Paper is frequently sold by the pad or bulk of 100, 500, or 1000 sheets, or by the pound.

### Time Measures

60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day
7 days = 1 week
365 days = 1 year
366 days = 1 leap year
10 years = 1 decade
100 years = 1 century

Thirty days have September,
April, June, and November.
All the rest have thirty-one,
Save February, which alone
Has twenty-eight, and one day more
We add to it one year in four.

### Measures of Angles and Arcs

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)
360 degrees = 4 right angles or 1 circumference
90° of angle = 1 right angle; 90° of arc = 1 quadrant.

### United States Money

10 cents = 1 dime
10 dimes = 1 dollar
10 dollars = 1 eagle

### English Money

4 farthings = 1 penny
12 pence = 1 shilling
20 shillings = 1 pound
1 pound (£) = $4.8665

### German Money

1 mark (M.) = $.238

### French Money

1 franc (fr.) = $.193

### Avoirdupois Weight

16 ounces = 1 pound
7000 grains = 1 pound
100 pounds = 1 hundredweight
2000 pounds = 1 ton
2240 pounds = 1 long ton
20 cwt. = 1 ton
437½ grains = 1 ounce

1 ton of anthracite coal, loose, occupies 40 to 43 cubic feet; 1 ton of bituminous coal, 40 to 48 cubic feet.

### Troy Weight

24 grains = 1 pennyweight
20 pennyweights = 1 ounce
12 ounces = 1 pound
5760 grains = 1 pound
480 grains = 1 ounce

The term *carat* is used to denote the number of parts in 24 that are pure gold. Thus, gold that is 18 carats fine means 18 parts gold out of 24, or $\frac{18}{24}$ gold and $\frac{6}{24}$ alloy.

### Apothecaries' Weight

20 grains = 1 scruple (℈)
3 scruples = 1 dram (ʒ)
8 drams = 1 ounce (℥)
12 ounces = 1 pound (℔)

### Apothecaries' Liquid Measure

60 minims (♏) = 1 fluid dram (f ʒ)
8 fluid drams = 1 fluid ounce (f ℥)
16 fluid ounces = 1 pint (O.)
8 pints = 1 gallon (Cong.)

### Generally Accepted Weights of Produce

| | Weight of 1 Bu. | | Weight of 1 Bu. |
|---|---|---|---|
| Alfalfa seed | 60 lb. | Hungarian grass seed | 50 lb. |
| Apples, dried | 24 lb. | Lime, unslaked | 80 lb. |
| Barley | 48 lb. | Malt | 38 lb. |
| Beans, castor | 46 lb. | Millet seed | 50 lb. |
| Beans, white | 60 lb. | Oats | 32 lb. |
| Bluegrass seed | 14 lb. | Onions | 57 lb. |
| Bran | 20 lb. | Peaches, dried | 33 lb. |
| Buckwheat | 48 lb. | Peas | 60 lb. |
| Clover seed | 60 lb. | Peas, green (unshelled) | 56 lb. |
| Coal | 80 lb. | Potatoes, Irish | 60 lb. |
| Corn, in the ear | 70 lb. | Potatoes, sweet | 55 lb. |
| Corn, shelled | 56 lb. | Rye | 56 lb. |
| Corn meal | 48 lb. | Timothy seed | 45 lb. |
| Flaxseed | 56 lb. | Turnips | 55 lb. |
| Hair, for plastering | 8 lb. | Wheat | 60 lb. |
| Hemp seed | 44 lb. | | |

NOTE. — The weight per bushel for many commodities varies in different states. The pupil should ascertain the weight in his own state.

| | Weight of 1 Bbl. | | Weight of 1 Bbl. |
|---|---|---|---|
| Beef | 200 lb. | Pork | 200 lb. |
| Fish | 200 lb. | Salt | 280 lb. |
| Flour | 196 lb. | | |

| | Approximate Weight of 1 Cu. Ft. | | Approximate Weight of 1 Cu. Ft. |
|---|---|---|---|
| Ash | 53 lb. | Oak, whole dry | 54 lb. |
| Brick, clay | 102 lb. | Pine, white | 34 lb. |
| Brick and mortar | 103 lb. | Pine, yellow | 34 lb. |
| Coal, anthracite (broken) | 54 lb. | Poplar | 23 lb.–33 lb. |
| Coal, bituminous (broken) | 49 lb. | Sand, dry | 98 lb. |
| Earth, common (loose) | 94 lb. | Stone, common | 158 lb. |
| Ice, common | 57½ lb. | Walnut | 31 lb.–41 lb. |
| Marble, Italian | 169 lb. | Water, rain | 62½ lb. |
| Marble, Vermont | 165 lb. | Water, salt | 64 lb. |
| Mortar | 110 lb. | | |

# INDEX

# ANSWERS

## TO

# THOMAS'S RURAL ARITHMETIC

**Page 7.**—**1.** Vertically, 27, 20, 25, 17, 20; horizontally, 15, 25, 19, 29, 21; total, 109. **2.** Vertically, 27, 22, 22, 17, 22; horizontally, 19, 12, 24, 26, 29; total, 110. **3.** Vertically, 28, 19, 20, 26, 27; horizontally, 22, 24, 27, 22, 25; total, 120.

**Page 8.**—**4.** 411. **5.** 462. **6.** 411. **7.** 455. **8.** 3188. **9.** 4234. **10.** 4136. **11.** 4187. **12.** $20,000.78. **13.** $30,852.28. **14.** $23,009.37. **15.** $20,805.34. **16.** 802. **17.** 2239. **18.** 1493. **19.** 2785.

**Page 9.**—**20.** $968.85. **21.** $193.87. **22.** $528.95. **23.** $1588.90. **24** 89,776. **25.** 61,916. **26.** 8280. **27.** 1,306,162. **28.** $11.9691. **29.** $473.7222. **30.** $188.10. **31.** $2227.4802. **32.** 729. **33.** 2390, 70 rem. **34.** 213. **35.** 131. **36.** $4 84, 1 cent rem. **37.** $25.50, 14 cents rem. **38.** $16.43, 5 cents rem. **39.** $1.87, 2 cents rem. **40.** $2\frac{1}{8}$. **41.** $1\frac{1}{4}\frac{3}{2}$. **42.** $1\frac{1}{4}$. **43.** $1\frac{1}{14}$. **44.** $2\frac{3}{20}$. **45.** $61\frac{1}{8}$. **46.** $340\frac{7}{16}$. **47.** $203\frac{1}{8}$. **48.** $435\frac{1}{8}$. **49.** $237\frac{3}{5}$. **50.** $260\frac{1}{15}$. **51.** $58\frac{3}{10}$.

**Page 10.**—**52.** $\frac{2}{11}$. **53.** $\frac{1}{8}$. **54.** $\frac{1}{12}$. **55.** $\frac{5}{16}$. **56.** $\frac{1}{4}$. **57.** $\frac{8}{20}$. **58.** $1\frac{5}{8}$. **59.** $41\frac{3}{8}$. **60.** $41\frac{28}{40}$. **61.** $45\frac{17}{30}$. **62.** $75\frac{3}{4}$. **63.** $24\frac{23}{24}$. **64.** $49\frac{1}{72}$. **65.** $28\frac{107}{120}$. **66.** $53\frac{11}{20}$. **67.** $10\frac{3}{8}$. **68.** $26\frac{7}{10}$. **69.** $25\frac{5}{8}$. **70.** $23\frac{311}{18}$. **71.** $25\frac{11}{15}$. **72.** 5. **73.** 5. **74.** $3\frac{1}{18}$. **75.** 5. **76.** $8\frac{2}{3}$. **77.** $48\frac{3}{9}$. **78.** $12\frac{1}{4}$. **79.** 56. **80.** 90. **81.** 98. **82.** 42. **83.** $31\frac{1}{5}$. **84.** $\frac{7}{12}$. **85.** $\frac{48}{96}$. **86.** $\frac{85}{128}$. **87.** $\frac{77}{120}$. **88.** $36\frac{3}{4}$. **89.** $257\frac{1}{7}$. **90.** $245\frac{5}{8}$. **91.** 594. **92.** $907\frac{1}{2}$. **93.** $9022\frac{1}{2}$. **94.** $288\frac{9}{32}$. **95.** $737\frac{7}{12}$. **96.** 3822. **97.** $8125\frac{7}{12}$. **98.** $5870\frac{1}{2}$. **99.** $1037\frac{17}{25}$. **100.** $1505\frac{7}{10}$. **101.** $1517\frac{17}{40}$. **102.** $\frac{3}{5}$. **103.** $\frac{4}{5}$. **104.** $\frac{3}{7}$. **105.** $\frac{5}{24}$. **106.** $\frac{7}{32}$. **107.** $\frac{3}{16}$. **108.** $\frac{11}{48}$. **109.** $5\frac{17}{18}$. **110.** $7\frac{88}{84}$. **111.** $11\frac{78}{294}$. **112.** $1\frac{147}{50}$. **113.** $20\frac{88}{1350}$. **114.** $27\frac{25}{27}$. **115.** 20. **116.** 63. **117.** 77. **118.** 288. **119.** 33.

