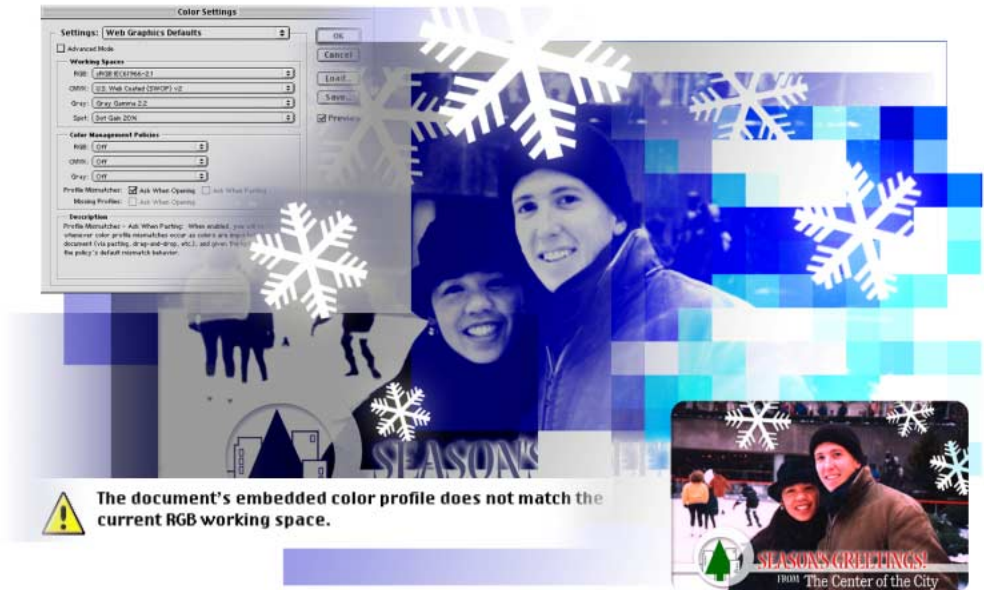


12 Producing and Printing Consistent Color



To produce consistent color, you define the color space in which to edit and display RGB images, and in which to edit, display, and print CMYK images. This helps ensure a close match between on-screen and printed colors.

In this lesson, you'll learn how to do the following:

- Define RGB, grayscale, and CMYK color spaces for displaying, editing, and printing images.
- Prepare an image for printing on a PostScript® CMYK printer.
- Proof an image for printing.
- Create a color separation, the process by which the colors in an RGB image are distributed to the four process ink colors: cyan, magenta, yellow, and black.
- Understand how images are prepared for printing on presses.

This lesson will take about 60 minutes to complete. The lesson is designed to be done in Adobe Photoshop.

If needed, remove the previous lesson folder from your hard drive, and copy the Lesson12 folder onto it. As you work on this lesson, you'll overwrite the start files. If you need to restore the start files, copy them from the *Adobe Photoshop Classroom in a Book* CD.

Note: *Windows users need to unlock the lesson files before using them. For information, see “Copying the Classroom in a Book files” on page 3.*

Reproducing colors

Colors on a monitor are displayed using combinations of red, green, and blue light (called RGB), while printed colors are typically created using a combination of four ink colors—cyan, magenta, yellow, and black (called CMYK). These four inks are called *process colors* because they are the standard inks used in the four-color printing process.



RGB image with red, green, and blue channels



CMYK image with cyan, magenta, yellow, and black channels

● For color samples of channels in both RGB and CMYK images, see figures 12-1 and 12-2 in the color section.

Because the RGB and CMYK color models use very different methods to display colors, they each reproduce a different *gamut*, or range of colors. For example, because RGB uses light to produce color, its gamut includes neon colors, such as those you'd see in a neon sign. In contrast, printing inks excel at reproducing certain colors that can lie outside of the RGB gamut, such as some pastels and pure black. For an illustration of the RGB and CMYK gamuts and color models, see figures 12-3, 12-4, and 12-5 in the color section.

But not all RGB and CMYK gamuts are alike. Each model of monitor and printer is different, and so each displays a slightly different gamut. For example, one brand of monitor may produce slightly brighter blues than another. The *color space* for a device is defined by the gamut it can reproduce.

