COMMON CHEMICALS AND SUPPLIES IN AND AROUND YOUR HOME

Revised and updated

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Many schools share the problem of insufficient budgets for purchasing chemicals necessary for laboratory experiments and demonstrations. Fortunately "chemicals" are everywhere (after all, what isn't a chemical?) and cheap supplies of many useful chemicals can be found at local stores. This compilation lists sources as grocery store, drug store, hardware store, garden supply, and photo store. Much of these classifications have changed and now include supermarkets, natural food markets, hyperstores, pharmacy superstores, and home centers. Not every store carries all these items and some may have to be special ordered.

Most of these chemicals are not reagent grade chemicals, but are C.P., U.S.P., or technical grade suitable for most laboratory applications (See Grades of Purity for Chemicals, page 18). Using household chemicals not only can save money and the trouble of ordering from multiple catalogs, but it is effective in encouraging students to read the labels on products they use and thus become more "chemically literate". In some cases, it may be necessary to determine the percent purity of the compound from the label and adjust your "recipes" accordingly. In most cases, the other ingredients will not significantly affect results. As always, pretesting your activities with proper precautions (especially eye protection) is essential for pedagogical and safety implications.

Name of Chemical	Common Name	Formula	Source
acetic acid	vinegar (5% solution) acetic acid, glacial stop bath (28%)	CH_3COOH	grocery store photo store photo store
acetone	nail polish remover epoxy and fiberglass cleaner acetone	CH_3COCH_3	drug store paint store paint store
acetylsalicylic acid	aspirin	$C_9H_8O_4$	drug store
aluminum	aluminum foil aluminum wire and sheet	Al	grocery store hardware store building supply
aluminum ammonium sulfate	ammonium alum	$AlNH_4(SO_4)_2$	drug store
aluminum potassium sulfate	alum	$KAl(SO_4)_2 \cdot 12H_2O$	drug store
aluminum sulfate	sulfate of aluminum flocculating powder	$Al_2(SO_4)_3$	garden supply pool store
ammonia	ammonia	$NH_{3\ (aq)}$	grocery store
ammonium carbonate	smelling salt	$(NH_4)_2CO_3$	drug store
ammonium chloride	sal ammoniac	NH_4Cl	hardware store
ammonium nitrate	nitrate of ammonia	NH_4NO_3	garden supply
amylum	corn starch	$[C_6H_{10}O_5]_n$	grocery store
ascorbic acid	vitamin C fruit fresh	$C_6H_8O_6$	drug store grocery store natural food store
boric acid	boric acid eyewash solution roach killer (solid)	H_3BO_3	drug store drug store hardware store
butane	lighter fuel	C_4H_{10}	grocery store
caffeine	No-Doz tablets	$C_8H_{10}N_4O_2$	drug store
calcium carbonate	chalk limestone marble chips some antacids	$CaCO_3$	variety store garden supply drug store
calcium chloride	ice melter road salt/deicer	$CaCl_2$	hardware store pool store

Name of Chemical	Common Name	Formula	Source
calcium hydroxide	slaked lime some antacids	$Ca(OH)_2$	hardware store drug store
calcium hypochlorite	bleaching powder chlorinating powder some mildew removers	$Ca(ClO)_2$	grocery store pool supply hardware store
calcium oxide	quicklime	CaO	hardware store
calcium phosphate	superphosphate	$Ca(H_2PO_4)_2$	garden supply
calcium sulfate	gypsum Plaster of Paris	$CaSO_4$	building supply hardware store school supply
carbon	charcoal activated charcoal graphite (powder) graphite (rod): pencil lead graphite (rod): carbon battery[1]	C	hardware store pet store hardware store stationery store toy/electronic store
carbon dioxide, solid	dry ice	CO_2	refrigeration supply ice cream company
carbonic acid	soda water (seltzer)	H_2CO_3	grocery store
citric acid	sour salt (limes, lemons, etc[2])	$C_6H_8O_7$	grocery store drug store
copper	BB's[3], sheet, pipe, or wire	Cu	hardware store building supply
copper sulfate copper(II) sulfate pentahydrate	Bluestone algicide Root Eater	$CuSO_4 \cdot 5H_2O$	pool supply hardware store
dichlorodifluoromethane	Freon-12 (may need permit)	Cl_2CF_2	auto supply
ethanol	ethyl alcohol, absolute ethyl alcohol, 95% denatured alcohol ethyl rubbing alcohol, 70% to 95%	CH_3CH_2OH	liquor store liquor store paint store drug store
ethylene glycol	antifreeze	$HOCH_2CH_2OH$	auto supply hardware store

[1] See section on Making Materials for Experiments.