**Page 11.**—**120.** 190. **121.** $1\frac{5}{32}$. **122.** $\frac{15}{16}$. **123.** 1. **124.** $1\frac{7}{15}$. **125.** $1\frac{1}{20}$. **126.** $1\frac{11}{24}$. **127.** $1\frac{29}{171}$. **128.** $1\frac{64}{225}$. **129.** $1\frac{37}{72}$. **130.** $2\frac{2}{3}$. **131.** $1\frac{7}{8}$. **132.** $1\frac{53}{74}$. **133.** $1\frac{557}{1111}$. **134.** 7. **135.** .400, .650, .175. **136.** .400, .250, .006. **137.** .04500, .20300, .06708. **138.** .0050, .2500, .0024. **139.** .10010, .23000, .00001. **140.** 6.201000, 100.001000, .000201. **141.** .90000, .01000, .24600, .00087. **142.** 2.450000, .750100, .010101. **143.** .20200, .10001, .84678. **144.** 3.27000, 1.00100, 1.00001. **145.** $\frac{3}{4}$. **146.** $\frac{13}{20}$. **147.** $\frac{16}{25}$. **148.** $\frac{13}{25}$. **149.** $\frac{9}{10}$. **150.** $\frac{12}{25}$. **151.** $\frac{9}{25}$. **152.** $\frac{16}{125}$. **153.** $\frac{4}{25}$. **154.** $\frac{19}{20}$. **155.** $\frac{258}{1000}$. **156.** $\frac{3}{500}$. **157.** $\frac{9}{100}$. **158.** $\frac{1}{2500}$. **159.** $\frac{21}{2500}$. **160.** $\frac{1}{2000}$. **161.** $\frac{101}{100000}$. **162.** $\frac{1001}{2500}$. **163.** $\frac{1981}{5000}$. **164.** $\frac{9}{10000}$. **165.** $\frac{61}{2000}$. **166.** .25. **167.** .6. **168.** .75. **169.** $.33\frac{1}{3}$. **170.** .4. **171.** .375. **172.** .875. **173.** .16. **174.** .65. **175.** 1.14. **176.** $3.83\frac{1}{3}$. **177.** .85. **178.** .1875. **179.** .225. **180.** .12. **181.** .42. **182.** .48. **183.** .55. **184.** 12.75. **185.** 16.875. **186.** $26.53\frac{1}{3}$.

**Page 12** — **187.** 53.1416. **188.** 67.6207. **189.** 48.6953. **190.** 67.9393. **191.** 88.5117. **192.** 38.7982. **193.** .4158. **194.** 1.883. **195.** 5.125. **196.** 18.103. **197.** 40.7102. **198.** 9.8264. **199.** .62593. **200.** 5.823. **201.** 19.901. **202.** 6.075. **203.** .000125. **204.** 2.5025. **205.** 1.6016. **206.** .155975. **207.** 18.9088. **208.** 50.48043. **209.** 183.9795. **210.** .090282. **211.** .0001200612. **212.** .252004. **213.** 490. **214.** .00567. **215.** 8.64061. **216.** 321.489. **217.** .52171. **218.** .3648. **219.** 5.26968.

**Page 13.** — **220.** .25. **221.** 30.1. **222.** 16.9. **223.** 25,500. **224.** .00005. **225.** .0000561. **226.** 6000. **227.** .027. **228.** 2644. **229.** .0704. **230.** $37\frac{1}{17}$ mi. **231.** $41\frac{7}{18}$ mi. **232.** 38 mi. per hour. **233.** $40\frac{4}{33}$ mi.

**Page 14.** — **234.** $36\frac{1}{57}$ mi. **235.** $40\frac{208}{305}$ mi. **236.** $1909\frac{1}{4}$ ft. **237.** $\frac{3277}{7040}$ mi. **238.** 16 min. $34\frac{53}{99}$ sec. **239.** 8 min. $17\frac{43}{99}$ sec. **240.** $3818\frac{1}{2}$ ft. **242.** 5280 ft.; 1760 yd.

**Page 15.** — **243.** 4800 sq. ft. **244.** 14 A. 74 sq. rd. 1 sq. yd. $4\frac{1}{2}$ sq. ft. **245.** 3136 cu. in. **246.** 4 hr. $15\frac{8}{11}$ min. **247.** $4\frac{27}{128}$ cu. ft. **248.** $41.81. **249.** $7509.33. **250.** $63.53. **251.** $3555\frac{5}{8}$ cu. yd.

**Page 16.** — **252.** $2416\frac{3}{4}$ cu. ft. **253.** 17,280 cu. ft. **254.** 4320 pieces. **255.** 1077.194 gal. **256.** 1346.493 gal. **257.** 8976.623 gal. **258.** 4039.48 gal. **259.** 718.129 gal. **260.** 4114.285 gal. **261.** 673.246 gal. **262.** 4398.545 gal. **263.** 49.864 pt. **264.** 59.844 pt. **265.** 93.088 pt. **266.** 359.064 pt. **267.** 45.595 bbl. **268.** 83.354 bbl. **269.** 85.491 bbl. **270.** $14.24. **271.** $95.59.

**Page 17.** — **272.** $14.25. **273.** No. 1, $15.40; No. 2, $16.23; No. 3, $14.58; No. 4, $17.38; total, $63.59.

**Page 18.** — **274.** 278 qt. **275.** 1080 pt. **276.** 61 pt. **277.** 15 pt. **278.** 44 pt. **279.** 87 pt. **280.** 12,512 lb. **281.** 9554 min. **282.** 282 cu. ft. **283.** 533 in. **284.** 1100 mills. **285.** 1200 sheets. **286.** 780 sheets. **287.** 1824 units. **288.** 2572 oz. **289.** 13,200 lb. **290.** 1440 sq. in. **291.** $77\frac{5}{8}$ gal. **292.** 20 bu. **293.** $2\frac{181}{1000}$ hr. **294.** $72\frac{1}{2}$ bu. **295.** $173\frac{17}{100}$ T. **296.** $2\frac{807}{880}$ mi. **297.** $15\frac{3}{11}$ hr. **298.** $72\frac{1}{32}$ bu. **299.** $1\frac{1}{2}$ lb. **300.** 1 cwt.

**Page 19.** — **301.** 6 hr. **302.** 2640 ft. **303.** 11 oz. **304.** 10 doz. **305.** 48 pt. **306.** 7 pt. **307.** 864 min. **308.** 4 quires. **309.** 26 bu. 6 qt. **310.** 23 gal. 3 qt. **311.** 23 lb. 14 oz. **312.** 5 T. 13 cwt. 60 lb. **313.** 16 da. 3 hr. **314.** 3 reams 9 quires 18 sheets. **315.** 22 gro. 10 doz. 8 units. **316.** 22 A. 52 sq. rd. $1\frac{3}{4}$ sq. yd. **317.** 1 bu. 2 pk. 5 qt. **318.** £1 17*s.* 11*d.* **319.** 4 rd. 4 yd. 1 ft. 6 in.

**Page 20.** — **320.** 26 gal. 1 qt. **321.** 29 gal. 1 qt. **322.** 1 wk. 3 da. 19 hr. **323.** 3 cu. yd. 24 cu. ft. 1028 cu. in. **324.** 2 T. 18 cwt. 97 lb. **325.** 1 cwt. 94 lb. 14 oz. **326.** 2 oz. 14 pwt. 16 gr. **327.** 23 gal. 1 qt. **328.** 40 bu. 1 pk. 7 qt. **329.** 13 wk. 4 da. 15 hr. **330.** 55 gal. **331.** 109 bu. 2 qt. **332.** 49 cwt. 51 lb. 8 oz. **333.** 96 oz. 18 pwt. 18 gr. **334.** 10 mi. 83 rd. 3 yd. 1 ft. 6 in. **335.** 6 reams 2 quires 12 sheets.

**Page 21.** — **336.** 1 bu. 2 pk. $3\frac{1}{8}$ qt. **337.** 2 gal. 2 qt. $1\frac{1}{8}$ pt. **338.** 2 cwt. 35 lb. $6\frac{1}{8}$ oz. **339.** 2 lb. 10 oz. $314\frac{11}{14}$ gr. **340.** 2 wk. 1 da. $8\frac{2}{3}$ hr. **341.** 1 T. 8 cwt. $54\frac{4}{5}$ lb. **342.** 4 bu. 2 pk $3\frac{6}{11}$ qt. **343.** 1 gal. 3 qt. $1\frac{1}{4}$ pt. **344.** 15%. **345.** 30%. **346.** 48%. **347.** 90%. **348.** $56\frac{2}{3}$%. **349.** $33\frac{1}{3}$%. **350.** 12.5%. **351.** 2.5%. **352.** 1%. **353.** .25; 25%. **354.** .2; 20%. **355.** .6; 60%. **356.** .0625; 6.25%. **357.** .77$\frac{7}{9}$; 77$\frac{7}{9}$%. **358.** .66$\frac{2}{3}$; 66$\frac{2}{3}$%. **359.** .14$\frac{2}{7}$; 14$\frac{2}{7}$%. **360.** .83$\frac{1}{3}$; 83$\frac{1}{3}$%. **361.** .41$\frac{2}{3}$; 41$\frac{2}{3}$%. **362.** .12. **363.** .18. **364.** .06. **365.** .72. **366.** .125. **367.** 1.25. **368.** .05. **369.** .352. **370.** .66$\frac{2}{3}$. **371.** 49. **372.** 390. **373.** 211. **374.** 28.5. **375.** 390. **376.** 744.

**Page 22.** — **377.** 118. **378.** 125. **379.** 510. **380.** 72. **381.** 334. **382.** 167. **383.** 960. **384.** 134. **385.** 220. **386.** 113. **387.** 60. **388.** 16. **389.** 110. **390.** 165. **391.** $434. **392.** $7440. **393.** $966.31. **394.** $240. **395.** $.80. **396.** $4,999,202.61. **397.** $3,701,925.51.

**Page 23.** — **398.** $35,805,313.93. **399.** $2,479,839.36. **400.** $11,007,397.49. **401.** 50%. **402.** 30%. **403.** 75%. **404.** 50%. **405.** 16% **406.** 50%. **407.** 6%. **408.** 42$\frac{8}{9}$%. **409.** 11$\frac{1}{9}$%. **410.** 25%. **411.** 12$\frac{1}{2}$%. **412.** 12$\frac{1}{2}$%. **413.** 25%. **414.** 37$\frac{1}{2}$%. **415.** 62$\frac{1}{2}$%. **416.** 87$\frac{1}{2}$%. **417.** 6$\frac{1}{4}$%. **418.** 18$\frac{3}{4}$%. **419.** 31$\frac{1}{4}$%. **420.** 90%. **421.** 8$\frac{1}{3}$%. **422.** 54$\frac{1}{6}$%. **423.** 18$\frac{3}{4}$%. **424.** 87$\frac{1}{2}$%.

