10-1 Printer Types and Features

Core 1 Objectives

- 3.6

  Given a scenario, deploy and configure multifunction devices/printers and settings.

- 3.7

  Given a scenario, install and replace printer consumables.

Printers come in many different types with varying features and are chosen by the production needs of users. Printers are capable of printing anything from a simple document to an entire building. Commonly, IT technicians support printers that print documents, receipts, photos, and even 3D objects. Many of these printers are multifunctional and not only print but also scan and fax documents or photos.

On the output side of this process, the major categories of printer types include laser, inkjet (ink dispersion), impact, thermal, and 3D printers. In the following sections, we look at the different types of printers for desktop computing. Table 10-1 lists some popular printer manufacturers.

Table 10-1

Printer Manufacturers

Printer Manufacturer	Website
Brother	brother-usa.com
Canon	usa.canon.com
Epson	epson.com
Hewlett-Packard	hp.com
Konica Minolta	kmbs.konicaminolta.us
Lexmark	lexmark.com
Oki Data	okidata.com
Xerox	xerox.com
Zebra Technologies	zebra.com

10-1a Scanners

As an output device, a printer converts digital data to hard copy on paper. Some printers are also multifunction input devices that can work as a scanner to scan printed paper and print additional hard copies of that information or create a digital file from it. The file can then be saved on a computer or sent out over a phone or network connection. A scanner can also be a dedicated device with no printing,

copying, or faxing capability. Scanners, whether dedicated devices or integrated in a printer, come in two primary types:

- **Flatbed scanners** must be fed one page at a time, with each page being lined up on a glass surface.
- **ADF (automatic document feeder) scanners** can automatically process a stack of papers, cards, or envelopes, pulling each page individually into a roller system for scanning and then spitting it out into a separate tray.

Note 1

For heavy business use, sometimes it's best to purchase a dedicated machine for each purpose instead of bundling many functions into a single machine. For example, if you need a scanner and a printer, purchase a good printer and a good scanner rather than a combo machine. Routine maintenance and troubleshooting are easier and less expensive on single-purpose machines, although the initial cost is higher. On the other hand, for home or small office use, a combo device can save money and counter space.

Exam Tip

The A+ Core 1 exam might give you a scenario that requires you to perform installation or maintenance steps on these types of printers: laser, inkjet, impact, thermal, and 3D printers.

10-1b Laser Printers

Core 1 Objective

- 3.7

Given a scenario, install and replace printer consumables.

A **laser printer** is a type of electro-photographic printer that can range from a small personal desktop model to a large network printer capable of handling and printing large volumes continuously. Figure 10-1 shows an example of a typical laser printer for a small office.

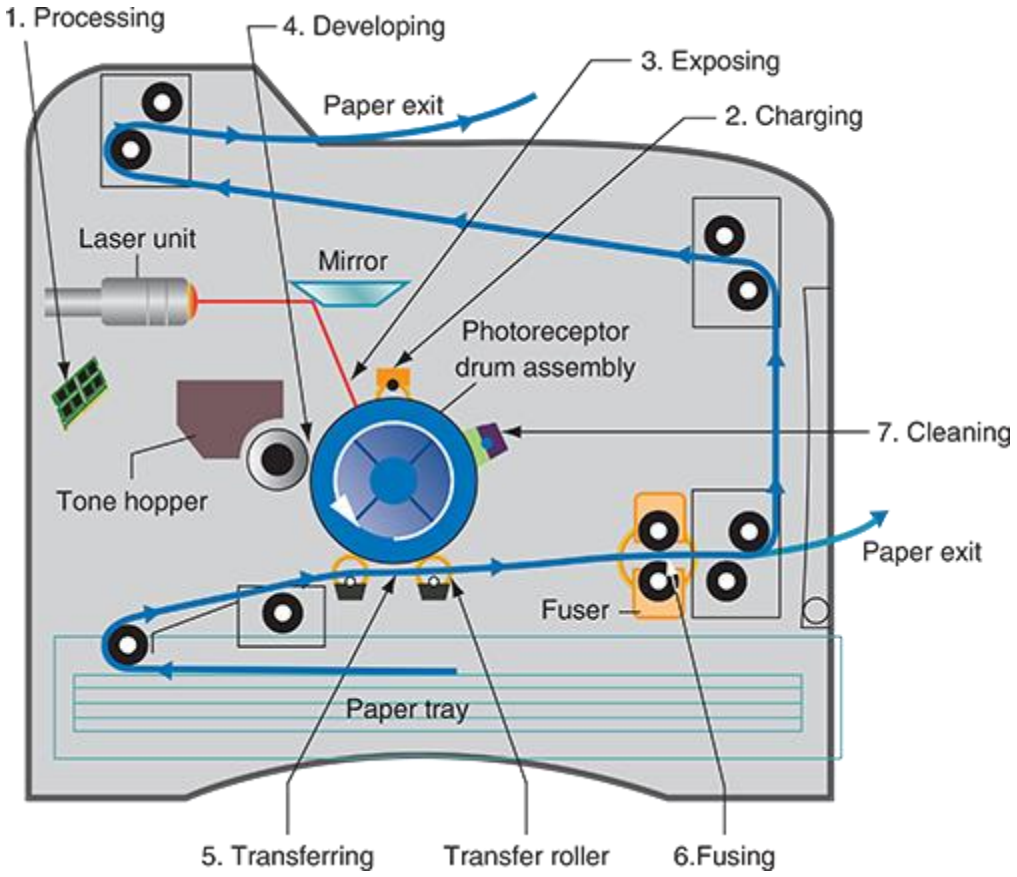
Figure 10-1

A Samsung Xpress color multifunction laser printer

Laser printers require the interaction of mechanical, electrical, and optical technologies. They work by placing toner on an electrically charged rotating drum called the **imaging drum**, transferring the toner onto paper as the paper moves through the system, and then fusing the toner to the paper. Figure 10-2 shows the seven steps of laser printing.

Figure 10-2

The seven progressive steps of laser printing



Note that Figure 10-2 shows only a cross-section of the drum, mechanisms, and paper. Remember that the drum is as wide as a sheet of paper. The mirror, blades, and rollers in the drawing are also as wide as paper. Also know that toner responds to a charge and moves from one surface to another if the second surface has a more positive charge than the first.