[2] Citric acid is the principal acid in these fruits, but cannot be obtained pure from this source.

[3] Some BB's are only copper coated.

Name of Chemical	Common Name	Formula	Source
glucose	Dextrose	$C_6H_{12}O_6$	drug store grocery store natural food store
glycerol	glycerin	$C_3H_8O_3$	drug store
gold	gold	Au	jewelry supply coin store
helium	helium	He	party shop welding supply
hydrochloric acid	muriatic acid masonry cleaner	HCl	hardware store
hydrogen		H_2	welding supply
hydrogen peroxide	hydrogen peroxide, 3% Clairoxide, 20 volume (6%) hydrogen peroxide, 40 volume (12%)	H_2O_2	drug store drug store beauty supply
hypochlorous acid	laundry bleach	HClO	grocery store
hydroquinone		$C_6H_6O_2$	photo store
iodine	Tincture of iodine (dissolved in ethanol)	I_2	drug store
iron	steel wool nails	Fe	hardware store hardware store
iron(III) chloride	ferric chloride	$FeCl_3$	drug store
iron (III) oxide	ferric oxide rust	Fe_2O_3	ceramic shop
kerosene	lamp oil	C_nH_{2n+2}	gas station home store
lactic acid	milk acid	$CH_3COHCOOH$	grocery store hardware store
latex	liquid rubber isoprene	C_5H_8	hobby shop craft shop
lead store	lead shot sinkers (fishing)	Pb	hardware store sporting goods

Name of Chemical	Common Name	Formula	Source
magnesium hydroxide	Milk of Magnesia some antacids	$Mg(OH)_2$	drug store drug store
magnesium silicate	Talc(um) powder	$Mg_3Si_4O_{10}(OH)_2$	drug store
magnesium sulfate	Epsom salt	$MgSO_4$	drug store
manganese dioxide	black powder in C batteries[4]	MnO_2	toy/electronic store
mercury	quicksilver	Hg	dental supply
methane	natural gas	CH_4	home gas range
methanol	methyl alcohol wood alcohol duplicator fluid gas dryer and antifreeze	CH_3OH	paint store paint store office supply auto store
methylene blue	Methidote	$C_{16}H_{18}ClN_3S$	veterinarian
methyl salicylate	oil of wintergreen	$C_6H_4(OH)COOCH_3$	grocery store drug store
mineral oil	Nujol		drug store
naphthalene	some Moth balls	$C_{10}H_8$	hardware store grocery store
nickel	nickel (Canadian, pre-1983) (Note: pure nickel is magnetic)	Ni	Canadian currency coin store
nitrogen (liquid)	liquid air	N_2	hospital welding/gas supply
oxygen	oxygen	O_2	drug store welding supply
oxalic acid	rust remover radiator cleaner	HO_2CCO_2H	hardware store auto supply
paradichlorobenzene	some moth balls	$C_6H_4Cl_2$	hardware store grocery store
paraffin	paraffin wax candles		grocery store hardware store
phenol red	$C_{19}H_{14}O_5S$		pool supply
polystyrene	casting resin		hobby shop

[4]See section on Making Materials for Experiments.

Name of Chemical	Common Name	Formula	Source
polyurethane foam	Craft Cast Mountains in Minutes Insulating foam spray		hobby shop building supply
potassium aluminum sulfate	potassium alum alum	$KAl(SO_4)_2•12H_2O$	photo store grocery store
potassium bitartrate	cream of tartar	$KHC_4H_4O_6$	grocery store
potassium bromide		KBr	photo store
potassium chloride	lite salt	KCl	grocery store
potassium chrome alum		$KCr(SO_4)_2•12H_2O$	photo store
potassium dichromate		$K_2Cr_2O_7$	photo store
potassium ferricyanide		$K_3Fe(CN)_6$	photo store
potassium hydroxide	lye caustic potash	KOH	grocery store hardware store
potassium nitrate	saltpeter	KNO_3	drug store
potassium permanganate	"Clearwater"[5] (0.53% solution)	$KMnO_4$	tropical fish store
propane	gas barbecue fuel blow torch fuel	C_3H_8	gas station hardware store
2-propanol	isopropyl alcohol rubbing alcohol (70% and 99%)	$CH_3CHOHCH_3$	drug store
quinine	quinine water[6]	$C_{20}H_{24}N_2O_2*3H_2O$	grocery store
red cabbage juice	red cabbage		grocery store
silicon dioxide	sand	SiO_2	hardware store garden supply washed beach sand
silver	silver	Ag	coin store
sodium acetate	heating pad (supersaturated solution)	$NaC_2H_3O_2$	drug store sporting goods
sodium borate	borax	$Na_2B_4O_7$	grocery store

