

# 14

## PRODUCING AND PRINTING CONSISTENT COLOR

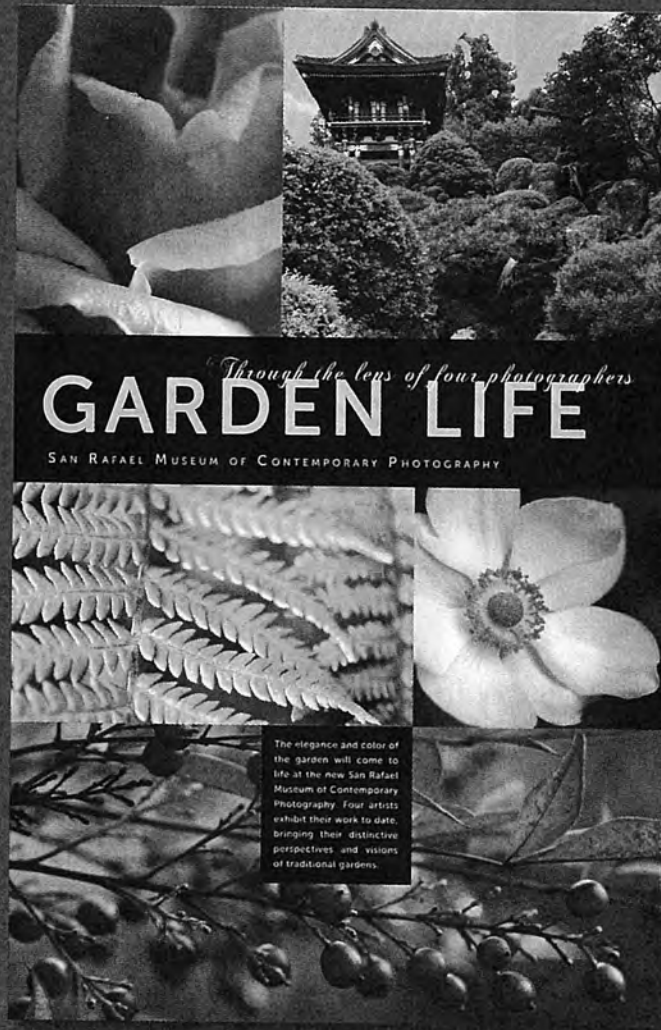
### Lesson overview

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.
- Save an image as a CMYK EPS file.
- Create and print a four-color separation.
- Understand how images are prepared for printing on presses.



This lesson will take less than an hour to complete. Copy the Lesson14 folder onto your hard drive if you haven't already done so. As you work through this lesson, you'll preserve the start files. If you need to restore the start files, copy them from the *Adobe Photoshop CS6 Classroom in a Book* DVD.

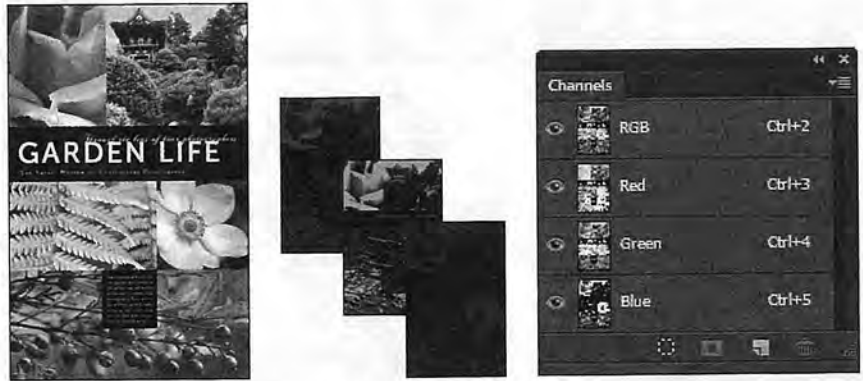


To produce consistent color, you define the color space in which to edit and display RGB images, and the color space in which to edit, display, and print CMYK images. This helps ensure a close match between onscreen and printed colors.