RGB model

A large percentage of the visible spectrum can be represented by mixing red, green, and blue (RGB) colored light in various proportions and intensities. Where the colors overlap, they create cyan, magenta, yellow, and white.

Because the RGB colors combine to create white, they are also called additive colors. Adding all colors together creates white—that is, all light is transmitted back to the eye. Additive colors are used for lighting, video, and monitors. Your monitor, for example, creates color by emitting light through red, green, and blue phosphors.


CMYK model

The CMYK model is based on the light-absorbing quality of ink printed on paper. As white light strikes translucent inks, part of the spectrum is absorbed and part is reflected back to your eyes.

In theory, pure cyan (C), magenta (M), and yellow (Y) pigments should combine to absorb all color and produce black. For this reason these colors are called subtractive colors. Because all printing inks contain some impurities, these three inks actually produce a muddy brown and must be combined with black (K) ink to produce a true black. (K is used instead of B to avoid confusion with blue.) Combining these inks to reproduce color is called four-color process printing.

—From Adobe Photoshop 6.0 online Help

An ICC profile is a description of a device's color space, such as the CMYK color space of a particular printer. In this lesson, you'll choose which RGB and CMYK ICC profiles to use. Once you specify the profiles, Photoshop can embed them into your image files. Photoshop (and any other application that can use ICC profiles) can then interpret the ICC profile in the image file to automatically manage color for that image. For general information about color management and about preparing your monitor, see Lesson 11, "Setting Up Your Monitor for Color Management".

 For information on embedding ICC profiles, see Photoshop 6.0 online Help.

Getting started

Before beginning this lesson, restore the default application settings for Adobe Photoshop. See “Restoring default preferences” on page 4.

You also need to make sure you have calibrated your monitor as described in Lesson 11. If your monitor does not display colors accurately, the color adjustments you make to an image displayed on that monitor may be wrong.

Specifying color management settings

In the first part of this lesson, you’ll learn how to set up a color-managed workflow. To help you with this, the Color Settings dialog box in Photoshop contains most of the color management controls you need. (This dialog box appears the first time you start Photoshop.)

For instance, Photoshop is set up for RGB as part of a Web/online workflow by default. However, if you’re preparing artwork for print production, you would likely change the settings to be more appropriate for images that will be printed on paper rather than displayed on a screen.

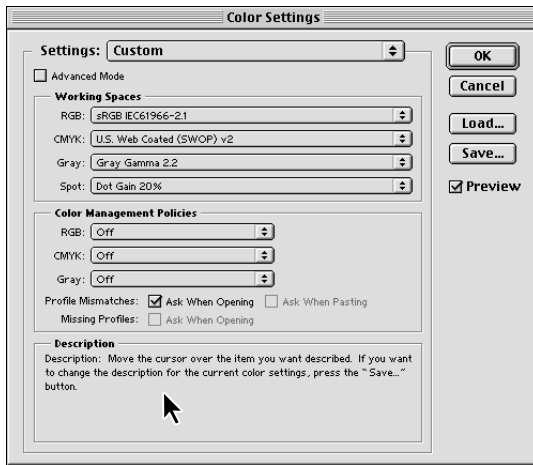
You’ll begin this lesson by starting Photoshop and creating customized color settings.

1 Start Adobe Photoshop.

If you used another application to modify and save the current color settings file, a dialog box appears, prompting you to synchronize the common color settings when you start Photoshop or reopen the Color Settings dialog box in it.

Synchronizing the color settings helps ensure that color is reproduced consistently between Adobe applications that use the Color Settings dialog box. You can also share custom color settings by saving and loading the settings file in the desired applications and providing the settings file to other users. For more information, see Photoshop 6.0 online Help.

2 Choose Edit > Color Settings to display the Color Settings dialog box.



The bottom of the dialog box contains information about the various color-management options in it, which you'll now review.

3 Move the mouse pointer over each part of the dialog box, including the names of areas (such as Working Spaces) and the options you can choose (such as the different menu options), returning the options to their defaults when you're done. As you move the mouse, view the information that appears at the bottom of the dialog box.