[5]Use to remove odors and cloudiness in aquariums.

[6]Quinine fluoresces in ultra violet light (UV).

Name of Chemical	Common Name	Formula	Source
sodium carbonate	washing soda	Na_2CO_3	grocery store
sodium chloride	table salt kosher salt pickling salt	NaCl	grocery store
sodium hydrogen carbonate (sodium bicarbonate)	baking soda	$NaHCO_3$	grocery store
sodium hydrogen phosphate (sodium biphosphate)	pH Down	Na_2HPO_4	tropical fish store
sodium hydrogen sulfate (sodium bisulfate)	pH Down	$NaHSO_4$	pool supply
sodium hydroxide	lye caustic soda many drain cleaners	NaOH	grocery store hardware store
sodium hypochlorite	bleach (5% solution) mildew remover	NaClO	grocery store paint store
sodium nitrate	nitrate of soda	$NaNO_3$	garden supply
sodium phosphate	trisodium phosphate	Na_3PO_4	paint store garden supply
sodium silicate	water glass egg preserver (40% solution) Magic Rocks	Na_2SiO_3 $Na_2Si_3O_7$	hardware store drug store toy store
sodium sulfite		Na_2SO_3	photo store
sodium sulfate		Na_2SO_4	photo store
sodium thiosulfate	hypo	$Na_2S_2O_3$	photo store
stearic acid	candle hardener	$C_{17}H_{35}CO_2H$	hobby shop
sucrose	table sugar	$C_{12}H_{22}O_{11}$	grocery store
sulfur	flowers of sulfur	S	drug store hardware store
sulfuric acid	battery acid some drain cleaners	H_2SO_4	auto store gas station hardware store
tannic acid	tannin	$C_{76}H_{52}O_{46}$	drug store dye/fabric store photo store

Name of Chemical	Common Name	Formula	Source
thymolphthalein	disappearing ink	$C_{28}H_{30}O_4$	toy/novelty store
1,1,1-trichloroethane	cleaning fluid	CCl_3CH_3	hardware store
tungsten (wolfram)	light bulb filament	W	grocery store hardware store
urea	ice melter fertilizer	H_2NCONH_2	hardware store garden supply
xylene	xylene	C_8H_{10}	paint store
zinc	canister of carbon batteries galvanizing coating	Zn	toy store hardware store

Acid-Base Indicators and Their Color Changes

Acid-Base Indicator	pH of color changes	Source
bromothymol blue	6.0/yellow-green - 7.6/blue	pH test kit tropical fish store
litmus paper	5.5/red-pink - 8.0/blue	science supply co.
malachite green	0.2/yellow - 1.8/bluegreen	Ich cure/tropical fish store
methyl orange	3.2/red-orange - 4.4/yellow	pool pH test kit
phenolphthalein	8.2/colorless - 10.0/pink	Ex-Lax
phenol red	6.6/yellow-orange - 8.0/red	pool pH test kit
red cabbage (juice)[7]	1-3/red 4-5/rose 6-8/purple 8-11/blue 12-13/green 14/yellow	grocery store
thymolphthalein	9.4/colorless - 10.6/blue	disappearing ink/ toy store

[7]See section on Making Materials for Experiments.