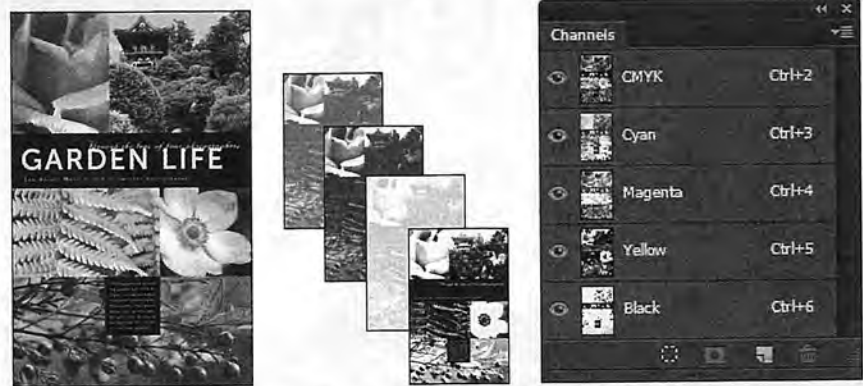
# About color management

● **Note:** One exercise in this lesson requires that your computer be connected to a PostScript color printer. If it isn't, you can do most, but not all, of the exercises.

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.

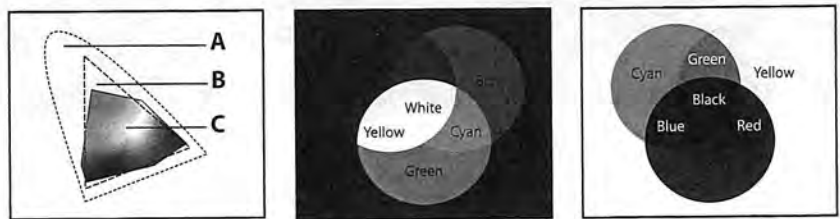


RGB image with red, green, and blue channels



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

Because the RGB and CMYK color models use different methods to display colors, each reproduces a different *gamut*, or range, of colors. For example, RGB uses light to produce color, so 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 the RGB gamut, such as some pastels and pure black.



- A. Natural color gamut
- B. RGB color gamut
- C. CMYK color gamut

RGB color model

CMYK color model

But not all RGB and CMYK gamuts are alike. Each monitor and printer model differs, 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, while other parts are 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. But 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.

The color management system in Photoshop uses International Color Consortium (ICC)-compliant color profiles to convert colors from one color space into another. A color profile is a description of a device's color space, such as the CMYK color space of a particular printer. You specify which profiles to use to accurately proof and print your images. Once you've selected the profiles, Photoshop can embed them into your image files, so that Photoshop and other applications can accurately manage color for the image.

For information on embedding color profiles, see Photoshop Help.

Before you begin working with color management, you should calibrate your monitor. If your monitor doesn't display colors accurately, color adjustments you make based on the image you see on your monitor may not be accurate. For information about calibrating your monitor, see Photoshop Help.

# Getting started

First, start Photoshop and restore its default preferences.

- 1 Start Photoshop, and then immediately hold down Ctrl+Alt+Shift (Windows) or Command+Option+Shift (Mac OS) to restore the default preferences. (See “Restoring default preferences” on page 4.)
- 2 When prompted, click Yes to delete the Adobe Photoshop Settings file.

## Specifying color-management settings

In the first part of this lesson, you’ll learn how to set up a color-managed workflow in Photoshop. Most of the color-management controls you need are in the Color Settings dialog box.

By default, Photoshop is set up for RGB as part of a digital workflow. If you are preparing artwork for print production, however, you’ll want to 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 creating customized color settings.