Now you'll choose a general set of options that will specify the individual options for you. In this case, you'll pick one designed for a print workflow, rather than an online workflow.

4 Select a prepress default from the Settings menu at the top of the dialog box (we used U.S. Prepress Defaults) and click OK.

Proofing an image

In this part of the lesson, you'll begin working with a typical file of the kind you might scan in from a printed original. You'll open it, convert its color profile, and set it up so that you can see online a close representation of what it will look like when printed. This will enable you to proof the printed image on your screen for printed output.

You'll begin by opening the file.

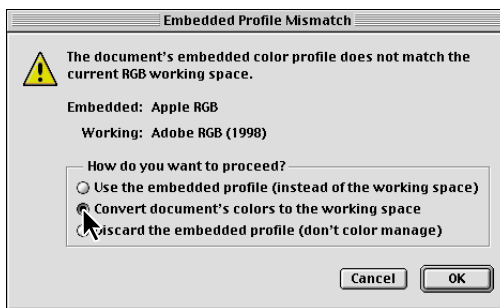
1 Choose File > Open, and open the file 12Start.tif from the Lessons/Lesson12 folder.

Because 12Start.tif contains a color profile that indicates the image was created in a different color space than the one you set up for Photoshop, the Embedded Profile Mismatch notice appears asking you to resolve this difference.

There are three options in the notice. Selecting Use the Embedded Profile changes the color settings from the ones you defined for Photoshop in the previous section to the ones represented by the profile in the image. Selecting Discard the Embedded Profile displays the document as though it had no profile and can result in inaccurate colors being displayed. Rather than choose either of these, you'll select another option instead.

2 Select Convert Document's Colors to the Working Space and click OK.

An RGB image of a scanned postcard is displayed.



The Convert Document's Color to the Working Space option makes Photoshop compare the color space in 12Start.tif's embedded color profile with the color space you defined in the Color Settings dialog box. Photoshop then converts 12Start.tif's colors as necessary to display the image on-screen as accurately as possible.

Note: Depending on what you've specified in the Color Settings dialog box, if the image did not have a color profile already, the Missing Profile notice would have appeared. This notice lets you choose whether to leave the image without a profile (that is, without color management); apply the current color profile that you specified in the Color Settings dialog box; or assign a profile from a list of possible profiles. Applying the current color profile is generally a good choice.

Before soft-proofing—that is, proofing on-screen—or printing this image, you’ll set up a proof profile. A proof profile (also called a *proof setup*) defines how the document is going to be printed, and adds those visual properties to the on-screen version for more accurate soft-proofing. Photoshop provides a variety of settings that can help you proof images for different uses, including print and display on the Web. For this lesson, you’ll create a custom proof setup. You can then save the settings for use on other images that will be output the same way.

3 Choose View > Proof Setup > Custom.

4 Select Preview to preview the effects of each option as you choose them.

5 From the Profile menu in the Proof Setup dialog box, choose a profile that represents a final output source color profile, such as the printer you’ll use to print the image. If you don’t have a specific printer, the profile Working CMYK - U.S. Web Coated (SWOP) v2 is generally a good choice.

6 Make sure Deselect Preserve Color Numbers is not selected. Leaving this option off simulates how the image appears if colors are converted from the document space to their nearest equivalents in the proof profile space.

7 From the Intent menu, choose a rendering intent for the conversion (we chose Relative Colorimetric, a good choice for preserving color relationships without sacrificing color accuracy).

8 If it’s available for the profile you chose, select Ink Black. Then choose Paper White.

Notice that the image appears to lose contrast. Ink Black simulates the dynamic range defined by an image’s profile. Paper White simulates the specific shade of white for the print medium defined by an image’s profile. That is, the whites shown in the image are now simulating the white of paper.



Normal image



Image with Ink Black
and Paper White options

9 Click OK.



To turn the proof settings off and on, choose View > Proof Colors.

Identifying out-of-gamut colors

Most scanned photographs contain RGB colors within the CMYK gamut, and changing the image to CMYK mode (which you'll do later in order to print the file) converts all the colors with relatively little substitution. Images that are created or altered digitally, however, often contain RGB colors that are outside the CMYK gamut—for example, neon-colored logos and lights.