**Page 24.** — **425.** 26$\frac{2}{13}$%. **426.** 200. **427.** 500. **428.** 1800. **429.** 576. **430.** 340. **431.** 2200. **432.** 2700. **433.** 960. **434.** 4400. **435.** 300. **436.** 30,400. **437.** 36,000. **438.** 2700. **439.** 1500. **440.** $10.20. **441.** $7. **442.** $20. **443.** $20. **444.** $2. **445.** $43.20. **446.** $380. **447.** $640. **448.** $94.50. **449.** $600. **450.** 50%. **451.** 32%. **452.** 40%. **453.** 32.5%. **454.** 28.75%. **455.** 36%. **456.** 55%. **457.** 39.2%. **458.** 51.25%. **459.** 25%. **460.** 40%. **461.** 72%.

**Page 25.** — **462.** $.75; $6.75. **463.** $.80; $3.20. **464.** $.11; $.86. **465.** $.45; $2.70. **466.** $3.13; $15.63. **467.** $.12; $.72. **468.** $.05; $.20. **469.** $.06; $.24. **470.** $.05; $.41. **471.** $.07; $.28. **472.** $.16. **473.** $.20. **474.** $.12. **475.** $.48. **476.** $.32. **477.** $.04. **478.** $.80. **479.** $.60. **480.** $.40. **481.** Loss, 33$\frac{1}{3}$%. **482.** Loss, 33$\frac{1}{3}$%. **483.** Gain, 33$\frac{1}{3}$%. **484.** Loss, 20%. **485.** Gain, 40%. **486.** Gain, 33$\frac{1}{3}$%. **487.** Gain, 66$\frac{2}{3}$%. **488.** Gain, 50%. **489.** Gain, 44$\frac{4}{9}$%. **490.** Gain, 75%.

**Page 26.** — **491.** $3.29. **492.** $33.13. **493.** $80.22. **494.** $109.75. **495.** $3.40. **496.** $21.96. **497.** $6.53. **498.** $19.27. **499.** $26.54. **500.** $61.95. **501.** $47.20. **502.** $43.26. **503.** $5.68. **504.** $3.72. **505.** $8.56. **506.** $57.17. **507.** $36.08. **508.** $39.51. **509.** $14.44. **510.** $7.80. **511.** $9.40. **512.** $.32. **513.** $20.70.

**Page 27.** — **514.** $15.31. **515.** $1.31. **516.** $\frac{1}{2}$. **517.** $\frac{1}{4}$. **518.** 4. **519.** $\frac{1}{7}$. **520.** 7. **521.** $\frac{3}{5}$.

**Page 28.** — **522.** $\frac{2}{5}$. **523.** 2.2. **524.** 3. **525.** 25. **526.** $\frac{1}{2}$. **527.** $\frac{24}{25}$. **528.** $\frac{1}{4}$. **529.** $\frac{1}{2}$. **530.** 12. **531.** 144 : 119. **532.** 5 : 14. **533.** 18. **534.** 3. **535.** 10. **536.** 2. **537.** $\frac{1}{2}$. **538.** 4. **539.** $\frac{15}{16}$. **540.** 7. **541.** 16. **542.** 45. **543.** 360 lb. **544.** 200 horses. **545.** 40 hr. **546.** 53$\frac{1}{3}$ ft. **547.** 90 wk.

**Page 29.**—**1.** 426. **2.** 470. **3.** 530. **4.** 494. **5.** 472. **6.** 4147. **7.** 3728. **8.** 4582. **9.** 3815. **10.** 4265.

**Page 30.**—**11.** 45,954. **12.** 48,570. **13.** 52,064. **14.** 53,936. **15.** 47,734. **16.** $4021.59. **17.** $3871.48. **18.** $28,674.36. **19.** $13,674.07. **20.** $21,894.80.

**Page 31.**—**21.** 1571. **22.** 4260. **23.** 4515. **24.** 3887. **25.** 3276. **26.** 14,571. **27.** 36,906. **28.** 56,133. **29.** 14,108. **30.** 28,791. **31.** 18,859. **32.** 17,703. **33.** 10,950. **34.** 21,896. **35.** 18,678. **36.** $210.66. **37.** $4181.58. **38.** $288.93. **39.** $108.95. **40.** $8106.87. **41.** $933.59. **42.** $15,648.07. **43.** $200.72. **44.** $1444.22. **45.** $2626.60. **46.** $22,928.97.

**Page 32.**—**47.** 904,456. **48.** 2,852,304. **49.** 2,532,516. **50.** 5,335,182. **51.** 4,883,286. **52.** 1,262,294. **53.** 2,206,827. **54.** 2,435,862. **55.** 2,341,692. **56.** 5,284,440. **57.** 1,181,968. **58.** 1,539,930. **59.** 2,800,244. **60.** 4,850,923. **61.** 564,512. **62.** 5518. **63.** 68,013. **64.** 10,006,115. **65.** 916. **66.** 24.

**Page 33.**—**67.** $1\frac{4}{6}\frac{8}{3}$. **68.** $198\frac{2}{3}$. **69.** $2\frac{1}{4}$. **70.** $2\frac{1}{3}\frac{1}{1}$. **71.** $1\frac{13}{10}\frac{5}{5}$. **72.** .125. **73.** $\frac{21}{100}$. **74.** 154.6977. **75.** 574.374. **76.** 184.278404. **77.** 12. **78.** 182.027. **79.** 76. **80.** $1\frac{3}{7}$. **81.** $90\frac{5}{8}$. **82.** 184 pt. **83.** 31 pt. **84.** 1672 oz. **85.** 3240 lb. **86.** 437 hr.

**Page 35.**—**1.** $.43; $.24; $.81; $1.20. **2.** $.51; $.14; $.32. **3.** $.26. **4.** $.07.

**Page 36.**—**5.** $.84. **6.** $.14. **7.** $.53. **8.** $.38; $.71; $1.04; $1.37; $1.71. **9.** $.32. **10.** $1.53. **13.** $.15. **14.** $.31. **15.** $.12.

**Page 37.**—**16.** $.22. **17.** $.26. **18.** $.14. **19.** $.43. **20.** $.34. **21.** $.43. **22.** $.39. **23.** $.84. **24.** $1.16. **25.** $1.10. **26.** $.34. **27.** $.24. **28.** $.92. **29.** $.74.

**Page 41.**—**5.** $7000; 80 A. **6.** 120 A.; $8400. **8.** W. $\frac{1}{2}$ of S.E. $\frac{1}{4}$; $5400. **9.** S. $\frac{1}{2}$ of N.E. $\frac{1}{4}$; 260 T.
**1.** 16 rd.

**Page 42.**—**2.** 40 A. **3.** 160 A. **4.** 10 A.

**Page 43.**—**7.** 8 rd. **8.** 640 A., $19,200; 23,040 A., $691,200. **9.** $314.51. **10.** $8480; $278\frac{1}{1}\frac{8}{5}$%. **11.** 15.9 A. **12.** 80 rd.; 160 rd.; 80 A. **13.** Farm, 145 A.; rye, $26\frac{1}{4}$ A.; wheat, $43\frac{3}{4}$ A.; corn, $52\frac{1}{2}$ A.; alfalfa, $22\frac{1}{2}$ A. **14.** Farm, 230 A.; corn, $101\frac{1}{4}$ A.; alfalfa, $26\frac{7}{8}$ A.; orchard, $12\frac{1}{2}$ A.; oats, $39\frac{3}{4}$ A.; wheat, 50 A.

**Page 44.**—**1.** 58.1%. **2.** 111.6%. **3.** 145%. **4.** 54.5%. **5.** 70.5%. **6.** 131.5%. **7.** 157.2%. **8.** 115.3%. **9.** 73.8%. **10.** 98.9%. **11.** $585.60.

**Page 45.**—**1.** $304. **2.** $12,160. **3.** $5066.67. **4.** $17.31. **5.** $225. **6.** $8100.

**Page 46.**—**7.** $5625. **8.** $21,160. **9.** $13,225. **10.** $14.69.
**1.** $42.66. **2.** $73.50; $77.25. **3.** To bid $9.50 is $.37 better.

**Page 47.**—**5.** $2319.74. **6.** $247.56; $246.67.

**Page 48.** — **7.** $2811.25. **8.** $1317.63.

1. 2,707,516,800 bu.; $1,115,496,921.60. **2.** 13.974 bu. **3.** $616,750,656. **4.** $331,408,656. **5.** 2,666,845,600 bu.

**Page 49.** — **6.** 807,565,677.966 bu.; $52,171,000. **7.** 1.522 T.; $8.98. **8.** 20.8 %. **9.** $.62; 23.921 bu.; $14.78.

**Page 50.** — **10.** $.87; 12.541 bu.; $10.96. **11.** $.45; 24.423 bu.; $10.97. **12.** $.83; 15.57 bu.; $12.95. **13.** Barley, $.87, 21.009 bu., $18.24; buckwheat, $.73, 21.067 bu., $15.27. **14.** 1.1029 T.; $14.64; $16.15. **15.** $.80; 80.888 bu.; $64.55. **16.** $1.82; 7.025 bu.; $12.79. **17.** .386 bales; $68.57; $26.47. **18.** Potatoes, $64.55; cotton, $26.47; barley, $18.24; hay, $16.15; buckwheat, $15.27; corn, $14.78; rye, $12.95; flaxseed, $12.79; oats, $10.97; wheat, $10.96.

**Page 51.** — **1.** $13\frac{1}{2}$ da.; $68.91. **2.** $3\frac{9}{32}$ da.; $13.78. **3.** $4\frac{2}{3}$ da.; $45.50. **4.** $12\frac{1}{2}$ da.; $48.57. **5.** $93.60. **6.** $120.

**Page 52.** — **7.** $6.15. **8.** Gain, $337.05. **9.** 11.5 %. **10.** $135.24.

**Page 53.** — **11.** 95 da. **12.** $246.62. **13.** $336.92. **14.** $81.92. **15.** $31.29. **16.** $30 per month and board; $2.50 per month better. **17.** $30 per month and board; $2.14 per month better. **18.** $12.39.