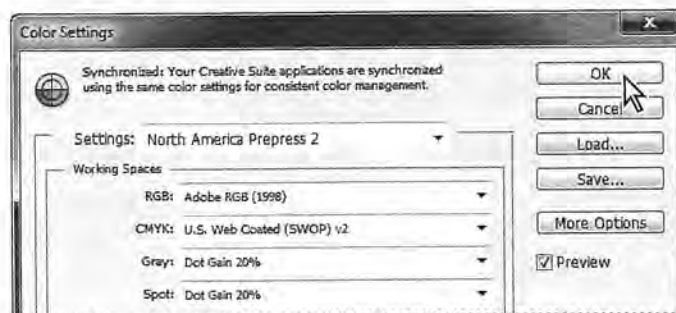
- 1 Choose Edit > Color Settings to open the Color Settings dialog box.

The bottom of the dialog box interactively describes each option.

- 2 Move the pointer over each part of the dialog box, including the names of areas (such as Working Spaces), the menu names, and the menu options. As you move the pointer, Photoshop displays information about each item. When you’ve finished, return the options to their defaults.

Now, you’ll choose a set of options designed for a print workflow, rather than an online workflow.

- 3 Choose North America Prepress 2 from the Settings menu. The working spaces and color-management policy options change for a prepress workflow. Then click OK.



# Proofing an image

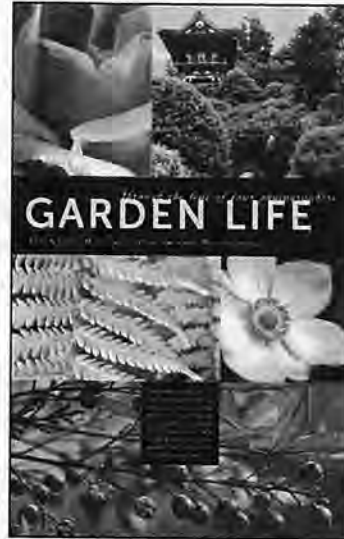
You'll select a proof profile so that you can view a close onscreen representation of what an image will look like when printed. An accurate proof profile lets you proof on the screen (*soft-proof*) for printed output.

- 1 Choose File > Open. Navigate to the Lessons/ Lesson14 folder, and double-click the 14Start.tif file. Click OK if you see an embedded profile warning.

An RGB image of a scanned poster opens.

- 2 Choose File > Save As. Rename the file **14Working.tif**, keep the TIFF format selected, and click Save. Click OK in the TIFF Options dialog box.

Before soft-proofing 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 adjusts the onscreen appearance accordingly. 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. The Customize Proof Condition dialog box opens. Make sure Preview is selected.
- 4 From the Device To Simulate menu, choose a profile that represents the final output device, such as that for 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.
- 5 Make sure that Preserve Numbers is *not* selected.

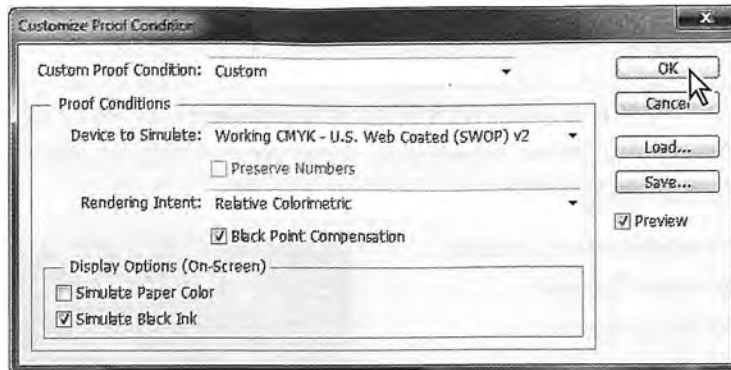
The Preserve Numbers option simulates how colors will appear without being converted to the output device color space.

- 6 From the Rendering Intent menu, choose Relative Colorimetric.