Exam Tip

The A+ Core 1 exam might give you a scenario that requires you to solve a problem using your knowledge of the seven steps of laser printing. Be sure you know the order of steps.

Laser Printing Steps

The seven steps of laser printing are described next:

1. **Processing the image.** A laser printer processes and prints an entire page at one time. The page data comes to the printer encoded in a **page description language (PDL)**, which describes the appearance of the printed page that the printer understands. The firmware inside the printer processes the incoming data to produce a bitmap (a bunch of bits in rows and columns) of the final page, which is stored in the printer's memory. One bitmap image is produced for monochrome images. For color images, one bitmap is produced for each of four colors. (The colors are blue, red, yellow, and black—better known as cyan, magenta, yellow, and black, and sometimes written as CMYK.)

2. **Charging or conditioning.** During **charging**, the drum is conditioned by a roller that places a high, uniform electrical charge of –600 V to –1000 V on the surface of the drum. The roller is called the primary charging roller or primary corona, and it is charged by a high-voltage power supply assembly. For some printers, a corona wire is used instead of the charging roller to charge the drum.
3. **Exposing or writing.** A laser beam controlled by motors and a mirror scans across the drum until it completes the correct number of passes. The laser beam is turned on and off continually as it makes a single pass down the length of the drum, once for each raster line, so that dots are exposed only where toner should go to print the image. A raster line, or scan line, is the horizontal line of dots across the page or image. For example, for a 1200 dots-per-inch (dpi) printer, the beam makes 1200 passes for every inch of the drum circumference. This means that 1200 dots are exposed or not exposed along the drum for every inch of linear pass. The 1200 dots per inch down this single pass, combined with 1200 passes per inch of drum circumference, accomplish the resolution of 1200 × 1200 dots per square inch of many laser printers. For each exposed dot, the laser beam applies a charge of –100 V, which is significantly more positive than for the unexposed dots on the drum. The charge on this image area will be used in the developing stage to transmit toner to the drum surface.
4. **Developing.** The developing cylinder applies toner to the surface of the drum. The toner is charged between –200 V and –500 V, and it sticks to the developing cylinder because of a magnet inside it.

   A control blade prevents too much toner from sticking to the cylinder surface. As the cylinder rotates very close to the drum, the toner is attracted to the parts of the drum surface that have a –100 V charge, and it is repelled from the more negatively charged parts of the drum surface. The result is that toner sticks to the drum where the laser beam has hit, and it is repelled from the areas where the laser beam has not hit.

5. **Transferring.** During transfer, a strong electrical charge draws the toner off the drum onto the paper. This is the first step that takes place outside the cartridge and the first step that involves the paper. The soft, black **transfer roller** puts a positive charge on the paper to pull the toner from the drum onto the paper. Then the static charge eliminator weakens the charges on both the paper and the drum, so the paper does not stick to the drum. The stiffness of the paper and the small radius of the drum also help the paper move away from the drum and toward the fusing assembly. Very thin paper can wrap around the drum, which is why printer manuals usually instruct you to use only paper designated for laser printers.

6. **Fusing.** The **fuser assembly** uses heat and pressure to fuse the toner to the paper. Up to this point, the toner is merely sitting on the paper. The fusing rollers apply heat to the paper, which causes the toner to melt, and the rollers apply pressure to bond the melted toner into the paper. The temperature of the rollers is monitored by the printer. If the temperature exceeds an allowed maximum value (for example,), the printer shuts down.
7. **Cleaning.** A sweeping blade cleans the drum of any residual toner. The charge left on the drum is then neutralized. Some printers use erase lamps in the top cover of the printer for this purpose. The lamps use red light so they won't damage the photosensitive drum.

For color laser printers, the writing process repeats four times, one for each toner color of cyan, magenta, yellow, and black. Each color might require a separate image drum, although many color printers can use the same drum for all four colors. Then the paper passes to the fusing stage, where the fuser bonds all toner to the paper and aids in blending the four tones to form specific colors.

Exam Tip

The A+ Core 1 exam expects you to know these laser printer terms: imaging drum, fuser assembly, transfer belt, transfer roller, pickup roller, separate pads, and duplexing assembly.

Note 2

Watching a video of the laser printing process can be helpful when trying to remember how it all works. A quick search on YouTube returns several good videos about the laser printing process. Watching a short video is worth the time.

Cartridges and Other Replaceable Parts

The charging, exposing, developing, and cleaning steps use the printer components that undergo the most wear. To make the printer last longer, some or all of these steps are done inside a removable cartridge that can be replaced as a single unit. For older printers, all four steps are done inside one cartridge. For newer printers, the charging, exposing, and cleaning steps are done inside the image drum cartridge. The developing cylinder is located inside the toner cartridge. The transferring is done using a **transfer belt** that can be replaced on some printers, and the fusing is done inside a fuser cartridge, which also might be replaceable.

By using these multiple cartridges inside laser printers, the cost of maintaining a printer is reduced. You can replace one cartridge without having to replace them all. The toner cartridge needs replacing the most often, followed by the image drum, the fuser cartridge, and the transfer assembly, in that order.

Other printer parts that might need replacing include the **pickup roller**, which pushes a sheet of paper forward from the paper tray, and the **separation pad** (also called a **separate pad**), which keeps more than one sheet of paper from moving forward. If the pickup roller is worn, paper may misfeed into the printer. If the separation pad is worn, multiple sheets of paper may be drawn into the printer. Sometimes you can clean a pickup roller or separation pad to prolong its life before it needs replacing.

Note 3

Before replacing expensive parts in a printer, consider whether purchasing a new printer might be more cost-effective than repairing the old one.

Duplexing Assembly

A printer that is able to print on both sides of the paper is called a **duplex printer** or a double-sided printer. Many laser printers and a few inkjet printers offer this feature. After the front of the paper is printed, a **duplexing assembly**, which contains several rollers, turns the paper around and draws it back through the print process to print on the back of the paper. Alternatively, some high-end printers have two print engines so both sides of the paper are printed at the same time.

Main content

10-1c Inkjet Printers

Core 1 Objective

- 3.7

Given a scenario, install and replace printer consumables.

An **inkjet printer** (see Figure 10-3) uses a type of ink-dispersion printing and doesn't normally provide the high-quality resolution of laser printers. Inkjet printers are popular because they are small and can print color inexpensively. Most inkjet printers today can print high-quality photos, especially when used with photo-quality paper.