**Page 54.** — **19.** $121.20. **20.** $145.40.

**Page 55.** — **1.** $639.48. **2.** 1522.571 bu. **3.** $5.38. **4.** $226.17. **5.** $2.64. **6.** $403.73. **7.** $11.19. **8.** $100.82. **9.** $65.10.

**Page 56.** — **10.** Gain, $153.75. **11.** Loss, $7.63. **12.** $263.75. **13.** $1.95. **14.** $4.86. **15.** $9.13. **16.** Corn, $2.55 per acre better. **17.** $.66.

**Page 57.** — **18.** $1.12. **19.** $62,750,143. **20.** $391.43. **21.** $684.45. **22.** $618.68. **23.** $61.60. **24.** Gain, $440. **25.** Gain, $2.98. **26.** $128.25. **27.** Corn, $5.72 per acre. **28.** Net gain, $156.25.

**Page 58.** — **1.** $1169.25. **2.** $10.97. **3.** $167.10.

**Page 59.** — **4.** 167.851 lb.; $66.28. **5.** $27.73. **6.** $26.25. **7.** $7.99. **8.** 32.738 da.; $21.28. **9.** $262.50. **10.** $496.55.

**Page 60.** — **1.** $1344. **2.** $11.72. **3.** $40.32. **4.** $39.38. **5.** $130.48. **6.** $44.52. **7.** $50.72.

**Page 61.** — **8.** $27.36. **9.** $23.02. **10.** 2 A. **11.** $2\frac{1}{4}$ A. **12.** $13\frac{1}{2}$ A. **13.** 10 da. **14.** $31\frac{1}{2}$ A.

**Page 62.** — **15.** $12\frac{1}{2}$ mi. **16.** 9 A. **17.** $.25. **18.** $1. **19.** $.15 per acre cheaper to hire. **20.** $1.24.

**Page 64.** — **12.** 8937 plants. **14.** 89.37 bu. **15.** 29.79 bu. **16.** $18.47. **17.** $1477.52. **20.** $7.24.

**Page 65.** — **21.** $16\frac{2}{3}$ %. **22.** 42 bu. **23.** $3.95.

**Page 66.** — **24.** $315.84. **25.** 50 %; $\frac{1}{2}$. **26.** $33\frac{1}{3}$ %; 28 bu.

**Page 69.** — **1.** .974 bu.; $.55. **2.** .375 bu.; $.30. **3.** .349 bu.; $1.75. **4.** .582 bu.; $.89. **5.** .66 bu.; $.67. **6.** $160,165,273.

**Page 70.** — **7.** 35 trees. **8.** 302 trees. **9.** 275 trees. **10.** $126.

**Page 71.** — **11.** 2380 qt.; $297.50. **12.** $714. **13.** $237.50. **14.** $292.

**Page 72.** — **15.** $24.75. **16.** $64.80. **17.** $19.13. **18.** $1485. **19.** $173.91; $1739.06. **20.** $278.44.

**Page 73.** — **21.** 89.8%. **22.** 86.06%. **23.** 98.7%. **24.** .2%. **25.** 7.4%. **26.** 3.7%. **27.** Sprayed tree, 2375 sound apples, 125 diseased apples; unsprayed tree, 300 sound apples, 2200 diseased apples. **28.** $3.40. **29.** $3.50. **30.** $6.90. **31.** 3.45¢; 10.35¢. **32.** $28. **33.** $132. **34.** $1.30; $390.

**Page 76.** — **1.** Accurate, 1234.274 bu.; approximate, 1228½ bu. **2.** 600 bu.; $432. **3.** 48 bu. **4.** 1728 bu. **5.** 32 bu. **6.** 965.099 bu. **7.** 1286.799 bu. **8.** 25,088 lb. **9.** 78 bu. **10.** $5.76.

**Page 77.** — **11.** 1209.6 bu. **12.** 1036.8 bu.; $622.08. **13.** 1200 bu. **14.** 1680 lb. **15.** 960 lb. **16.** 3584 lb. **17.** 810 bu. **18.** 589 bu. **19.** 2560 bu. **20.** $1075.20.

**Page 78.** — **21.** 614.4 bu. **22.** 768 bu. **23.** 705.6 bu. **24.** 960 bu. **25.** 714 bu. **26.** 872.1 bu. **27.** 684 bu. **28.** 478.4 bu. **29.** 57.6 bu. **30.** 537.6 bu. **31.** 648 bu. **32.** 608 bu. **33.** 648 bu. **34.** 1094.4 bu. **35.** 45.6 bu. **36.** 800 bu.

**1.** 360 gal. **2.** 11,451.06 gal. **3.** 13,571.64 gal. **4.** 2120.55 gal.; 19,471.25 lb.

**Page 79.** — **5.** 69,272.1 gal. **6.** 1440 gal. **7.** 341.25 gal. **8.** 628.2 gal. **9.** 2.617 gal. **10.** 8100 gal.

**Page 81.** — **1.** 4.32 T. **2.** 14.042 T. **3.** 9.332 T.

**Page 82.** — **4.** 12.817 T. **5.** $96.13. **6.** 1⅛ T. **7.** 8.389 loads. **8.** $92.98. **9.** $38.86. **10.** 327.98 bales. **12.** 5.187 A.

**Page 83.** — **13.** 13.49 T. **14.** 2.016 T. **15.** 29.229 T. **16.** 47.216 T. **17.** $126.47. **18.** $336.13.

**Page 84.** — **19.** 90 T. **20.** $900. **21.** 36 T.; $306. **22.** $.40. **23.** $165.25. **24.** $227.02. **25.** 47.284 A. **26.** 30.746 A.

**Page 85.** — **2.** 49.762 T. **3.** 3.6 T. **4.** 4.806 A. **5.** 16 cattle.

**Page 86.** — **6.** Dry matter, 8.36 lb.; protein, .36 lb.; carbohydrates, 4.52 lb.; fat, .28 lb. **7.** $17.59. **8.** $38.00. **9.** 2.4 A. **10.** $30.40; 5.428 A. **11.** 33.157 ft. **12.** 2.262 T. **13.** 58.189 T. more in square silo.

**Page 87.** — **2.** 3.576 lb. dry matter; .312 lb. protein; 2.668 lb. carbohydrates; .172 lb. fat. **3.** 5.34 lb. dry; .552 lb. prot.; 2.838 lb. c. h.; .252 lb. fat. **4.** 3.56 lb. dry; .368 lb. prot.; 1.892 lb. c. h.; .168 lb. fat. **5.** 5.286 lb. dry; .732 lb. prot.; 2.352 lb. c. h.; .162 lb. fat. **6.** 3.524 lb. dry; .488 lb. prot.; 1.568 lb. c. h.; .108 lb. fat. **7.** 3.588 lb. dry; .5 lb. prot.; 1.2 lb. c. h.; .692 lb. fat. **8.** 1.794 lb. dry; .25 lb. prot.; .6 lb. c. h.; .346 lb. fat.

**Page 88.** — **9.** 17.36 lb. dry. **10.** .56 lb. prot.; 8.68 lb. c. h.; .28 lb. fat. **11.** 16.488 lb. dry. **12.** 1.98 lb. prot.; 7.128 lb. c. h.; .216 lb. fat. **13.** 5.944 lb. prot.; 17.832 lb. c. h.; 4 lb. fat. **14.** 1.68 lb. prot.; 15.986 lb. c. h.; .848 lb. fat. **15.** 2.944 lb. prot.; 15.136 lb. c. h.; 1.344 lb. fat. **16.** 4.368 lb. prot.; 37.352 lb. c. h.; 2.408 lb. fat. **17.** Protein in corn (3.9 lb.) is .847 times that in oats (4.6 lb.); carbohydrates in corn (33.35 lb.) is 1.41 times that in oats (23.65 lb.); fat in corn (2.15 lb.) is 1.023 times that in oats (2.1 lb.). **18.** Protein in timothy hay (2.8 lb.) is .254 times that in alfalfa hay (11 lb.); carbohydrates in timothy hay (43.4 lb.) is 1.095 times that in alfalfa hay (39.6 lb.); fat in timothy hay (1.4 lb.) is 1.166 times that in alfalfa hay (1.2 lb.). **19.** Protein in bran (12.2 lb.) is .976 times that in cottonseed (12.5 lb.); carbohydrates in bran (39.2 lb.) is 1.306 times that in cottonseed (30 lb.); fat in bran (2.7 lb.) is .156 times that in cottonseed (17.3 lb.). **20.** Protein in oats (1.84 lb.) is .736 times that in cottonseed (2.5 lb.); carbohydrates in oats (9.46 lb.) is 1.576 times that in cottonseed (6 lb.); fat in oats (.84 lb.) is .242 times that in cottonseed (3.46 lb.). **21.** 4.02 lb. prot.; 19.28 lb. c. h.; 1.24 lb. fat.

**Page 89.** — **22.** 22.76 lb. dry matter; 1.184 lb. protein; 12.372 lb. carbohydrates; .592 lb. fat; ration lacks protein but is rich in dry matter and carbohydrates and fat.

**Page 90.** — **23.** 24.584 lb. dry matter; 2.756 lb. protein; 10.937 lb. carbohydrates; .846 lb. fat; ration has more than required amount of each of elements. **24.** 24.262 lb. dry matter; 1.232 lb. protein; 13.675 lb. carbohydrates; .652 lb. fat; ration is lacking in protein but is rich in other elements.

**Page 91.** — **25.** 24.188 lb. dry matter; 2.191 lb. protein; 12.594 lb. carbohydrates; .522 lb. fat; ration has more than the required amounts of dry matter, carbohydrates, and fat, but lacks protein.

**Page 92.** — **27.** \$.206. **28.** \$14.42. **29.** \$432.60. **30.** \$1730.40. **31.** 21 T. **32.** 75.6 T. **33.** 21 T. **34.** Oats, 1.46 T.; corn, .73 T.; bran, 1.095 T.; hay, 1.825 T. **35.** \$87.24; \$174.47. **36.** 22.106 lb. dry matter; 2.15 lb. protein; 11.797 lb. carbohydrates; .935 lb. fat.