A rendering intent determines how the color is converted from one color space to another. Relative Colorimetric, which preserves color relationships without sacrificing color accuracy, is the standard rendering intent for printing in North America and Europe.

- 7 If it's available for the profile you chose, select Simulate Black Ink. Then deselect it, and select Simulate Paper Color; notice that selecting this option automatically selects Simulate Black Ink. Click OK.

● **Note:** The Preserve Numbers option is not available when the U.S. Web Coated (SWOP) v2 profile is selected.



► **Tip:** To display the document with and without the proof settings, choose View > Proof Colors.

Notice that the image appears to lose contrast. Paper Color simulates the dingy white of real paper, according to the proof profile. Black Ink simulates the dark gray that actually prints to most printers, instead of solid black. Not all profiles support these options.



Normal image



Image with Paper Color and Black Ink options selected

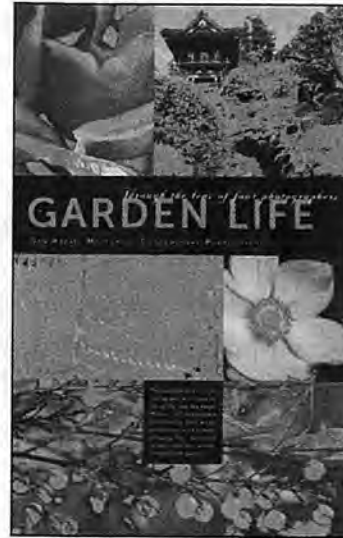
## Identifying out-of-gamut colors

Most scanned photographs contain RGB colors within the CMYK gamut, so changing the image to CMYK mode 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.

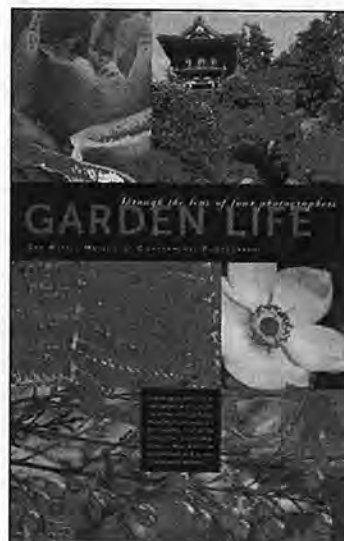
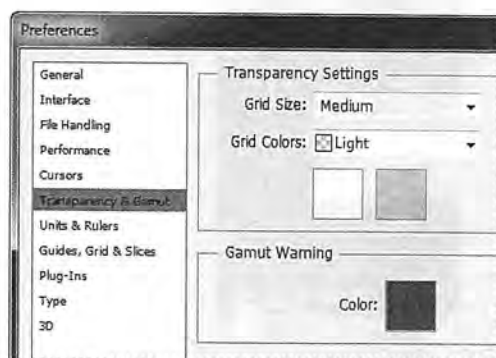
Before you convert an image from RGB to CMYK, you can preview the CMYK color values while still in RGB mode.

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

Because the gray can be hard to spot in the image, you'll convert it to a more visible color.



- 2 Choose Edit > Preferences > Transparency And Gamut (Windows) or Photoshop > Preferences > Transparency And Gamut (Mac OS).
- 3 Click the color sample in the Gamut Warning area at the bottom of the dialog box. Select a vivid color, such as purple or bright green, and click OK.
- 4 Click OK to close the Preferences dialog box.
- 5 Click anywhere on the image with the Move tool. The bright new color you chose appears instead of the neutral gray as the gamut warning color.





6 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 that are necessary. In this exercise, you'll add some tonal and color adjustments to correct an off-color scan of the original poster.