THE CHEMICAL LOCATER
A Cross Reference of Chemicals by Common Name

Common Name	Chemical Name
acetic acid, glacial	acetic acid
activated charcoal	carbon
alum	aluminum potassium sulfate
aluminum foil	aluminum
aluminum wire	aluminum
ammonia (household)	ammonia
ammonium alum	aluminum ammonium sulfate
antacid	calcium carbonate, calcium hydroxide, or magnesium hydroxide (check label)
antifreeze	ethylene glycol
aspirin	acetylsalicylic acid
baking soda	sodium hydrogen carbonate
battery acid	sulfuric acid
bleach	sodium hypochlorite, (may also be hypochlorus acid)
bleaching powder	calcium hypochlorite
blow torch	propane
Bluestone algicide	copper sulfate
borax	sodium borate
boric acid	boric acid
candle hardener	stearic acid
candles	paraffin
casting resin	polystyrene
caustic potash	potassium hydroxide
caustic soda	sodium hydroxide
chalk	calcium carbonate
charcoal	carbon
chlorinating powder	calcium hypochlorite
Clairoxide	hydrogen peroxide (6%)
cleaning fluid	1,1,1-trichloroethane
Clearwater	potassium permanganate
corn starch	amylum
Craft Cast	polyurethane foam
cream of tartar	potassium bitartrate
denatured alcohol	ethanol
Dextrose	glucose
disappearing ink	thymolphthalein
dry ice	carbon dioxide, solid
duplicator fluid	methanol
egg preserver	sodium silicate
epoxy cleaner	acetone
Epsom salts	magnesium sulfate
ethyl alcohol	ethanol
eyewash solution	boric acid
ferric chloride	iron(III) chloride
ferric oxide	iron(III) oxide
fertilizer	urea
fiberglass cleaner	acetone

Common Name	Chemical Name
flocculating powder	aluminum sulfate
flowers of sulfur	sulfur
Freon-12	dichlorodifluoromethane
gas barbecue fuel	propane
gas dryer	methanol
glycerin	glycerol
graphite (powder)	carbon
graphite (rod)	carbon
gypsum	calcium sulfate
heating pad	sodium acetate
hypo	sodium thiosulfate
ice melter	calcium chloride
ice melter	urea
isoprene	latex
isopropyl alcohol	2-propanol
kosher salt	sodium chloride
lamp oil	kerosene
laundry bleach	hypochlorous acid
lead shot	lead
light bulb filament	tungsten (wolfram)
lighter fuel	butane
limestone	calcium carbonate
liquid rubber	latex
lite salt	potassium chloride
lye	potassium hydroxide
lye	sodium hydroxide
Magic Rocks	sodium silicate
marble chips	calcium carbonate
masonry cleaner	hydrochloric acid
Methidote	methylene blue
methyl alcohol	methanol
mildew remover	sodium hypochlorite
milk acid	lactic acid
Milk of Magnesia	magnesium hydroxide
Moth balls	naphthalene
moth balls	paradichlorobenzene
Mountains in Minutes	polyurethane foam
muriatic acid	hydrochloric acid
nail polish remover	acetone
nails	iron
natural gas	methane
nitrate of ammonia	ammonium nitrate
nitrate of soda	sodium nitrate
No-Doz tablets	caffeine
Nujol	mineral oil
oil of wintergreen	methyl salicylate
paraffin wax	paraffin
pH Down	sodium hydrogen phosphate or sodium hydrogen sulfate
pickling salt	sodium chloride
potassium alum	aluminum potassium sulfate
potassium alum	potassium aluminum sulfate

Common Name	Chemical Name
quicklime	calcium oxide
quicksilver	mercury
quinine water	quinine
radiator cleaner	oxalic acid
red cabbage	red cabbage juice
roach killer	boric acid
road salt	calcium chloride
Root Eater	copper sulfate
rubbing alcohol	isopropyl alcohol (70%)
rubbing alcohol	2-propanol
rubbing alcohol	ethanol (70%)
rust	iron(III) oxide
rust remover	oxalic acid
sal ammoniac	ammonium chloride
saltpeter	potassium nitrate
sand	silicon dioxide
seltzer	carbonic acid
silver	silver
sinkers (fishing)	lead
slaked lime	calcium hydroxide
smelling salt	ammonium carbonate
soda water	carbonic acid
sour salt	citric acid
steel wool	iron
stop bath	acetic acid (28%)
sulfate of aluminum	aluminum sulfate
superphosphate	calcium phosphate
table salt	sodium chloride
table sugar	sucrose
Talc(um) powder	magnesium silicate
tannin	tannic acid
Tincture of iodine	iodine (in alcohol)
trisodium phosphate	sodium phosphate
vinegar	acetic acid (5% solution)
vitamin C	ascorbic acid
washing soda	sodium carbonate
water glass	sodium silicate
wood alcohol	methanol

MEASUREMENT EQUIVALENTS FOR SCIENCE ACTIVITIES

Teachers, particularly in elmentary and middle school, do not always have access to laboratory measuring devices such as graduated cylinders, volumetric glassware, balances, and thermometers. Common household devices are more readily available. Although most household measuring devices are graduated in English system units, a few will also contain metric equivalents.