**Page 93.** — **37.** Corn, 178$\frac{8}{9}$ lb.; cottonseed, 14$\frac{7}{12}$ lb.; alfalfa, 12$\frac{1}{9}$ lb. **38.** Corn, 175 lb.; cottonseed, 14$\frac{7}{12}$ lb.; alfalfa, 14 lb. **39.** \$5232.72. **40.** \$4296.60. **41.** \$36.34. **42.** \$35.81. **43.** 1.269 ¢. **44.** 1.647 ¢. **45.** \$.21. **46.** 20.14 lb. dry matter; 1.156 lb. protein; 10.294 lb. carbohydrates; .546 lb. fat; ration is lacking in each of the elements. **47.** \$.15.

**Page 94.** — **48.** Gain, \$18.11. **49.** (*a*) 2.036 lb. protein; 12.69 lb. carbohydrates; .899 lb. fat. (*b*) 2.084 lb. protein; 13.357 lb. carbohydrates; .726 lb. fat. (*c*) 1.606 lb. protein; 11.709 lb. carbohydrates; .826 lb. fat. (*d*) 2.336 lb. protein; 16.83 lb. carbohydrates; .828 lb. fat.

**Page 95.** — **2.** 1 : 3.5. **3.** 1 : 14.3. **4.** 1 : 16.6. **5.** 1 : 3 8. **6.** 1 : 9.7; wide. **7.** 1 : 15.1; wide. **8.** 1 : 11.7; wide. **9.** 1 : 5.3; narrow. **10.** 1 : 7.4; medium.

**Page 96.** — **11.** 1 : 5.3. **13.** 1 : 5.0. **14.** \$7.43. **15.** 2.25 T.

**Page 97.** — **16.** 9 cows. **17.** $355.32. **18.** $50.76. **19.** No. 1: Oct. 19.76 lb., Nov. 19.76 lb., Dec. 19 lb.; total 58.52 lb.; No. 2: Oct. 23.8 lb., Nov. 21.6 lb., Dec. 17.05 lb., total 62.45 lb.; No. 3: Oct. 25.6 lb., Nov. 25.2 lb., Dec. 25.2 lb., total 76 lb.; No. 4: Oct. 23.1 lb., Nov. 23.68 lb., Dec. 24.48 lb., total 71.26 lb.; No. 5: Oct. 22.4 lb., Nov. 23.46 lb., Dec. 23.1 lb., total 68.96 lb.; No. 6: Oct. 24.3 lb., Nov. 21.84 lb., Dec. 22 lb., total 68.14 lb.; No. 7: Oct. 23.52 lb., Nov. 23.65 lb., Dec. 23.65 lb., total 70.82 lb. **20.** $123.80.

**Page 98.** — **21.** In order: 1540 lb.; 1830 lb.; 1840 lb.; 2230 lb.; 2050 lb.; 1560 lb.; 1660 lb. **22.** In order: 1481.48 lb.; 1767.55 lb.; 1764 lb.; 2158.74 lb.; 1981.04 lb.; 1491.86 lb.; 1589.18 lb. **23.** In order: 3.8 %; 3.4 %; 4.1 %; 3.2 %; 3.3 %; 4.3 %; 4.2 %. **24.** In order: $6.87; $8.20; $8.18; $10.01; $9.19; $6.92; $7.37. **25.** In order: $74.30; $82.75; $93.52; $97.05; $91.92; $82.18; $86.14. **26.** 32.447 lb. **27.** $5.25.

**Page 99.** — **28.** $12.28. **30.** No. 2, in order: $7.378, $8.368, $15.746, $4.14, $11.61; No. 3, in order: $7.936, $7.835, $15.771, $4.14, $11.63; No. 4, in order: $7.161, $9.525, $16.686, $4.14, $12.55; No. 5, in order: $6.944, $8.641, $15.585, $4.14, $11.45; No. 6, in order: $7.533, $6.577, $14.11, $4.14, $9.97; No. 7, in order: $7.291, $6.842, $14.133, $4.14, $9.99; totals: $50.37, $54.17, $104.54, $28.98, $75.56.

**Page 100.** — **1.** 61.945. **2.** 39.093. **3.** 237,831,681. **4.** 94.8 %. **5.** $207,011,069.76.

**Page 101.** — **6.** $509,219,638.72; $1.04. **7.** $6,423,715. **8.** $7,333,062. **9.** 59.643; $29,886,576. **10.** 73.325; $27,529,989. **11.** 58.455; $25,920,801. **12.** 63.597; $25,560,987. **13.** 69.948; $21,957,177. **14.** 71.079; $21,234,660. **15.** 72.834; $20,111,454. **16.** 79.667; $18,629,007. **17.** 46.865; $17,412,243. **18.** 104.723; $16,295,523. **19.** 65.698; $13,874,874. **20.** 63.676; $12,962,439. **21.** 63.181; $12,339,642. **22.** 53.981; $10,601,202. **23.** 54.748; $9,542,397. **24.** 60.816; $7,665,138.

**Page 102.** — **26.** $.89. **27.** 119.937; $2.77. **28.** $1.88. **29.** $324\frac{4}{13}$ %. **30.** Gain, $37.98; gain, $.46. **31.** 70.426. **32.** $1.54. **33.** Gain, $77\frac{1}{8}$ %.

**Page 103.** — **34.** $226.52. **35.** $145.52. **36.** 117.8 %. **37.** $2.51.

**Page 104.** — **38.** $151.55. **39.** $480.41. **40.** 32.3 %. **41.** 82.4 %. **42.** 98.5 %. **43.** 49.6 %. **44.** In order: 131.2 %; 121.1 %; 109.9 %; 115.8 %; 111.5 %; 114.09 %; 134.1 %; 111.4 %; 116.5%; 110.3 %.

**Page 105.** — **45.** 168 eggs.

**Page 106.** — **1.** 130 da.; 113.6 lb. **2.** .873 lb. **3.** $4.65. **4.** 5.007 lb.; $.04. **5.** $.04. **6.** 568.1 lb.; $4.06. **7.** $18.60. **8.** $.63. **9.** 120.8 lb.; 483.2 lb.

**Page 107.** — **10.** 5.533 lb.; 22.132 lb. **11.** $20.80. **12.** .783 ¢ **13.** $10.12. **14.** Yes; $.84 per bushel. **15.** $1091.69; $563.77. **16.** Feed; $111.20.

**Page 108.** — **17.** Lot No. 1, 710 lb.; lot No. 2, 850 lb.; lot No. 3, 860 lb. **18.** Lot No. 1: 12.678 lb., $.39; lot No. 2: 15.178 lb., $.44; lot No. 3: 15.357 lb., $.47. **19.** In order: $42.60, $48.45, $46.44. **20.** Cost 100 lb. gain, in order: $4.35, $3.95, $4.38, $4.75, $4.39, $5.50; daily profit per pig, in order: $.02, $.03, $.02, $.01, $.02, $.004.

**Page 109.** — **1.** $10,779.

**Page 110.** — **2.** Gain, $280.65. **3.** $231.95. **4.** Profit, $405.43. **5.** Profit, $241.15.

**Page 111.** — **6.** Gain, $22.10. **7.** Gain, $315.80. **8.** Gain, $33.86.

**Page 112.** — **9.** Gain, $245.08. **10.** Gain, $17.80. **11.** Gain, $262.

**Page 113.** — **12.** Gain, $69.17. **13.** $56.22, man labor; $12.08, horse labor. **14.** Man labor, $3.12; horse labor, $4.81; total, $7.93.

**Page 114.** — **15.** $238.09. **16.** Gain, $1319.02.

**Page 115.** — **17.** $13.13. **18.** $14.03. **19.** $6.79. **20.** $25.34. **21.** $6.45. **22.** $14.05. **23.** $15.57. **24.** $4.43. **25.** $21,162.50.

**Page 117.** — **26.** $3946.13. **27.** $4750. **28.** $803.87. **29.** 3.7 %. **30.** $20,780.

**Page 118.** — **31.** 3.5 %. **32.** $10,560. **33.** 11.8 %. **34.** 23.4 %.

**Page 119.** — **35.** 10.2 %. **36.** $1861.95; 16.5 %.

**Page 120.** — **37.** $10,576.

**Page 121.** — **38.** $677. **39.** $2450. **40.** $1773.

**Page 122** — **1.** Nitrogen, 1851.3 lb.; phosphoric acid, 407.4 lb.; potash, 2150.4 lb. **2.** Nitrogen, 22.625 lb.; phosphoric acid, 13.062 lb.; potash, 23.975 lb.; lime, 5.525 lb.

**Page 123.** — **3.** Nitrogen, 26.25 lb.; phosphoric acid, 15 lb.; potash, 26.25 lb.; lime, 6 lb.

**Page 124.** — **5.** 225.806 lb. **6.** 142.857 lb. **7.** 70 lb. **8.** Nitrogen, 21 lb.; phosphoric acid, 10.5 lb.; potash, 19.95 lb.; lime, 4.725 lb. **9.** Nitrogen, 56.4 lb.; phos. acid, 28.5 lb.; potash, 48 lb.; lime, 11.1 lb.

**Page 125.** — **10.** 258.064 lb. **11.** 800 lb. **12.** 76 lb. **13.** Nitrogen, 29.08 lb.; phosphoric acid, 10.656 lb.; potash, 32.88 lb.; lime, 8.332 lb. **14.** 128.571 lb. **15.** 322.58 lb. **16.** 90 lb.

**Page 126.** — **17.** Nitrogen, 61.4 lb.; phosphoric acid, 20.858 lb.; potash, 72.181 lb.; lime, 17.033 lb. **18.** Nitrogen, 52 lb.; phosphoric acid, 20 lb.; potash, 12 lb. **19.** $111.87.

**1.** 7068 T. **2.** 1676.8 T.

**Page 127.** — **3.** 943.2 T. **4.** 1388.6 T. **5.** 2242.72 T. **6.** 17,640 T. **7.** 15,120 T. **8.** 4873.975 T. **9.** 47,120 T. **10.** 122,040.8 T. **11.** 37,570.8 T. **12.** 28.359 T. **13.** 47.643 T. **14.** 3630 T. **15.** 354,205.2 T.