Figure 10-3

An example of an inkjet printer with feeder trays open

An inkjet printer uses a **print head** that moves across the paper, creating one line of the image with each pass. The printer puts ink on the paper using a matrix of small dots. Different types of inkjet printers form their droplets of ink in different ways. Printer manufacturers use several technologies, one of which is the bubble-jet. Bubble-jet printers use tubes of ink that have tiny resistors near the end of each tube. These resistors heat up and cause the ink to boil. Then a tiny air bubble of ionized ink (ink with an electrical charge) is ejected onto the paper. A typical bubble-jet print head has 64 or 128 tiny nozzles, all of which can fire a droplet simultaneously. (High-end printers can have as many as 3000 nozzles.) Plates carrying a magnetic charge direct the path of ink onto the paper to form shapes.

Inkjet printers include one or more **ink cartridges** to hold the different colors of ink for the printer. Figure 10-4 shows four ink cartridges. A black cartridge is on the left, and the three color cartridges are cyan, yellow, and magenta. For this printer, a print head is built into each ink cartridge.

Figure 10-4

The ink cartridges of an inkjet printer

A stepper motor moves the print head and ink cartridges across the paper using a carriage and belt to move the assembly and stabilizing bars to control the movement (see Figure 10-5). A paper tray can hold a stack of paper, and a paper feeder on the back of the printer can hold a few sheets of paper. The sheets stand up in the feeder and are dispensed one at a time. Rollers pull a single sheet into the printer from the paper tray or paper feeder. A motor powers these rollers and times the sheet going through the printer in the increments needed to print the image. When the printer is not in use, the assemblage sits in the far-right position, which is called the home position or parked position. This position helps protect the ink in the cartridges from drying out. Figure 10-5 shows the assemblage positioned so that the ink cartridges are accessible for replacement.

Figure 10-5

The belt and stabilizing bars used to move the print head across the page

Some inkjet printers offer duplex printing. These printers are larger than normal inkjet printers because of the added space required for the duplexing assembly. For duplex printing, be sure to use heavy paper (rated at 24-pound paper or higher) so the ink doesn't bleed through.

Even with single-sided printing, inkjet printers tend to smudge on inexpensive paper, and they are slower than laser printers. If a printed page later becomes damp, the ink can run and get quite messy. The quality of the paper used with inkjet printers significantly affects the quality of printed

output. You should use only paper that is designed for an inkjet printer, and you should use a high-grade paper to get the best results.

Note 4

Weight and brightness are the two primary ways of measuring paper quality. The rated weight of paper (for example, 20–32 pounds) determines the thickness of the paper. Brightness is measured on a scale of 92 to 100.

Note 5

Photos printed on an inkjet printer tend to fade over time, more so than photos produced professionally. To make your photos last longer, use high-quality photo paper (rated at high gloss or studio gloss) and use fade-resistant ink (such as Vivera ink by HP). Then protect these photos from exposure to light, heat, humidity, and polluted air. To best protect photos made by an inkjet printer, keep them in a photo album rather than displayed and exposed to light.

When purchasing an inkjet printer, look for the kind that uses two or four separate cartridges. One cartridge is used for black ink. Three cartridges, one for each color, give better-quality color than one cartridge that holds all three colors. Some low-end inkjet printers use a single three-color cartridge and don't have a black ink cartridge. These printers must combine all colors of ink to produce a dull black. Having a separate cartridge for black ink means that it prints true black and, more important, does not use the more expensive colored ink for black print. To save money, you should be able to replace an empty cartridge without having to replace all cartridges.

Note 6

It's possible to refill an ink cartridge, and many companies will sell you the tools and ink you need as well as show you how to do it. You can also purchase refilled cartridges at reduced prices. When you purchase ink cartridges, make sure you know if they are new or refilled. Also, for best results, don't refill a cartridge more than three times. Many manufacturers and retail shops will accept empty cartridges for recycling.

10-1d Impact Printers

Core 1 Objective

- 3.7

Given a scenario, install and replace printer consumables.

An **impact printer** creates a printed page by using some mechanism that touches or hits the paper, similar to a typewriter. The best-known impact printer is a dot matrix printer, which prints only text that it receives as raw data. It has a print head that moves across the width of the paper, using pins to print a matrix of dots on the page. The pins shoot against a cloth ribbon, which hits the paper, depositing the ink. The

ribbon provides both the ink for printing and the lubrication for the pinheads. The quality of the print on an impact printer is poor compared with other printer types. However, you still see impact printers in use for three reasons:

- They use continuous **tractor feeds** and fanfold paper (also called computer paper) rather than individual sheets of paper, making them useful for logging ongoing events or data.
- They can use carbon paper to print multiple copies at the same time.
- They are extremely durable, give little trouble, and seem to last forever.

Exam Tip

The A+ Core 1 exam might give you a scenario that requires you to install or maintain an impact printer's print head, ribbon, and tractor feed, or to work with the impact paper used in the printer.

Maintaining a dot matrix impact printer is easy. The **impact paper** used by these printers comes as a box of fanfold paper or in rolls (used with receipt printers). When the paper is nearing the end of the stack or roll, a color on the edge alerts you to replace the paper. Occasionally, you should replace the ribbon of a dot matrix printer. If the print head fails, check on the cost of replacing the head versus the cost of buying a new printer. Sometimes, the cost of the head is so high that it's best to just buy a new printer. Overheating can damage a print head (see Figure 10-6), so keep it as cool as possible to make it last longer. Keep the printer in a cool, well-ventilated area, and don't use it to print more than 50–75 pages without allowing the head to cool down.

Figure 10-6

Keep the print head of a dot matrix printer as cool as possible so it will last longer

10-1e Thermal Printers

Core 1 Objective

- 3.7

Given a scenario, install and replace printer consumables.

Thermal printers use heat to create an image. Two types of thermal printers are a direct thermal printer and a thermal transfer printer. The older **direct thermal printer** burns dots onto specially coated paper called **thermal paper**; this process was used by older fax machines. The process requires no ink and does not use a ribbon. Direct thermal printers are often used as receipt printers that use rolls of thermal paper (see Figure 10-7). You know it's time to replace the paper roll on this type of thermal printer when it shows a color strip down one edge. The printed image can fade over time or if it interacts with another heat source or ultraviolet light.