Since most laboratory recipes for demonstrations and activites are written using metric measurements, it is useful to have a table of common equivalents to determine amounts needed for individual or class activites. The following tables give English-English and English-metric equivalents for common kitchen measures and for temperature.

Equivalents of Common Kitchen Measures

	Teaspoons	Table-spoons	Fluid ounces	Cups	Liquid pints	Liquid quarts	Milli-liters	Liters
1 teaspoon	1	1/3	1/6	-	-	-	5	-
1 tablespoon	3	1	1/2	1/16	1/32	-	15	-
1 fluid ounce	6	2	1	1/8	1/16	1/32	30	.03
1 cup	48	16	8	1	1/2	1/4	237	.24
1 liquid pint	96	32	16	2	1	1/2	473	.47
1 quart	-	-	32	4	2	1	946	.95
1 milliliter	1/5	1/15	1/30	-	-	-	1	1/1000
1 Liter	-	-	34	4.2	2.1	1.06	1000	1

MASS-VOLUME EQUIVALENTS OF COMMON CHEMICAL SOLIDS

Volume and temperature measurements can easily be used for many materials, but when using weight measurements of solid materials there are no universal measurments. The masses of solids vary widely and a balance is needed for accurate measurements. Since accurate balances can be expensive, a cheaper alternative is knowing the approximate weight equivalents of various substances using common kitchen measuring devices. The following table lists the approximate weights of some common materials.

Measuring devices vary greatly from manufacturer to manufacturer. A cup measure can vary as much as 10% between two manufacturers. There are also differences in capacities between glass, plastic, and metal measuring devices. In addition, relationships between measuring devices within a set show variations from standards. For example, in a set of measuring spoons used by the author, one tablespoon was slightly more than 3 teaspoons.

Finding accurate measuring devices is not practical. Instead, when purchasing measuring devices for class use, purchase several sets from a single manufacturer to reduce variations in the class. Test all procedures and make adjustments in recipes, as needed, to allow for variations in the measuring devices.

All volume measurements were made by overfilling the measuring device and leveling with a spatula. No effort was made to pack material into the measuring device.

All weights were measured in grams. Ounces can calculated using an equivalent of 453.6 grams per pound.

Name of Chemical	**Formula**	**Form**	**Mass in grams**			
			1 tsp	**1 Tbsp**	**1 cup**	**other**
aluminum potassium sulfate	$KAl(SO_4)_2 \cdot 12H_2O$	powder	3.6	10.8	173	
aluminum sulfate	$Al_2(SO_4)_3$	powder	3.8	11.4	182	
ammonium carbonate	$(NH_4)_2CO_3$	powder	3.0	9.0	144	
ammonium nitrate	NH_4NO_3	crystal	3.8	11.2	180	
ascorbic acid	$C_6H_8O_6$	crystal	2.8	8.4	134	
boric acid	H_3BO_3	powder	4.0	12	192	
calcium acetate	$Ca(C_2H_3O_2)_2$	crystal	1.9	5.7	91.2	
calcium carbonate	$CaCO_3$	powder chips	1.5 6.3	4.5 19	72 302	
calcium chloride	$CaCl_2$	round mesh	4.5	13.5	216	
calcium hydroxide	$Ca(OH)_2$	powder	2.2	6	96	
calcium oxide	CaO	powder	1.5	4.5	72	
calcium phosphate	$Ca(H_2PO_4)_2$	crystal	3.9	9.0	144	
calcium sulfate	$CaSO_4\ 2H_2O$	powder	1.4	4.2	67	