**Page 129.** — **1.** 70,000 cu. ft. **2.** 23,000 cu. ft. **3.** 79,300 cu. ft. **4.** 37,700 cu. ft. **5.** 69,200 cu. ft. **6.** 92,000 cu. ft.

**Page 130.** — **8.** Coal, $.30. **9.** $4.80. **10.** $2.10. **11.** $1.53. **12.** $10.21.

**Page 131.** — **13.** $2.16; $.12. **14.** $32.28. **15.** $11.10. **16.** $20.10. **17.** $11.20.

**Page 133.** — **2.** 40 c. p. **3.** 102.04 c. p. **4.** 10.666 c. p. **6.** 16½ K. W. H. **7.** 54 K.W. H. **8.** $6.20. **9.** 62 K. W. H. **10.** $5.58. **11.** $2.76. **12.** $25.34. **13.** $96.12.

**Page 134.** — **14.** 330 watts. **15.** 28.8 K.W.H. **16.** $3.78. **17.** $4.46.

**Page 135.** — **1.** 8915 cu. ft. **2.** 264,738 cu. ft. **3.** 862 cu. ft. **4.** 73 cu. ft. **5.** 111,122 cu. ft. **6.** $24. **7.** $.48. **8.** $1.88. **9.** $9.65.

**Page 136.** — **10.** $3.62. **11.** $1.05.

**Page 137.** — (I.) **1.** Walk, 756.25 sq. ft.; blue grass, 4824.875 sq. ft. **2.** 20 A. 40 sq. rd. **3.** $19,712. **4.** 9.424 ft. **5.** 11,309.76 sq. ft.

**Page 138.** — (I.) **6.** 18.849 sq. in. **7.** 14,504 cu. in. **8.** 125.66 sq. in. **9.** 215.985 cu. in. **10.** 42,411.375 gal.

(II.) **1.** 1¼ cu. in. **2.** $850. **3.** 140⅞ bu. **4.** $2500. **5.** $9600. **6.** 8 %.

**Page 139.** — (II.) **7.** 20 A.; $1700. **8.** $3622.35. **9.** $21.20. **10.** $105.94.

(III.) **1.** $39.39. **2.** 22¾ mi. **3.** $71.44. **4.** 22.08 %. **5.** $7.02.

**Page 140.** — (III.) **6.** $4.95. **7.** 691.2 bu. **8.** 614.4 bu. **9.** 391⅞ gal. **10.** 9.801 T.; $102.91.

(IV.) **1.** 1 : 9.5. **2.** 1 : 9.4. **3.** Dry matter, 24.536 lb.; protein, 2.116 lb.; carbohydrates, 12.162 lb.; fat, .8 lb. **4.** 1 : 6.5. **5.** $3.42.

**Page 141.** — **6.** $69.98. **7.** $336.10. **8.** Dry matter, 50.064 lb.; protein, 4.368 lb.; carbohydrates, 37.352 lb.; fat, 2.408 lb. **9.** Dry matter, 91.6 lb.; protein, 11 lb.; carbohydrates, 39.6 lb.; fat, 1.2 lb. **10.** $12.02.

**Page 143.** — **1.** 9 P.M.; 9 P.M.; 7 P.M. **2.** 5 A.M.; 4 A.M.

**Page 145.** — **1.** Pittsburgh. **2.** 21 hr. 56 min. **3.** 907.5 mi. **4.** 41.376 mi. **5.** 21 hr. 6 min. **6.** Ft. Wayne to Englewood, 141 mi. **7.** 439.1 mi. **8.** Tuesday, 9.28 A.M. **9.** No. 22; 1 hr. 14 min. **10.** 39.116 mi. **11.** 21 hr. 2 min.; 20 hr. 48 min. **12.** Thursday, 8.57 A.M. **13.** 1815 mi.; $56.30.

**Page 146.** — **14.** 491 mi. **15.** 1782 mi. **16.** 1693 mi. **17.** 2184 mi. **18.** 2273 mi. **19.** North Platte. **20.** Ogden. **22.** 39.28 mi. **23.** 32.589 mi. **24.** 35.24 mi. **25.** $169,000. **26.** 630 T. **27.** 12.753 ft.; 9.736 ft.

**Page 149.** — **28.** $81.80. **29.** Friday, 9.30 A.M. **30.** Pittsburgh, North Platte, Ogden. **31.** Set back 1 hr. at Pittsburgh, at North Platte, and at Ogden. **32.** Set ahead 1 hr. at Ogden, at North Platte, and at Pittsburgh. **33.** 1 hr. earlier. **34.** Tuesday, 7.30 A.M.; Wednesday, 10.20 A.M.; Thursday, 9.30 A.M. **35.** Wells, 5625 ft. **36.** 4483 ft. **37.** $20.79; $32.76; $25.89. **38.** 758 mi.; $22.74.

**Page 150.** — **39.** $129.60. **40.** $27,200,000. **41.** $848,000. **42.** $2,449,340. **43.** $2,824,200.

**Page 151.** — **44.** $1,425,600. **45.** $1,069,600. **46.** $2,584,680. **47.** $2,935,200. **48.** 4.595 da. **49.** 10 da.

**Page 152.** — **50.** 10.138 da. **51.** 18.825 da. **52.** 211.787 gal. **53.** $35.50.

**Page 153.** — **4.** 8 bd. ft.

**Page 154.** — **6.** 8 bd. ft. **7.** 10⅔ bd. ft. **9.** 160 bd. ft. **10.** 288 bd. ft. **11.** 192 bd. ft. **12.** 280 bd. ft. **13.** 149⅓ bd. ft. **14.** 640 bd. ft. **15.** 3200 bd. ft. **16.** 3360 bd. ft. **17.** 5333⅓ bd. ft. **18.** 3266⅔ bd. ft. **19.** 1050 bd. ft. **20.** 640 bd. ft. **21.** 163⅓ bd. ft. **22.** 280 bd. ft. **23.** 320 bd. ft. **24.** 333⅓ bd. ft. **25.** 1200 bd. ft. **26.** 160 bd. ft. **27.** 1512 bd. ft. **28.** 1764 bd. ft. **29.** 8856 bd. ft. **30.** 586⅔ bd. ft. **31.** 1120 bd. ft. **32.** 1120 bd. ft.

**Page 155.** — **34.** 512 bd. ft. **35.** 384 bd. ft. **36.** 480 bd. ft. **37.** $17.95.

**Page 156.** — **38.** $15.12. **39.** $10.08. **40.** $13.25. **41.** $12.96. **42.** $28.08. **43.** $77.24.

**Page 157.** — **2.** 299 ft. **3.** $11.72. **4.** $6.23. **5.** $17.08. **6.** $12.43.

**Page 158.** — **7.** $39.70. **9.** $56. **10.** $92.88.

**Page 159.** — **12.** 1074 laths; nails, 6.711 lb. **13.** $11.03. **14.** $15.61. **16.** $33.44.

**Page 160.** — **17.** $51.22. **20.** 42 yd. **21.** $37.80. **22.** $25.90; crosswise. **23.** $51.60. **24.** Length, 14 ft.; width, 11 ft.

**Page 161.** — **25.** Length, 11 ft.; width, 9 ft.; 14⅔ yd.

**Page 162.** — **27.** 12 double rolls. **28.** 23 rolls. **29.** $9.60. **30.** 28 rolls. **31.** $3.94. **32.** $12.76.

**Page 163.** — **33.** $124.80. **34.** $62.40. **35.** 78,000 bricks. **36.** 9760 bricks. **37.** 14,340 bricks. **38.** $114.72; $181.44.

**Page 164.** — **39.** 19.932 perches. **40.** 25.858 perches. **41.** 118⅔ perches. **42.** 387.878 perches.

**Page 165.** — **43.** $88.08. **44.** $488.28. **46.** $6.51. **47.** $41.36. **48.** $10.72. **49.** 291 cu. yd.

**Page 166.** — **51.** $15.70; $6.30.

**Page 167.** — **52.** $86. **53.** $215.86.

**Page 168.** — **54.** $261. **55.** $894.96.

**Page 169.** — **56.** $74.79. **58.** $183.07. **59.** $85.52.

**Page 170.** — **60.** $24.20. **61.** $5.50. **62.** $37.20. **63.** $5.89.

**Page 171.** — **64.** $34.70. **65.** $419.33. **66.** $1.84.

**Page 172.** — **5.** $70.20. **6.** $134.40.

**Page 173.** — **10.** $686.91. **11.** $246.91. **12.** $1714.41. **13.** $679.41. **14.** State, $922.23; county, $1135.06; township, $472.94; school, $1714.41; total tax, $4244.64. **15.** $93.34. **16.** 27.4 mills. **17.** State, $2268.05; county, $2791.45; township, $1453.88; school, $8868.67.

**Page 174.** — **18.** $300,000. **19.** 41.4 mills. **20.** $59,438.38. **21.** $41.40. **22.** $82.80. **23.** $14. **24.** $54. **25.** $350. **26.** $307.40. **27.** $214.50. **28.** $32.90. **29.** $63. **30.** $374.40. **31.** $1900. **32.** $345.60. **33.** $2299.15.

**Page 175.** — **1.** $410.60.

**Page 176.** — **2.** $239.91. **3.** $167.90.

**Page 178.** — **1.** $116.90. **2.** $106.60. **5.** $46.40. **7.** $28.60. **9.** $45.35. **10.** Debits, $343.85; credits, $108.45; balance, $235.40.

**Page 179.** — **1.** Interest, $2000; amount, $102,000. **2.** Interest, $3.56; amount, $478.56. **3.** $1040.60. **4.** $10,175. **5.** $156.25.

**Page 182.** — **1.** $185.25. **2.** $52.20. **3.** $40. **4.** $175.50. **5.** $27.30. **6.** $9.60. **7.** $50.94. **8.** $87.50. **9.** $36. **10.** $58.50. **11.** $92.

**Page 183.** — **12.** $54. **13.** $88.30. **14.** $294.40. **15.** $286.50. **16.** $424. **17.** $10.80. **18.** $34.80. **19.** $40.60. **20.** $96.60. **21.** $21.45.