Figure 10-7

The TM-T88V direct thermal printer by EPSON

Courtesy of EPSON America, Inc.

A **thermal transfer printer** uses a ribbon that contains wax-based ink. The heating element melts the ribbon (also called foil) onto special thermal paper so it stays glued to the paper as the feed assembly moves it through the printer. Thermal transfer printers are used to print receipts, barcode labels, clothing labels, or container labels. Figure 10-8 shows a thermal transfer printer used to make barcodes and other labels.

Figure 10-8

The GC420 printer by Zebra is both a thermal transfer printer and a direct thermal printer

Courtesy of Zebra Technologies

Thermal printers are reliable and easy to maintain. It's important to regularly clean the print head on a thermal printer because buildup can harden over time and permanently damage the head. Follow the printer manufacturer's directions to clean the print head. Some thermal printer ribbons have a print head cleaning stripe at the end, and it's a good idea to clean the head each time you replace the ribbon. Additionally, some manufacturers suggest cleaning the head with isopropyl alcohol wipes.

When cleaning, remove any dust and debris that get down in the print head assembly. As you work, ground yourself to protect the sensitive heating element against static electricity. Don't touch the heating element with your fingers. You might need to clean it with a lint-free cotton swab dabbed in isopropyl alcohol. Also, to prolong the life of the print head, use the lowest heat setting for the heating element that still gives good printing results.

Exam Tip

The A+ Core 1 exam might give you a scenario that requires you to install or maintain the feed assembly or heating element used in thermal printers, or you might need to work with the special thermal paper used in the older direct thermal printers.

10-1f3D Printers

Core 1 Objective

- 3.7

Given a scenario, install and replace printer consumables.

While impact printers and thermal printers have been around for a very long time, a newer type of printer is the 3D printer. **3D printers** use a plastic filament or a resin to build a 3D model of a digital image. In Figure 10-9, notice the coil of **filament**, a thermoplastic strand, on the left that is fed into the 3D printer, which heats the plastic and deposits thin layer upon layer onto the print bed to build a three-dimensional object. A **print bed** on a 3D printer is where the filament is deposited to build the objects. Some print beds are fixed whereas others move, depending on the technology used in the printer. Filament 3D printers are better able to create hollow objects, and filament is less expensive than resin.

Figure 10-9

A 3D printer heats a plastic filament and layers the plastic to build three-dimensional objects

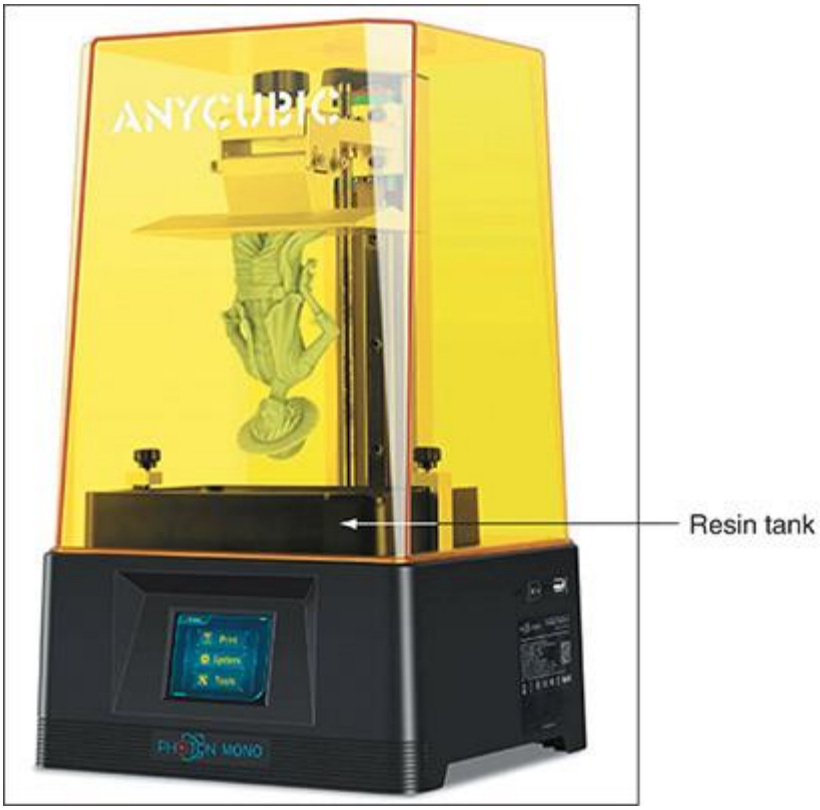
iStock.com/izusek

A resin 3D printer uses **resin**, a liquid photopolymer, which is held in a resin tank with a transparent bottom. A resin 3D printer projects UV light up through the bottom of the resin tank to cure layer under layer to build three-dimensional objects. A 3D object printed using resin is printed upside down because it raises up out of the resin tank layer by layer (see Figure 10-10).

Resin 3D printers produce objects that are stronger and smoother than filament 3D printers, but resin is more expensive than filament. When using a resin printer, always be sure to wear gloves because the resin is a toxin to your body. To fully harden an object printed using a resin 3D printer, you need a UV light-curing station. Both the resin tank and the print bed are considered consumable parts of a 3D printer.

Figure 10-10

A resin printer prints objects upside down



Source: Amazon.com, Inc.

When setting up a 3D printer, make sure the printer is level. The most common file type for a 3D image file is an STL file (.stl), which stands for stereolithography. You can buy premade images online from sites such as thingiverse.com. If you want to design your own images, you'll need a 3D modeling program. Some, such as Sketchup (sketchup.com) and Tinkercad (tinkercad.com), are free and easy to learn. Others have a much steeper learning curve and a higher price in exchange for more features. Any computer used for 3D imaging and design will perform more quickly and gracefully with more RAM and CPU power. Before you start printing, do some research online for tips on getting a cleaner finished product. YouTube has several informative videos by 3D Printing Nerd (the3dprintingnerd.com), Matter Hackers (matterhackers.com), Thomas Sanladerer (toms3d.org), and others.

Now let's turn our attention to using Windows to install, share, and manage printers.

Main content

10-2 Using Windows to Install, Share, and Manage Printers

Core 1 Objectives

- 3.6

  Given a scenario, deploy and configure multifunction devices/printers and settings.
- 3.7

  Given a scenario, install and replace printer consumables.