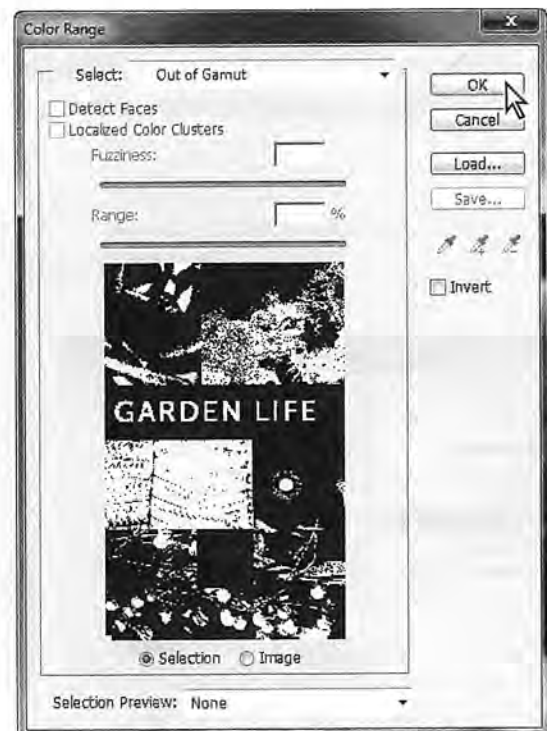
So that you can compare the image before and after making corrections, you'll start by making a copy.

- 1 Choose Image > Duplicate, and click OK to duplicate the image.
- 2 Choose Window > Arrange > 2 Up Vertical so you can compare the images as you work.

You'll adjust the hue and saturation of the image to move all colors into gamut.

- 3 Select 14Working.tif (the original image).
- 4 Choose Select > Color Range.
- 5 In the Color Range dialog box, choose Out Of Gamut from the Select menu, and then click OK.

The areas that were marked as out of gamut earlier are now selected, so you can make changes that affect only those areas.



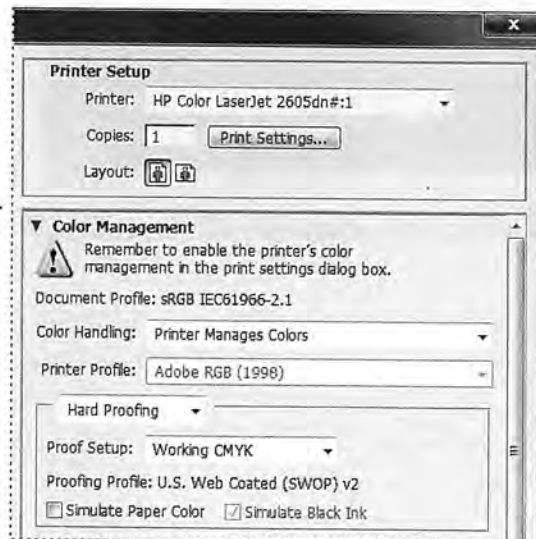
- 6 Click the Hue/Saturation button in the Adjustments panel to create a Hue/Saturation adjustment layer. (Choose Window > Adjustments if the panel isn't open.) The Hue/Saturation adjustment layer includes a layer mask, created from your selection.
- 7 In the Properties panel, do the following:
  - Drag the Hue slider until the colors look more neutral (we used -5).
  - Drag the Saturation slider until the intensity of the colors looks more realistic (we used -40).
  - Leave the Lightness setting at the default value (0).



- 8 Choose View > Gamut Warning. You have removed most of the out-of-gamut colors from the image. Choose View > Gamut Warning again to deselect it.
- 9 With 14Working.tif still selected, choose File > Print.

- 10 In the Print dialog box, do the following:

- Choose your printer from the Printer menu.
- In the Color Management area of the dialog box, choose Printer Manages Colors from the Color Handling menu.
- Choose Hard Proofing from the pop-up menu.
- For Proof Setup, choose Working CMYK.
- If you have a color PostScript printer, click Print to print the image, and compare the color with the onscreen version. Otherwise, click Cancel.