**Page 185.** — **1.** $11.80 per $1000. **2.** $13.50 per $1000. **3.** $15.40. **4.** $307.50. **5.** $196.50. **6.** $1005. **7.** $7640.

**Page 186.** — **8.** $95; $100; $219. **9.** $1120. **10.** $3165. **11.** $397.

**Page 187.** — **12.** $30.40; $608. **13.** $99.60; $1992. **14.** $176; $3520. **15.** $1015.71. **16.** $212.80; $5889.45. **17.** $287; $7943.01. **18.** $3830. **19.** $570; $15,775.32.

**Page 188.** — **20.** $63; $1743.59. **21.** $964; $1016; $1272. **22.** $500; $10,000. **23.** $3000.

**Page 190.** — **1.** $2435.52. **2.** $7055.55. **3.** $1687.87. **4.** $870.96.

**Page 191.** — **6.** 78.025¢. **7.** 50.98¢. **8.** $607.12. **9.** $652.80. **10.** $236.50. **11.** Loss, $30.73. **12.** $1152.22.

**Page 192.** — **13.** $772.20. **14.** $381.95. **15.** $.51; $600.73. **16.** $713.99.

**Page 193.** — **17.** $580.42; $.77. **18.** $566.30.

**Page 194.** — **19.** $.66. **20.** $1.09; $.06. **21.** $772.62; $.39. **22.** $1115.46; $.44.

**Page 195.** — **23.** $794.52; $.62. **24.** $1610.25; $1.05. **25.** $787.34; $.61.

**Page 196.** — **26.** $762.65; $.60. **27.** Proceeds, $113.28. **28.** Proceeds, $108.23.

**Page 197.** — **29.** Loss, $72.90. **30.** March. **31.** May 1, .794¢. **32.** Feb. 1; $91.90. **33.** Feb. 1; $55.09. **34.** $448.08; $.52.

**Page 199.** — **36.** $71.95. **37.** $523,600. **38.** $11,200. **39.** $1275.30. **40.** $81.95. **41.** $6440.

**Page 200.** — (I.) **1.** $401.10. **2.** $985.20. **3.** $47.50. **4.** $27. **5.** $41\frac{2}{3}$ %.

(II.) **1.** $33\frac{1}{3}$ %. **2.** $2.65.

**Page 201.** — (II.) **3.** 3 mo. 9 da. **4.** $82.46. **5.** Amount of sales, $762; charges, $109.53; net proceeds, $652.47.

(III.) **1.** $9.35; $458.15. **2.** $126. **3.** 15 mills. **4.** $8750.

**Page 202.** — (III.) **5.** $201.43.

(IV.) **1.** $8.84. **2.** $18.60. **3.** $10.03. **4.** $253.46. **5.** $24.13.

**Page 203.** — (V.) 1. $5.29. 2. $6.13. 3. $14.40. 4. $16.04. 5. $71.68.
(VI.) 1. Rug, 10′ × 11′ 6″. 2. $45. 3. 9600 shingles. 4. $57.50. 5. $131.25.

**Page 204.** — 1. 2.3¢. 2. 5.88¢. 3. .18¢. 4. 2½¢. 5. 1¾¢. 6. 4½¢. 7. 1¢.

**Page 205.** — 8. 11.27¢. 9. 5.72¢. 10. 12.28¢. 11. $4.91.

**Page 206.** — 12. $14\frac{4}{55}$¢. 13. $7.31. 14. $20\frac{11}{55}$¢. 15. 70¾¢. 16. $21.17½. 17. $63.

**Page 207.** — 19. .408 lb. 20. Protein, .0268 lb.; fat, .021 lb. 21. Protein, 1.115 lb; fat, 1.43 lb. 22. Protein, 1.3603 lb.; carbohydrates, 1.8816 lb.; fat, 1.9675 lb. 23. .462 lb. 24. .145 lb 25. Protein in Irish potatoes (1.32 lb.) is 1½ times that in sweet potatoes (.99 lb.); fat in Irish potatoes (.06 lb.) is .155 times that in sweet potatoes (.385 lb.); carbohydrates in Irish potatoes (11.04 lb.) is .732 times that in sweet potatoes (15.07 lb.) 26. Protein, 3.5 lb.; fat, 2.8 lb.; carbohydrates, 7.1 lb. 27. .0279 lb. 28. .0045 lb.

**Page 208.** — 29. 9.2 da. 30. 7.105 da. 31. Wheat bread, 1.589 lb.; Irish potatoes, 1.589 lb. 32. Bread and milk furnish .076 lb. more than is required. 33. Bread and milk furnish .041 lb. more than is required. 34. Bread and milk furnish .042 lb. more than is required. 35. Protein, .146 lb.; fat, .116 lb.; carbohydrates, .437 lb. 36. Protein, .13 lb.; fat, .406 lb.; carbohydrates, .427 lb.

**Page 209.** — 38. 1 : 38.3. 39. 1 : 13.8. 40. 1 : 6.3. 41. 1 : 3.3. 42. 1 : 11.2. 43. 1 : 1.8. 44. 1 : 20.9. 46. 1360 calories; 1520 calories.

**Page 210.** — 47. 3754 calories. 48. 3928 calories. 49. 3335 calories. 50. 2577 calories. 51. 1827 calories. 52. 1758 calories. 53. 202 calories. 54. 912 calories. 55. 9 handkerchiefs; 8⅓¢. 56. 4 centerpieces; 21¼¢.

**Page 211.** — 57. 6 yd.; $1.32. 58. $4; $.75. 59. $1.44. 60. $9; 7.6%. 61. $15. 62. $1.13. 63. 18 yd. 64. 20%; $11^{1}$%.

**Page 212.** — 65. Food, $360; rent, $120; operating expenses, $80; clothes, $80; human interest items, $160. 66. Food, $280; rent, $200; operating expenses, $100; clothes, $150; cultural items, $200; savings, $70. 67. Food, $500; rent, $400; operating expenses, $300; clothes, $400; higher life materials, $240; savings, $160. 68. Food, $190; rent, $209; operating expenses, $171; clothing, $142.50; church and charity, $95; books, $47.50; saving, $95. 69. Food, $600; rent, $480; operating expenses, $360; clothing, $360; charity and savings, $600. 70. Food, $396; taxes, etc., $180; clothing, $360; fuel, etc., $360; church, etc., $180; cultural materials, $144; savings, $180. 71. Food, $1000; rent, $750; clothes, $1000; miscellaneous expenses, $2250.

**Page 213.** — 1. (*a*) In order: $.81; $14.53; $3.51; $86; $3.61; $4.75; $1.30. (*b*) Provisions, $5.35; clothing, $3.75; operating expenses, $17.70; cultural items, $.37; church and charity, $1.25; health, $.00; amusements, $.95. (*c*) $29.37. (*d*) 18.2%. (*e*) 12.7%. (*f*) 60.2%. (*g*) 8.7%. 2. (*a*) In order: $101.33; $60.35;

$57.95. (*b*) Provisions, $58.35; clothing, $41.30; operating expenses, $84.70; cultural items, $4.18; church and charity, $21.40; health, $2; amusements, $7.70. (*c*) $219.63.

**Page 215.** — **1.** In order: $133; $127; $154; $146; $142. **2.** In order: 37.3%; 40.7%; 45.4%; 45.4%; 43.9%. **3.** South Atlantic Division. **4.** North Central and South Central Divisions. **5.** 13%. **6.** 42.5%. **7.** 26%.

**Page 216.** — **8.** 19.6%. **9.** $148.96. **10.** $160. **11.** $345.28. **12.** Balance to his credit, $10.75.

**Page 217.** — **13.** $12.50. **14.** 52.7%. **15.** $72\frac{8}{11}$%. **16.** 63.2%.

**Page 218.** — **17.** $121\frac{1}{2}$%. **18.** 30.4%. **19.** $22\frac{1}{11}$%. **20.** 64.1%. **21.** 100%. **22.** 28%. **23.** 40%. **24.** 21.5%. **25.** 73.9%. **26.** 33.7%. **27.** 39.1%. **28.** 100%.

**Page 219.** — **29.** 100%. **30.** 57%. **31.** $491.72. **32.** $468.86. **33.** $452.16. **34.** $54.24; $85.15.

**Page 220.** — **35.** $1399.17. **36.** $173.33. **37.** $327.36. **38.** In order: 30.9%; 35.5%; 18.3%; 7.2%; 22.3%; 18%; 18.8%; 23.8%; 13.5%. **39.** Lawyers; railroad officials.

**Page 222.** — **11.** 13 ft. **12.** 25 in. **13.** 4 ft. **14.** 12 ft. **17.** 19.277 ft.

**Page 223.** — **18.** 150 sq. in. **19.** 24 sq. ft. **20.** $67\frac{1}{2}$ sq. ft. **21.** $21\frac{3}{4}$ sq. ft. **22.** 72 sq. in. **23.** 72 sq. in.

**Page 224.** — **27.** 64 sq. in. **28.** 50 sq. ft. **29.** $2\frac{2}{3}$ sq. ft. **30.** $20\frac{5}{6}$ sq. in. **34.** 36 sq. ft. **35.** 70 sq. in. **36.** 34 sq. ft. **37.** $10\frac{2}{3}$ sq. ft.

**Page 225.** — **39.** 90 sq. in. **40.** 130 sq. in. **42.** 90 sq. ft. **43.** 72 sq. in. **44.** 189 sq. in. **45.** $12\frac{3}{8}$ sq. ft. **46.** 63 sq. yd.; $13.86. **47.** 8,976,000 cu. ft.

**Page 226.** — **48.** 5,772,800 cu. ft. **49.** 111.621 lb.

**Page 227.** — **50.** 31.416 ft.; 78.54 sq. ft. **51.** 37.699 in.; 113.097 sq. in. **52.** 157.08 ft.; 1963.5 sq. ft. **53.** 94.248 yd.; 706.86 sq. yd. **54.** 138.23 ft.; 1520.534 sq. ft. **55.** 87.964 in.; 615.753 sq. in. **56.** 314.16 ft.; 7854 sq. ft. **57.** 628.32 yd.; 31,416 sq. yd. **58.** 32.672 in.; 84.948 sq. in. **59.** 96.132 ft.; 735.417 sq. ft.