In this section of the module, you learn to install local and network printers, share an installed printer, secure a shared printer, and remotely use a shared printer. You also learn about how to configure printer add-ons and features. We begin with how to unbox a printer and then move on to installing local and network printers.

To properly unbox a printer, consider the following guidelines:

- Remove the printer from the box, keeping it upright, and remove protective packing foam pieces.
- Place the printer on a flat, hard surface near an outlet. The printer needs room for air movement around it.
- Remove any protective tapes or film from the printer, including the control screen.
- Plug the power cord into the printer and the outlet.
- Press the power button on the printer, and allow it to turn on fully.
- Add paper to the paper tray. If needed, remove protective tape from ink cartridges.
- Configure settings for intended use.

10-2a Local or Network Printer

Core 1 Objectives

- 3.6

  Given a scenario, deploy and configure multifunction devices/printers and settings.
- 3.7

  Given a scenario, install and replace printer consumables.

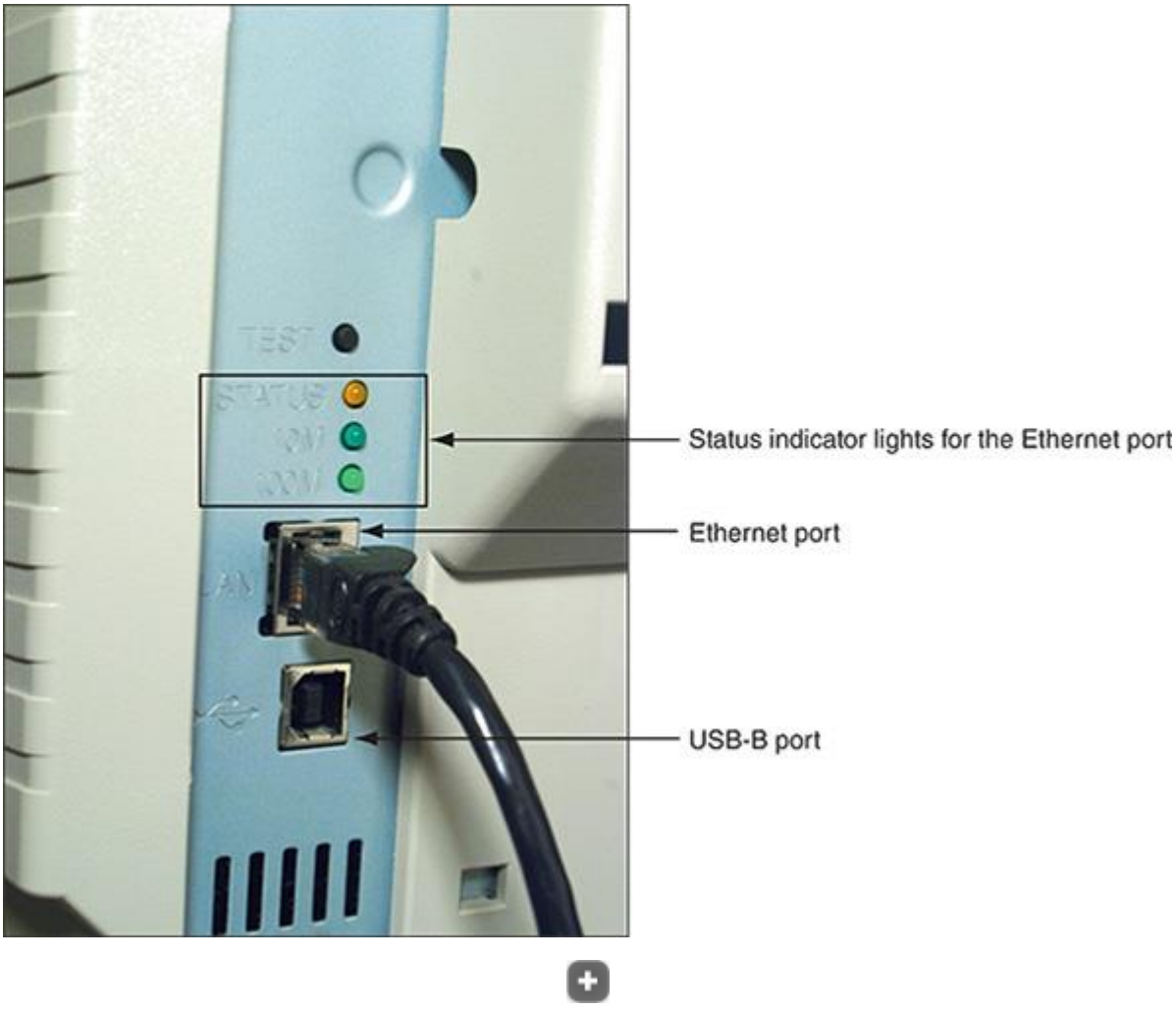
A printer connects to a single computer or to the network:

- A **local printer** connects directly to a computer by way of a USB port or wireless connection (Bluetooth or Wi-Fi). Most printers these days support more than one method.
- A **network printer** has an Ethernet port to connect directly to the network or uses Wi-Fi to connect to a wireless access point.

Some printers have both an Ethernet port and a USB-B port (see Figure 10-11), as well as multiple wireless connection options. These printers can be installed as either a network printer (connecting directly to the network) or a local printer (connecting directly to a computer).