Name of Chemical	Formula	Form	Mass in grams			
			1 tsp	1 Tbsp	1 cup	other
carbon (activated)	C	granular	2.1	6.3	131	
citric acid	$C_6H_8O_7*H_2O$	crystal	3.6	10.8	-	
cobalt chloride	$CoCl_2*6H_2O$	powder	4.5	13.2	211	
copper(II) chloride	$CuCl_2•2H_2O$	crystal	4.7	14.1	226	
copper(II) sulfate	$CuSO_4•5H_2O$	large crystals	6.4	19.2	307	
flour (all purpose)		powder	2.5	7	118	
glucose	$C_6H_{12}O_6$	crystals	3.5	10.5	168	
iron(III) chloride	$FeCl_3•6H_2O$	powder	5.1	15.3	245	
iron(III) nitrate	$Fe(NO_3)_3•9H_2O$	crystals	4.6	13.7	219	
lithium chloride	LiCl	fine crystal	4.0	1267		
luminol		powder		6.4		1/8 tsp = 0.8 g
magnesium chloride	$MgCl_2•6H_2O$	wet crystals	3.2	9.7	155	
magnesium hydroxide	$Mg(OH)_2$	fine granular	2.4	7.2	115	
magnesium sulfate	$MgSO_4•7H_2O$	fine crystals	3.3	9.9	158	
magnesium sulfate (anhy.)	$MgSO_4$	crystals	3.6	10.8	173	
manganese dioxide	MnO_2	powder	9.25	27.8	-	1/8 tsp = 1.35 g
methylene blue	$C_{16}H_{18}ClN_3S$	powder	3.3	9.9	-	1/8 tsp = 0.4 g
naphthalene	$C_{10}H_8$	crystal	2.6	7.8	125	
oxalic acid	HO_2CCO_2H	crystal	3.5	10.5	168	
paradichlorobenzene	$C_6H_4Cl_2$	crystal	3.4	10.1	163	
phenolphthalein	$C_{20}H_{14}O_4$	powder	1.84	-	-	1/8 tsp = 0.23 g
potassium aluminum sulfate	$KAl(SO_4)_2•12H_2O$	powder	3.6	10.8	173	
potassium bitartrate	$KHC_4H_4O_6$	powder	2.7	8	130	

Name of Chemical	Formula	Form	Mass in grams			
			1 tsp	1 Tbsp	1 cup	other
potassium bromide	KBr	granular	6.2	18.6	298	
potassium chloride	KCl	crystal	4.5	13.5	216	
potassium chrome alum	$KCr(SO_4)_2 \cdot 12H_2O$	crystal	3.9	11.6	186	
potassium dichromate	$K_2Cr_2O_7$	crystal	5.4	16.3	260	
potassium ferricyanide	$K_3Fe(CN)_6$	fine crystal	4.0	12	192	
potassium ferrocyanide	$K_4Fe(CN)_6 \cdot 3H_2O$	lump, flakes	4.6	13.6	218	
potassium hydroxide	KOH	pellets	4.5	13.5	216	
potassium iodate	KIO_3	powder	3.3	9.8	157	
potassium nitrate	KNO_3	crystal	5.7	17	274	
potassium oxalate	$K_2C_2O_4$	crystal	4.2	12.6	202	
potassium permanganate	$KMnO_4$	fine crystal	5.7	17.1	274	1/8 tsp = 0.95 g
potassium sodium tartrate	$KNaC_4H_4O_6 \cdot 4H_2O$	crystal	4.0	12	192	
potassium thiocyanate	KSCN	crystal	3.5	10.5	168	
sodium acetate (anhy.)	$NaC_2H_3O_2$	crystal	2.6	7.8	125	
sodium acetate	$NaC_2H_3O_2 \cdot 3H_2O$	crystal	3.8	11.4	182	
sodium bicarbonate sodium hydrogen carbonate	$NaHCO_3$	powder	4.7	14.5	240	
sodium bisulfite	$NaHSO_3$	crystal	5.5	16.5	264	
sodium borate	$Na_2B_4O_7$	crystal	3.3	9.9	158	
sodium carbonate	$Na_2CO_3 \cdot H_2O$	powder	4.6	13.8	221	
sodium carbonate (anhy.)	Na_2CO_3	powder	4.7	14	225	
sodium chloride	NaCl	crystal	6.0	18	290	
sodium hydroxide	NaOH	pellets	4.6	13.8	221	
sodium nitrate	$NaNO_3$	crystal	4.6	13.8	221	
sodium phosphate	$Na_3PO_4 \cdot 12H_2O$	crystal	3.6	10.8	173	