Note: *Out-of-gamut colors are identified by an exclamation point next to the color swatch in the Color palette, the Color Picker, and the Info palette.*

Before you convert an image from RGB to CMYK, you can preview the CMYK color values while still in RGB mode.

1 Choose View > Gamut Warning to see out-of-gamut colors. Adobe Photoshop builds a color conversion table and displays a neutral gray where the colors are out-of-gamut.

Because the gray can be hard to spot in the image, you'll now convert it to a stronger gamut warning color.

2 Choose Edit > Preferences > Transparency & Gamut. Then click the Color sample at the bottom of the dialog box.

3 Choose a vivid color, such as pink, and click OK.

4 Click OK again to close the Transparency & Gamut dialog box. The gray is replaced by the new color you chose.

5 Choose View > Gamut Warning to turn off the preview of out-of-gamut colors.

Photoshop will automatically correct these out-of-gamut colors when you save the file in Photoshop EPS format later in this lesson. Photoshop EPS format changes the RGB image to CMYK, adjusting the RGB colors as needed to bring them into the CMYK color gamut.

Adjusting an image and printing a proof

The next step in preparing an image for output is to make any color and tonal adjustments to the image. In this part of the lesson, you'll add some tonal and color adjustments to correct an off-color scan of the original postcard.

So that you can compare the image before and after making corrections, you'll start by making a copy.

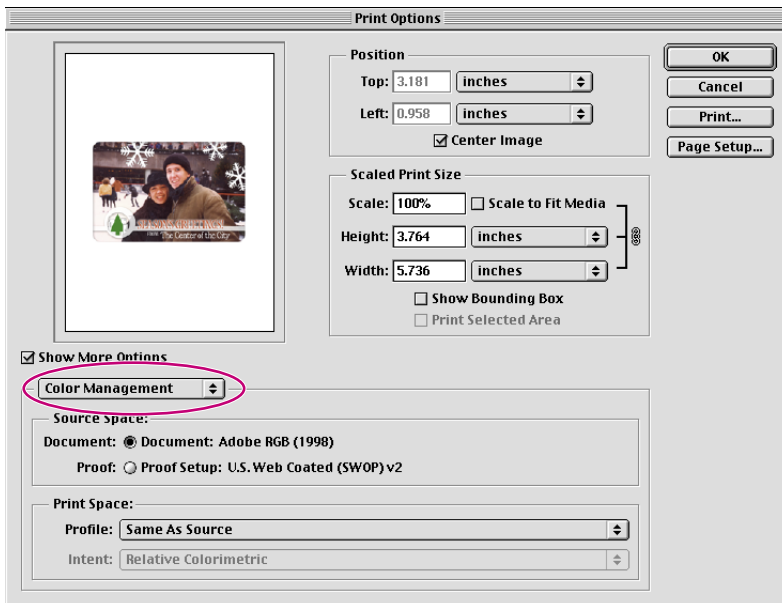
- 1 Choose Image > Duplicate and click OK to duplicate the image.
- 2 Align the images near each other.

Here you'll adjust the hue and saturation of the image. There are various ways to adjust color, including using the Levels and Curves commands. In this lesson, you'll use the Hue/Saturation command to adjust the artwork.

- 3 Select 12Start.tif (the original image) and choose Image > Adjust > Hue/Saturation.
- 4 Adjust the Hue until the colors, especially the fleshtones, look more natural. (We used +20.)
- 5 Adjust the Saturation until the intensity of the colors looks normal (we used -17), and click OK.

Now you're ready to specify how to print the image.

- 6 With 12Start.tif still selected, choose File > Print Options.
- 7 Select Show More Options. Then choose Color Management from the pop-up menu that appears.



- 8 In the Source Space area, select Proof to use the color profile that describes the way you intend to print the image, rather than the image's embedded color profile.
- 9 In the Print Space area, choose the profile for the color printer on which you plan to print the image for proofing. If your specific printer isn't listed, choose Working CMYK.
- 10 Click OK.
- 11 Choose File > Save to save your work.
- 12 Print a copy of the image to a color printer and compare it to the online version.