Figure 10-11

This printer has an Ethernet port and a USB-B port



Two ways to install a printer and make it available on a network are as follows:

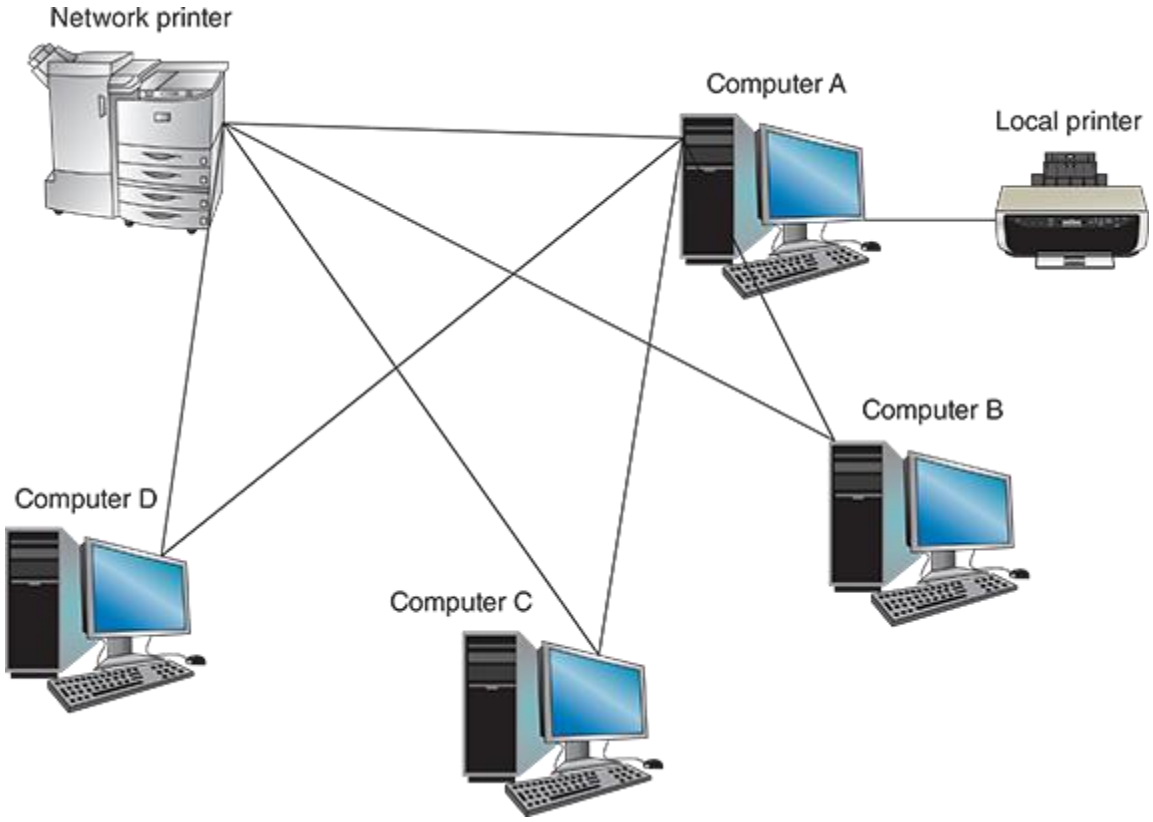
- **Shared local printer.** Connect a local printer to a computer on the network, and then share the printer through the computer's network

connection. See the local printer and computer A in Figure 10-12. Keep in mind the following two requirements when sharing a local printer:

  - For a shared local printer to be available to other computers on the network, the host computer must be turned on and not in sleep or standby mode.
  - For another computer on the network to use the shared printer, the appropriate printer drivers for the computer's OS must be installed on the remote computer.
- **Network printer.** A network printer can connect directly to a network with its own NIC (see the network printer in Figure 10-12), and it is identified on the network by its IP address or host name. To use the printer, any computer on the network can install this printer and print to it; this is called **remote printing**.

Figure 10-12

A shared local printer and a network printer



Note 7

A computer can have several printers installed. Of these, Windows designates one printer to be the **default printer**, which is the one Windows prints to unless another is selected.

10-2bWired or Wireless Printer Connections

Core 1 Objectives

- 3.6

  Given a scenario, deploy and configure multifunction devices/printers and settings.

- 3.7

  Given a scenario, install and replace printer consumables.

Connecting a wired printer (USB or Ethernet) is easy:

- **USB.** Plug the USB cable into the printer and computer, and Windows installs the printer automatically.
- **Ethernet.** Plug the Ethernet cable into the printer and network wall jack, switch, or router, and install the printer as a network printer on any computer on the network.

Connecting a wireless printer is a little more complex:

- **Bluetooth.** For a Bluetooth printer installed as a local printer, turn on Bluetooth in Windows, move the printer within range of the computer, and watch as the two Bluetooth devices pair up. While you might need to navigate some of the Bluetooth settings on the printer's display to enable pairing, the process works like most other Bluetooth connections.
- **Wi-Fi infrastructure mode.** In **infrastructure mode**, Wi-Fi devices connect to a Wi-Fi access point, such as a SOHO router. Put the Wi-Fi printer within range of the access point and use controls on the printer to select the Wi-Fi network using the highest IEEE standard (802.11x) supported by both the access point and the printer. Enter the security key to the network if one is required. All Wi-Fi printers support infrastructure connections, and some Wi-Fi printers can handle ad hoc connections, which are discussed next.
- **Wi-Fi ad hoc mode.** Some Wi-Fi printers can connect directly to a nearby computer in a Wi-Fi **ad hoc mode** network to be installed as a local printer. This is accomplished in different ways depending on the technology available in the printer and the computer:
  - Many modern Wi-Fi printers include the ability to host a Wi-Fi hotspot to which nearby computers can connect. The main disadvantage here is that most computers can connect to only one Wi-Fi network at a time, so if a computer is connected to the

printer's Wi-Fi network, it can't communicate with the Internet or other network resources.

- The reverse arrangement might work better: Set up a mobile hotspot on the computer and connect the printer to the computer's hotspot. In Windows 10, click the computer's notifications icon in the taskbar, and click the **Mobile hotspot** tile to turn it on. Right-click the tile, and click **Go to Settings**, where you'll find the hotspot's network name and network password. On the printer, use that information to connect to the computer's hotspot.

10-2c Installing a Local or Network Printer

Core 1 Objectives

- 3.6

Given a scenario, deploy and configure multifunction devices/printers and settings.

- 3.7

Given a scenario, install and replace printer consumables.

With some printers, you launch the installation program that came bundled on the setup CD or was downloaded from the printer manufacturer's website. With others, use the Windows Settings app or the Devices and Printers window in Control Panel to install a printer. These windows are also used to manage and uninstall printers, as you'll see throughout the rest of this module.

10-2d Choosing a Driver

Core 1 Objective

- 3.6

Given a scenario, deploy and configure multifunction devices/printers and settings.

When you install a printer, printer drivers are required that are compatible with the installed operating system. Be sure to use 32-bit drivers for a 32-bit OS and 64-bit drivers for a 64-bit OS. Windows has many printer drivers built in. The drivers might also come on a CD bundled with the printer or you can download them from the printer manufacturer's website. Using the drivers downloaded from the manufacturer's website ensures you have the most up-to-date version of the full drivers, with support for all of a printer's features.