Name of Chemical	Formula	Form	Mass in grams			
			1 tsp	1 Tbsp	1 cup	other
sodium silicate	Na_2SiO_3	powder	4.0	12	192	
sodium sulfate	Na_2SO_4	powder	6	18	288	
sodium sulfite	Na_2SO_3	crystal	5.5	16.5	264	
sodium thiosulfate	$Na_2S_2O_3$	crystal	3.75	11.2	180	
starch		powder	2.4	7.3	117	
strontium chloride	$SrCl_2 \cdot 6H_2O$	crystal	4.2	12.7	203	
sucrose	$C_{12}H_{22}O_{11}$	granular	4.0	12	192	
sulfur	S	powder	3.2	9.6	154	
tannic acid	$C_{76}H_{52}O_{46}$	powder	1.27	3.81	61	
thymolphthalein	$C_{28}H_{30}O_4$	powder	2.3	7	-	1/8 tsp = 0.2 g
urea	H_2NCONH_2	round pellets	3.4	10.2	163	
zinc	Zn	granular (20 mesh)	10	30	480	

GRADES OF PURITY FOR CHEMICALS

The following is a partial listing of designations which have been generally adopted to indicate different degrees of quality and primary uses of laboratory chemicals. The grades are listed by decreasing degrees of purity.

Reagent. High purity for analytical use. Bottles are often labeled to show lot analysis and/or maximum limits of impurities.

ACS. Meets reagent specifications of the American Chemical Society.

Chemically Pure (CP). Suitable for routine use. Lot analysis not specified.

USP. Meets the specifications of the United States Pharmacopeia.

NF. Meets the specifications of the National Formulary.

Pharmaceutical Grade. Designates products listed in the USP and NF compendia.

Practical. Principally organic compounds of medium purity often purified from technical grade. Considered suitable for most syntheses.

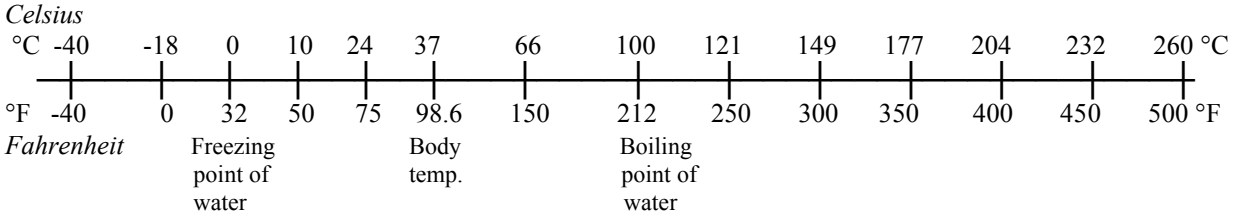
Purified. Superior to technical grade, being free from excessive foreign matter. Suitable for most purposes except analysis.

Technical, Commercial, or **Industrial**. Chemicals of ordinary commercial purity. Not refined for laboratory use.

Most household chemicals are purified grade or better. They can be used in most experiments and activities with no adverse effects on results. Always pretest any materials in the experiment/demonstration with proper precautions.

TEMPERATURE

In the metric system, degrees Celsius are used rather than degrees Fahrenheit. One degree Celsius is equivalent to 1.8 degrees Fahrenheit.



MAKING MATERIALS FOR EXPERIMENTS

graphite electrodes	Obtain heavy pencil leads from a stationery store. Shave the wood off a lead pencil exposing the lead. Use the center electrode from a dry cell (carbon) battery (any size).
iron filings	Rub two pieces of steel wool together over a piece of paper to catch the small pieces.
manganese dioxide	Break open a dry cell battery (carbon type). The black powder is a mixture of ammonium chloride and manganese dioxide. For many applications, the powder can be used directly. To purify the manganese dioxide: Mix the black powder with water. Filter the mixture through filter paper, wash with small portions of water, and let dry.
potassium hydroxide	Mix wood ashes with water. Let stand overnight. Filter the solution of caustic potash. (CAUTION: This is a highly caustic solution.) To make potassium hydroxide, add calcium oxide, stir, and filter the solution.
red cabbage juice	Place some pieces of red cabbage in a beaker or pot, cover with water, and heat to boiling. Save the red liquid. Refrigerate it to slow spoiling. Alternate method: Place red cabbage and water in a blender. Blend the mixture. Strain into a jar and refrigerate the liquid.
turmeric solution	Mix some turmeric with alcohol. Save the solution.
zinc	Use the metal casing from a dry cell (carbon type) battery. (Note: Some batteries have iron cases. Test with a magnet.)