Saving the image as a separation

In this part of the image, you'll learn how to save the image as a separation, so that it can print out in separate cyan, magenta, yellow, and black plates.

- 1 With 12Start.tif still selected, choose File > Save As.
- 2 Choose Photoshop EPS from the Format menu.

Saving the file in Encapsulated PostScript (EPS) format changes the file from an RGB image to a CMYK image. This enables you to select the Use Proof Setup option to save the image as CMYK.


Note: To switch the image and view the difference between the RGB and CMYK versions, you can choose Image > Mode > CMYK Color.

- 3 Select Use Proof Setup.

A warning appears, indicating that some data won't be saved. As described earlier in the lesson, this is because some of the colors in the file will be shifted from the RGB gamut of the original file to the CMYK gamut of the Photoshop EPS file.

It is useful to tag an image so that you can preserve the color management settings. This helps maintain color consistency when, for example, you move the image to another application or system.

- 4 Select Embed Color Profile to save the image as a tagged file.

 You can choose Embed Color Profile to save any untagged document with a color profile.

- 5 Name the file **12Start.eps** and click Save.
- 6 Click OK on the EPS Options dialog box that appears.


7 Choose File > Open, and open the 12Start.eps file, located in the Lessons/Lesson12 folder.

Notice that 12Start.eps is now a CMYK file. You are done using the TIF and copy versions of the file and can close them now.

8 Choose File > Save to save the changes before closing 12Start.tif and 12Start copy.tif.

Selecting print options

To select printing options, you make choices in the File Info and Page Setup dialog boxes and then choose Options from the Print dialog box. The next sections introduce you to some of the printing options.

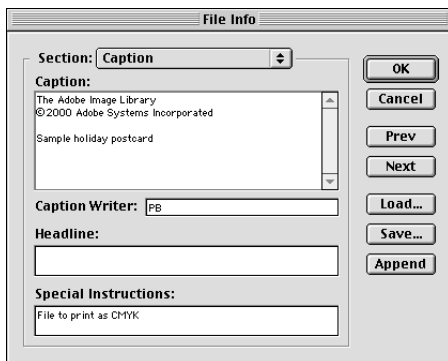
 For information on all the print options, see Photoshop 6.0 online Help.

Entering file information

Photoshop supports the information standard developed by the Newspaper Association of America and the International Press Telecommunications Council to identify transmitted text and images.

In Windows, you can add file information to files saved in Photoshop, TIFF, and JPEG formats. In Mac OS, you can add file information to files saved in any format.

1 Select the 12Start.eps image and choose File > File Info.



2 In the File Info dialog box, type a description of the file in the Caption text box.

Note: To print a caption when you print an image, choose *File > Page Setup*, and click the *Caption* option.

3 Enter your name in the Caption Writer text box.

4 Enter any special instructions you may have for printing the image in the Special Instructions text box.

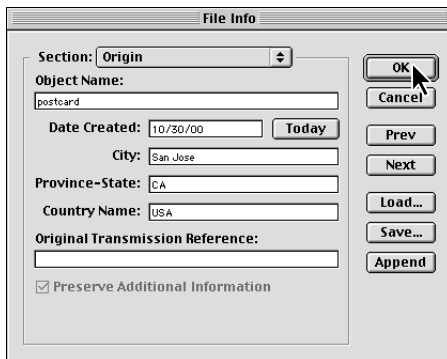
5 For Section, choose Origin. In the origin section, enter information that you or others can refer to later, including an address, date, and other data.


6 Click the Today button to enter today's date in the date box.

Other types of file information you can record include the following:

- Keywords for use with image browser applications.
- Categories for use with the Associated Press regional registry.
- Credits for copyrighted images.
- Copyright & URL for online images.