Some printer manufacturers give you a choice of drivers based on the PDL included. The most common PDLs are PCL and Postscript. Hewlett-Packard developed **Printer Control Language (PCL)**, which is used by many different printer manufacturers and supported by many different OSs, providing you the flexibility to work in different environments. PCL depends on the drivers in the printer hardware for creating print data, which results in a higher print-processing speed compared to Postscript (described next). Consistency in printer outputs can vary between printers with PCL because hardware varies, which also means the final print quality depends on the quality of the printer.

The alternative, Adobe's **Postscript (PS)**, is also used by many different printer manufacturers but supported by fewer OSs compared to PCL because it is mostly focused for use with Macintosh devices. Postscript does not rely on the printer to create the print data; this creates consistency in print quality between different Postscript printers. In Postscript, graphics are more detailed and have larger file sizes. Postscript is favored by graphics-intense users, especially those who need to produce high-volume output. A designer can test their design with a sample on their printer and then outsource the volume print job to a print shop that uses Postscript to ensure consistent quality. When a printer offers a choice of drivers between PCL or Postscript, choose PCL for general applications and speed, and choose Postscript for graphic-intense applications printing.

Exam Tip

The A+ Core 1 exam might give you a scenario that requires you need to know which type of driver to choose—PCL or Postscript.

Applying Concepts

Installing a Printer

- **Est. Time:** 30 minutes
- **Core 1 Objectives:** 3.6,3.7

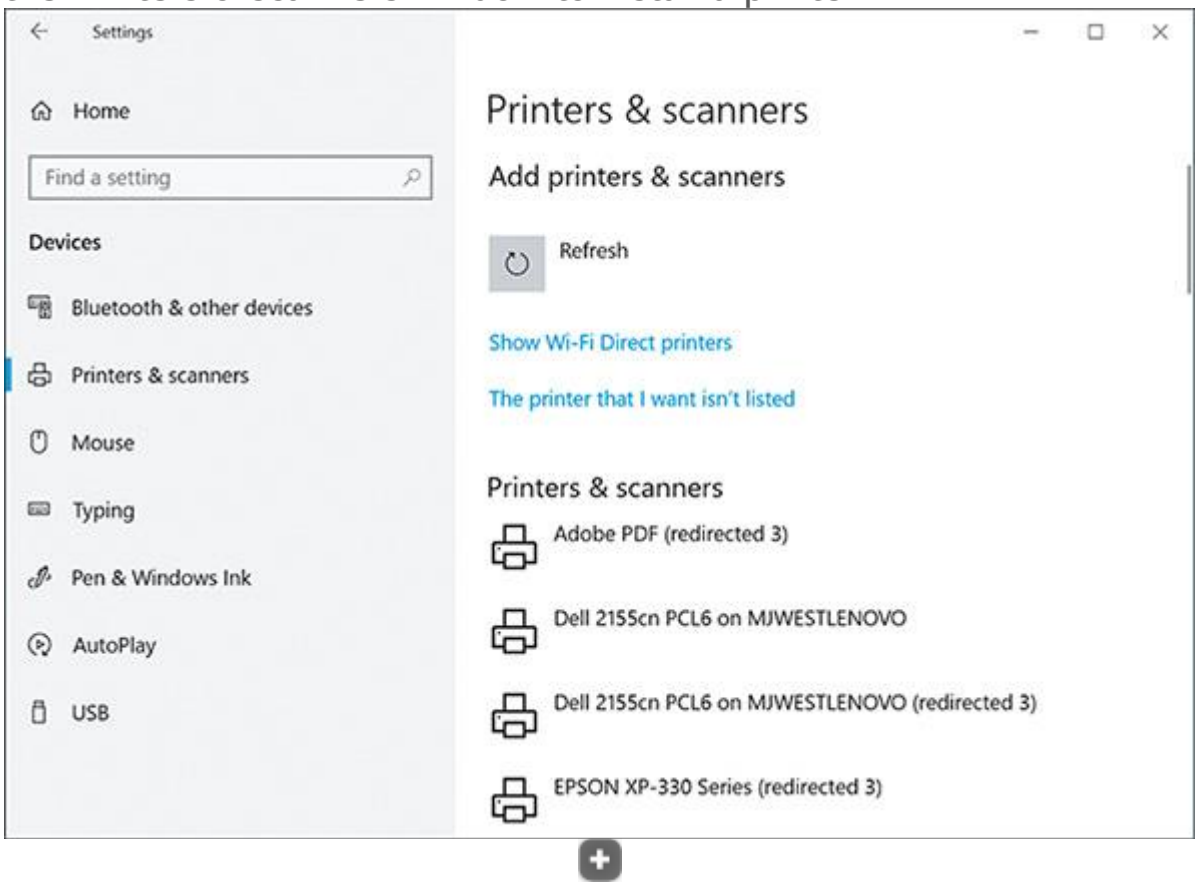
Installing a network printer is sometimes called mapping a printer. Windows has many preinstalled printer drivers that make printer installation particularly easy and straightforward. However, some manufacturers recommend that you install their drivers before connecting the printer to your computer or the network. This provides additional printer configuration and management tools that are not included in the Windows drivers. Follow these steps to install a wired or Wi-Fi network printer or Bluetooth printer using the Windows drivers, or follow more specific instructions from the printer's manufacturer:

1. 1
   Make sure the printer is connected to the network or the computer. In Windows, open the **Settings** app, click **Devices**, and then click **Printers & scanners**. Click **Add a printer or scanner**. (For Windows 11, in the Settings app, select **Bluetooth & devices,**

Printers & scanners, and **Add device**.) Windows searches for available printers and lists them (see Figure 10-13).

Figure 10-13

Use the Printers & scanners window to install a printer



2. 2
   Select the printer, and click **Add printer**. Follow the on-screen instructions to add the printer.