**Page 229.** — **60.** 20 sq. ft. **61.** 168 sq. ft. **62.** 75 sq. ft. **63.** $22\frac{1}{2}$ sq. ft. **64.** 240 cu. ft. **65.** 2000 cu. in. **66.** 300 cu. in. **67.** 200 cu. ft.

**Page 230.** — **69.** 336 sq. in. **70.** 150.796 sq. ft. **71.** 678.582 sq. in. **72.** 1000 sq. in.

**Page 231.** — **74.** 104.64 cu. in. **75.** 5.599 gal. **76.** 3.773 gal. **77.** 5.512 gal.

**Page 232.** — **78.** 452.39 sq. in. **79.** 904.608 cu. in. **80.** 1256.64 sq. in. **81.** 4188 cu. in. **82.** 243.968 cu. in. **83.** $.33. **84.** 33.504 cu. in. **85.** 258,105,916,500 cu. mi.

**Page 233.** — **3.** In order: 2; 2.76; 7.2; 8.788; 19.25; 10.5; .88; .942; 1.5; 2.78; .24; 11.35.

**Page 234.** — **4.** In order: 875 lb.; 50 lb.; 54.375 lb.; 90.625 lb.; 449.375 lb.; 455.625 lb.; 63.125 lb.; 64.375 lb.; 72.5 lb.; 57.5 lb. **5.** 5212.5 lb. **6.** 290 lb. **7.** 388⅛ lb. **8.** 29.925 lb. **9.** 517.5 lb. **10.** 74.384 lb. **11.** 411$\frac{13}{16}$ lb. **12.** 88.165 lb. **13.** 90⅞ lb. **14.** 4712.312 lb. **15.** 1800 lb. **16.** 750 lb. **17.** 14.755 lb. **18.** 29.35 cu. in. **19.** $833.33.

**Page 235.** — **2.** 32.22° C.

**Page 236.** — **5.** 48.88° C. **6.** — 23.33° C. **7.** 24.44° C. **8.** 10° C. **9.** — 27.4° F. **10.** —49° F. **11.** 113° F. **12.** 176° F. **13.** 114.8° F. **14.** 89.6° F. **15.** — 20.55° C. **16.** 15.55° C. **17.** 122° F. **18.** 64.4° F. **19.** 194° F. **20.** 332.22° C. **21.** 467.22° C. **22.** 1530° C. **23.** 172.4° F. **24.** 95° F.

**Page 237.** — **2.** 100 %. **3.** 100 %. **4.** 50 %. **5.** 25 %. **6.** In order: 76.9 %; 58.3 %; 58.3 %; 54.5 %; 50 %; 33.3 %; 33.3 %. 30 %.

**Page 238.** — In order: **7.** 61.5 %; 60 %; 60 %; 53.3 %; 50 %; 40 %; 40 %; 35.7 %. **8.** 64.4 %; 62 %; 58.2 %; 51.3 %; 49 %; 46.4 %; 40.6 %; 27.6 %.

**Page 239.** — In order: **9.** 36.9 %; 36.2 %; 32.7 %; 35.5 %; 33.2 %; 31.7 %; 30.9 %. **10.** 53.1 %; 47.6 %; 62 %; 60 %; 66.6 %; 47 %; 69.2 %; 82.1 %; 77.2 %; 61.9 %; 67.8 %; 273, games played; 174, games won; 63.7 % games won.

**Page 240.** — (I.) **1.** 278, 252, 289, 288, 264, 299; 217, 378, 243, 224, 297, 311; 1670. **2.** 38,502. **3.** 1430. **4.** 86,400 times. **5.** .00057264. **6.** 8.5653. **7.** 86,396; 63,030; 632.02304; 122.99715; .346383.

**Page 241.** — (1.) **8.** 32.935 A. **9.** $147.30. **10.** 4 bu.

(II.) **1.** $100.80. **2.** $43,864.67. **3.** $99.08. **4.** $231.30. **5.** 200,000. **6.** 34.801 mi. **7.** $1153. **8.** 24⅝.

**Page 242.** — (II.) **9.** 2, 2, 2, 2, 3, 3, 7. **10.** 20 %; 80 %.

(III.) **1.** 9.7 %. **2.** $6,876,398,621; $343,819,931.05; 153.8 %. **3.** 1909.854 revolutions per minute. **4.** 35.997 sq. ft.

**Page 243.** — (III.) **5.** For 1912, $93,449,500; for 1913, $88,302,022; 5.5 %. **6.** 82$\frac{1}{5}$ hr.; 51.555 mi.

**Page 244.** — (III.) **7.** Cattle, 20,421; hogs, 57,413; sheep, 52,205; total, 130,039. **8.** 19.085 T. **9.** 23.877 hr. **10.** $1.2165; $.2865.

(IV.) **1.** $541.86.

**Page 245.** — (IV.) **2.** 26¼ mi. **3.** 16,043,000 bales. **4.** 410 mi. **5.** 67.2 cu. in. **6.** 57.75 cu. in. **7.** 1 : 1.163. **8.** $2.35. **9.** .0032; 26.032. **10.** 630.

**Page 246.** — (V.) **1.** $6.50. **2.** $8473.19. **3.** 18,479,000 bales. **4.** $26.76.

**Page 247.** — (V.) **5.** 128$\frac{4}{7}$ bbl. **6.** 4 mo. **7.** $4455. **8.** 9 mo. **9.** 5 mo. **10.** 12¢; 16.8¢.

(VI.) **1.** 1 : 1.1. **2.** .96 lb.

**Page 248.** — (VI.) **3.** 1 : 1.7. **4.** $1.8247. **5.** In order: 24,239,820; 17,506,175; 12,684,837. **6.** 72.2 %. **7.** 72.4 %. **8.** 144 sq. ft. **9.** 64 sq. ft. **10.** 96¾ bbl.

**Page 249.** — (VII.) **1.** $3.85; $113.85. **2.** 111,111,111; 555,555,555; 999,999,999. **3.** $57.77. **4.** In order: 107,755,000; 23,055; .021 %. **5.** Metal mining.

**Page 250.** — (VII.) **6.** $119.28. **7.** $201.50. **8.** 84 T. **9.** 2646 lb. **10.** 12.2 %.

(VIII.) **1.** $789.60. **2.** 2288.55 lb. **3.** 595 lb. **4.** 18.816 T.

**Page 251.** — (VIII.) **5.** 365.268 T. **6.** $792.57. **7.** 14 %. **8.** 56.9 %. **9.** 5.892 wk. **10.** $21,906.50, $13,007.52, $27,776.30; $7525,70, $12,613.15, $8388.42, $16,955.40, $17,207.65; $62,690.32.

(IX.) **1.** 1010⅝ lb. **2.** $147.

**Page 252.** — (IX.) **3.** 187 qt.; 33⅓ ft.; 10,754 min. **4.** $654.50. **5.** $236.25; $46 38; $257.60; $30.60. **6.** $5475. **7.** $27,600. **8.** $1545.48. **9.** 100.5%. **10.** $12,515,774,921.

**Page 253.** — (X.) **1.** $3414.80. **2.** 1071⅞ lb. **3.** 116.1 gr. **4.** 34.722 gr. **5.** 371.25 gr. **6.** 28¾ gr. **7.** 19.29 gr. **8.** $72.

**Page 254.** — (X.) **9.** $11.76. **10.** 19,200 cu. ft.

(XI.) **1.** 5 %. **2.** 7 oz. **3.** 120 %. **4.** $2500; 9.6 %. **5.** $818,125. **6.** 441,180 bricks; $5385.60.

**Page 255.** — (XI.) **7.** Aug. 11, 1916; $137.11. **8.** $2.17. **9.** $5.60. **10.** 1.45 ℘.

(XII.) **1.** $27,000. **2.** 3⅜. **3.** 1.

**Page 256.** — (XII.) **4.** $13.75; $288.75. **5.** 14 ft. by 14 ft. **6.** Width, 20 ft.; length, 40 ft. **7.** 80 rd. by 320 rd. **8.** 30 rd. by 30 rd. **9.** In order: (square) .0001, .0004, .0009, .0016, .0025, .0036, .0049, .0064, .0081, .01, .0121, .0144, .0169, .0196, .0225, .0256, .0289, .0324, .0361, .04; (cube) .000001, .000008, .000027, .000064, .000125, .000216, .000343, .000512, .000729, .001, .001331, .001728, .002197, .002744, .003375, .004096, .004913, .005832, .006859, .008. **10.** Second bid.

**Page 257.** — (XIII.) **1.** $3216.25. **2.** $22.47. **3.** April 14, 1916; $1522.50. **4.** Gross amount, $720; net amount, $518.40; discount, $201.60. **5.** 30.926. **6.** $192.50.

**Page 258.** — (XIII.) **7.** $8.80. **8.** $150. **9.** $788.96. **10.** $1.09.

(XIV.) **1.** 1 : 5.6. **2.** 1 : 5 6. **3.** $1.90 per 10 sacks. **4.** Food, $600; clothing, $540; operating expenses, $450; amusements, $150; incidentals, $150; health, $60; books and magazines, $120; savings, $930.

**Page 259.** — (XIV.) **5.** $1.38; $18.92; $9.20. **6.** 116.363 bbl.; 15.312 T. **7.** Discount, $630.39; net amount, $570.36. **8.** Net amount, $1960.69; discount, $379.31. **9.** 25.128 cu. in. **10.** 4.76 gal.

(XV.) **1.** 17⅞ gal. **2.** $173.12. **3.** $30,000. **4.** $20.59.

**Page 260.** — (XV.) **5.** 31,896 ½½ A.; $2,166,438 58; $67.92. **6.** 254,600 T. **7.** 4658.54 lb.; 3629.66 lb. **8.** $6674.80. **9.** $20.43. **10.** 2000 steers.