MOLARITY OF MURIATIC ACID SOLUTIONS

Muriatic acid, the commercial form of hydrochloric acid available in hardware stores, is sold with its concentration listed in percent hydrochloric acid and degrees Baume (a method of expressing specific gravity). The following table lists equivalents in Molarity (moles/liter) for use in chemical experiments.

°Baume	% HCl	Molarity
10°	14.8	4.4
11°	16.4	4.9
12°	18.0	5.4
13°	19.6	5.9
14°	21.3	6.5
15°	22.9	7.0
16°	24.6	7.6
17°	26.2	8.1
18°	27.9	8.7
19°	29.7	9.3
20°	31.5	10.0

DILUTING SOLUTIONS

To dilute a concentrated solution to a lower concentration (such as a muriatic acid solution), the formulas to use are:

$$V_i = \frac{M_f V_f}{M_i}$$

and

$$V_w = V_f - V_i$$

where M_i = molarity of the initial or concentrated solution
V_i = volume of initial or concentrated solution needed
M_f = molarity of diluted or final solution
V_f = volume of diluted or final solution
V_w = volume of water needed

Example: To make 100 mL of a 1.0 M solution of hydrochloric acid from 8.7 M hydrochloric acid

$$V_i = \frac{(1.0\ M) \times (100\ mL)}{(8.7\ M)} = 11.5\ mL \text{ hydrochloric acid solution needed}$$

$V_w = 100\ mL - 11.5\ mL = 88.5\ mL$ water needed

To make the solution, measure 88.5 mL of water into an appropriate container and add 11.5 mL of the hydrochloric acid solution. **Safety note:** Always add acid to water to prevent splattering from occuring.

REFERENCES FOR USING AND/OR FORMULATING HOUSEHOLD PRODUCTS

This following is a brief list of some books that utilize household products for a wide range of activities from simple experiments to formulating household products.[8]

Cosmetics

Cobb, Vicki, **The Secret Life of Cosmetics**, J. B. Lippincott, 1985.
Information and experiments on soap and toothpaste, lotions and creams, fragrances, hair, and makeup.

Crafts

Hobson, Phyllis, **Making Homemade Soaps and Candles**, Garden Way Publishing 1974.

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[8]A comprehensive list of demonstration and activity books, many of which use common chemicals, can be found in Katz, D. A., "Science Demonstrations, Experiments, and Resources", *J. Chem. Educ.*, **68**, 235 (March, 1991).

Dyeing:

Brooklyn Botanical Garden, **Natural Plant Dyeing**, A Handbook

Kramer, Jack, **Natural Dyes: Plants and Processes**, Charles Scribner's Sons, 1972.

Foods

Cobb, Vicki, **Science Experiments You Can Eat**, and **More Science Experiments You Can Eat**, J. B. Lippincott, Harper and Row, New York, 1972 and 1979.

A collection of experiments with food covering everything from acids and bases through popping popcorn to yeast.

Hobson, Phyllis, **Making Homemade Cheeses & Butter**, Garden Way Publishing, 1973.

Formula Books and Experiment Books

Cobb, Vicki, **The Secret Life of Hardware**, J. B. Lippincott, 1982.

Science experiments with cleaners, polishes, waxes, paints, rope, glue, tools, and electricity. Each section explains how things were invented and why things work.

Cobb, Vicki, **Chemically Active**, J. B. Lippincott, New York, 1985

A collection of chemical experiments using materials found at home combined with explanations of chemical principles.

Herbert, Don, **Mr. Wizard's Supermarket Science**, Random House, 1980.

Over 100 experiments and projects using and making household materials.

Hiscox, Gardner D. (Ed), **Henley's Formulas for Home and Workshop**, Crown, 1979.

Originally published in 1907, and revised in 1927 and 1979, this volume contains over 10,000 scientific formulas, trade secrets, food and chemical recipes, and money saving ideas. It does contain a disclaimer about the lack of a thorough safety review, but with wise use, is a valuable reference book.

Stark, Norman, **The Formula Book**, Volumes 1, 2, & 3, Sheed and Ward, Inc., 1975, 1976, & 1978.

Recipes for making a variety of personal care and household products.

Tocci, Salvatore, **Chemistry Around You**, Arco Publishing, Inc., 1985.

Experiments and projects with everyday chemicals. Divided by sections of the house: kitchen, bathroom, laundry room, garage, and backyard.