7 Click OK to attach the information to the file.

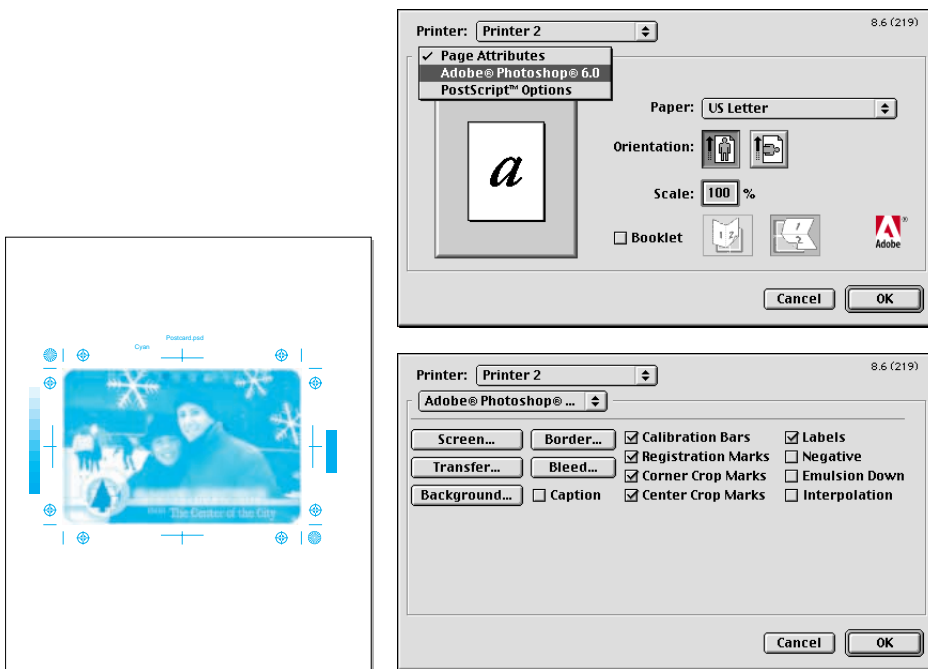


 For complete information about all the File Info sections, see Photoshop 6.0 online Help.

Specifying settings for different image types

The type of image you're printing and the type of output you or your prepress service provider require determine the selections you make in the Page Setup and Print dialog boxes.

The Page Setup dialog box lets you set up print labels, crop marks, calibration bars, registration marks, and negatives. You can also print emulsion-side down, and use interpolation (for PostScript Language Level 2 printers). The specific options that appear in your Page Setup dialog box depend on the printer you have selected.



Printing

When you're ready to print your image, use the following guidelines for best results:

- Set the parameters for the halftone screen.
- Print a *color composite*, often called a *color comp*. A color composite is a single print that combines the red, green, and blue channels of an RGB image (or the cyan, magenta, yellow, and black channels of a CMYK image). This indicates what the final printed image will look like.

- Print separations to make sure the image separates correctly.
- Print to film.

Printing a halftone

To specify the halftone screen when you print an image, you use the Screen option in the Page Setup dialog box. The results of using a halftone screen appear only in the printed copy; you cannot see the halftone screen on-screen.

You use one halftone screen to print a grayscale image. You use four halftone screens (one for each process color) to print color separations. In this example, you'll be adjusting the screen frequency and dot shape to produce a halftone screen for a grayscale image.

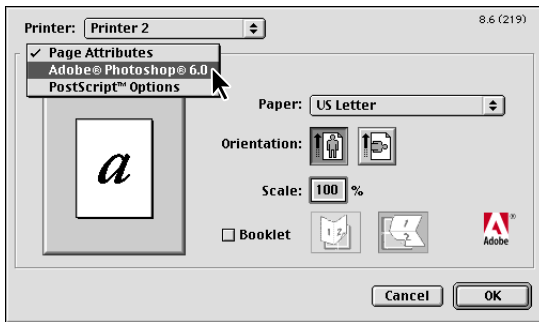
The *screen frequency* controls the density of dots on the screen. Since the dots are arranged in lines on the screen, the common measurement for screen frequency is lines per inch (lpi). The higher the screen frequency, the finer the image produced (depending on the line screen capability of the printer). Magazines, for example, tend to use fine screens of 133 lpi and higher because they are usually printed on coated paper stock on high-quality presses. Newspapers, which are usually printed on lower-quality paper stock, tend to use lower screen frequencies, such as 85-lpi screens.