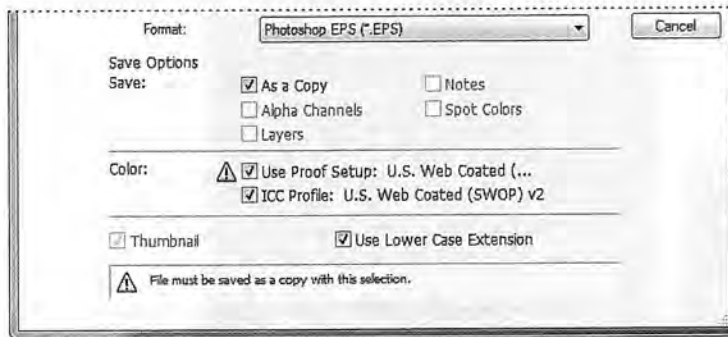


# Saving the image as a CMYK EPS file

You'll save the image as an EPS file in CMYK format.

- 1 With 14Working.tif still selected, choose File > Save As.
- 2 In the Save As dialog box, do the following, and then click Save:
  - Choose Photoshop EPS from the Format menu.
  - Under Color, select Use Proof Setup. Don't worry about the warning icon; you'll save a copy.
  - Accept the filename 14Working.eps.

**Note:** These settings cause the image to be automatically converted from RGB to CMYK when it is saved in the Photoshop Encapsulated PostScript (EPS) format.



- 3 Click OK in the EPS Options dialog box that appears.
- 4 Save and then close the 14Working.tif and 14Working copy.tif files.
- 5 Choose File > Open, navigate to the Lessons/Lesson14 folder, and double-click the 14Working.eps file.



Notice in the image file's title bar that 14Working.eps is a CMYK file.

# Printing

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

- Print a *color composite*, often called a *color comp*, to proof your image. 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.
- Set the parameters for the halftone screen.
- Print separations to make sure the image separates correctly.
- Print to film or plate.

When you print color separations, Photoshop prints a separate sheet, or *plate*, for each ink. For a CMYK image, it prints four plates, one for each process color.

In this exercise, you'll print color separations.

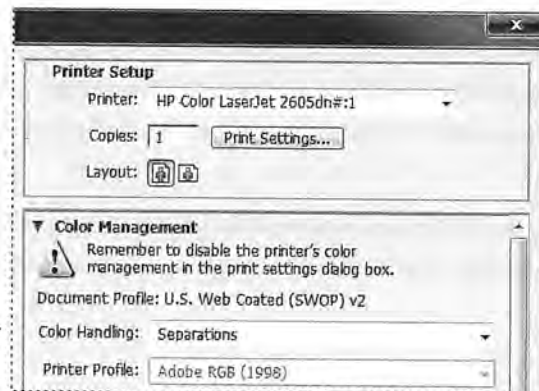
- 1 With the 14Working.eps image open from the previous exercise, choose File > Print.

By default, Photoshop prints any document as a composite image. To print this file as separations, you need to explicitly instruct Photoshop in the Print dialog box.

- 2 In the Print dialog box, do the following:

- In the Color Management area, choose Separations from the Color Handling menu.
- Click Print.

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



This lesson has provided an introduction to printing and producing consistent color from Adobe Photoshop. If you're printing on a desktop printer, you can experiment with different settings to find the best color and print settings for your system. If you're preparing images for professional printing, consult with your print service provider to determine the best settings to use. For more information about color management, printing options, and color separations, see Photoshop Help.

## Review questions

- 1 What steps should you follow to reproduce color accurately?
- 2 What is a gamut?
- 3 What is a color profile?
- 4 What are color separations?

## Review answers

- 1 To reproduce color accurately, first 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 A gamut is 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 A color 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 color profiles in an image to maintain consistent color across different applications, platforms, and devices.
- 4 Color separations are separate plates for each ink used in a document. Often, you'll print color separations for the cyan, magenta, yellow, and black (CMYK) inks.