The *screen angle* used to create halftones of grayscale images is generally 45°. For best results with color separations, select the Auto option in the Halftone Screens dialog box (choose Page Setup > Screens > Halftone Screens). You can also specify an angle for each of the color screens. Setting the screens at different angles ensures that the dots placed by the four screens blend to look like continuous color and do not produce moiré patterns.

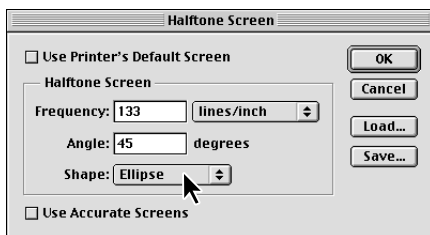
Diamond-shaped dots are most commonly used in halftone screens. In Adobe Photoshop, however, you can also choose round, elliptical, linear, square, and cross-shaped dots.

Note: By default, an image will use the halftone screen settings of the output device or of the software from which you output the image, such as a page-layout program. You usually don't need to specify halftone screen settings in the following way unless you want to override the default settings.

- 1 Select 12Start.eps to make it the active window.
- 2 Choose Image > Mode > Grayscale; then click OK to discard the color information.
- 3 Choose File > Page Setup, and choose Adobe® Photoshop® 6.0. (Depending on the printer driver you currently have selected, Photoshop 6 options may already be displayed. The specific options that appear in the dialog box depend on the printer you have selected.)




- 4 Click Screen.
- 5 In the Halftone Screen dialog box, deselect the Use Printer's Default Screen check box to enter another number.
- 6 Enter 133 in the Frequency text box, and make sure that the unit of measurement is set to Lines/Inch.
- 7 For Angle, enter a screen angle of 45°.
- 8 For Shape, choose Ellipse.



- 9 Click OK; then click OK again in the Page Setup dialog box.
- 10 To print the image, choose File > Print. (If you don't have a printer, skip this step.)
- 11 Look at the printed output to see the shape of the halftone dots (in this case, Ellipse).

12 Choose File > Close, and don't save your changes.

 For more information about printing halftones, see Photoshop 6.0 online help.

Printing separations

By default, a CMYK image prints as a single document. To print the file as four separations, you need to select the Separations option in the Print dialog box. Otherwise the CMYK image prints as a single, composite image.

In this optional part of the lesson, you can print the file as separations.

1 Choose File > Open, and open the12Start.eps file in the Lessons/Lesson12 folder on your hard drive.

2 Choose File > Print.

3 Do one of the following:

- In Windows, for Space, choose Separations (at the bottom of the dialog box).
- In Mac OS, choose Adobe Photoshop 6.0. For Source Space, select Document. For Profile, choose Separations.

4 Click Print. (If you don't have a printer, skip this step.)

5 Choose File > Close, and don't save the changes.

This completes your introduction to producing color separations and printing using Adobe Photoshop.

 For information about all color management and printing options, see Photoshop 6.0 online Help.

Review questions

- 1 What steps should you follow to reproduce color accurately?
- 2 What is a gamut?
- 3 What is an ICC profile?
- 4 What is a color separation? How does a CMYK image differ from an RGB image?
- 5 What steps should you follow when preparing an image for color separations?

Review answers

- 1 Calibrate your monitor, and then use the Color Settings dialog box to specify which color spaces to use. For example, you can specify which RGB color space to use for online images and which CMYK color space to use for images that will be printed. You can then proof the image, check for out-of-gamut colors, adjust colors as needed, and for printed images, create color separations.
- 2 The range of colors that can be reproduced by a color model or device. For example, the RGB and CMYK color models have different gamuts, as do any two RGB scanners.
- 3 An ICC profile is a description of a device's color space, such as the CMYK color space of a particular printer. Applications such as Photoshop can interpret ICC profiles in an image to maintain consistent color across different applications, platforms, and devices.
- 4 A color separation is created when an image is converted to CMYK mode. The colors in the CMYK image are separated in the four process color channels: cyan, magenta, yellow, and black. An RGB image has three color channels: red, green, and blue.
- 5 You prepare an image for print by following the steps for reproducing color accurately, and then converting the image from RGB mode to CMYK mode to build a color separation.