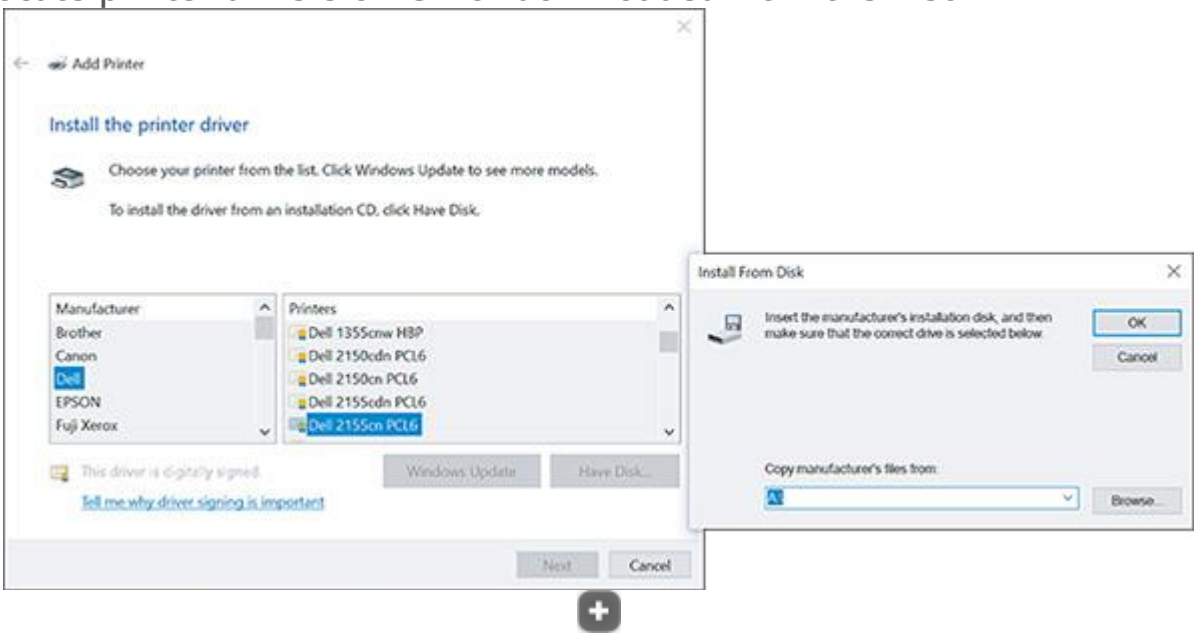
3. 3
   If your printer isn't listed, open **Devices and Printers** in the Control Panel to add the printer. Click **Add a printer**, and then click **The printer that I want isn't listed**. Choose one of the following options:

   - **My printer is a little older** searches for older printer drivers.
   - **Select a shared printer by name** allows you to enter a network location for the printer.
   - **Add a printer using a TCP/IP address or hostname** allows you to address the printer by IP address or host name.
   - **Add a Bluetooth, wireless or network discoverable printer** searches again for printers connected through Bluetooth or the network.
   - **Add a local printer or network printer with manual settings** gives you the option to make more granular changes to the printer's installation, use a setup CD or downloaded drivers provided by the manufacturer, or select an appropriate driver from a list of available Windows printer drivers. In the next

box, choose the port where the printer is connected, and click **Next**. Then you can select the brand and printer model to use drivers provided by Windows (see the left side of Figure 10-14), or you can use drivers stored on CD or previously downloaded from the web by clicking **Have Disk**. The Install From Disk box appears (see the right side of Figure 10-14). Click **Browse** to locate the drivers; Windows is looking for an .inf file. Be sure to select 32-bit or 64-bit drivers, depending on which type of OS you are using; then click **OK**.

Figure 10-14

Locate printer drivers on CD or downloaded from the web



Note 8

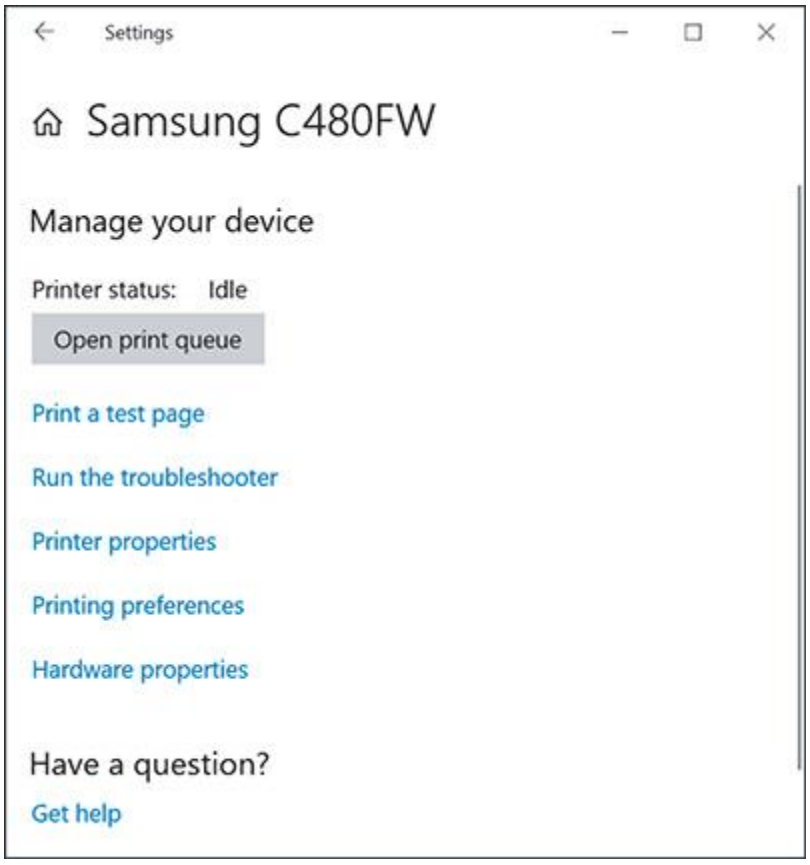
Use the About window to find out if a 32-bit or 64-bit OS is installed. To open the About window in Windows 10/11, press **Win+X**, and then click **System**.

1. 4
   Continue to follow the wizard to install the printer. Dialog boxes give you the opportunity to change the name of the printer and designate it as the default printer. You can also test the printer. It's always a good idea to print a test page when you install a printer to verify that the installation works.

You can send a test page to the printer at any time. Click the printer in the Printers & scanners window, click **Manage**, and then click **Print a test page** (see Figure 10-15). This screen is also where you find printer properties and printing preferences.

Figure 10-15

Send a test page to the printer to test connectivity to the printer, the printer, and the printer installation



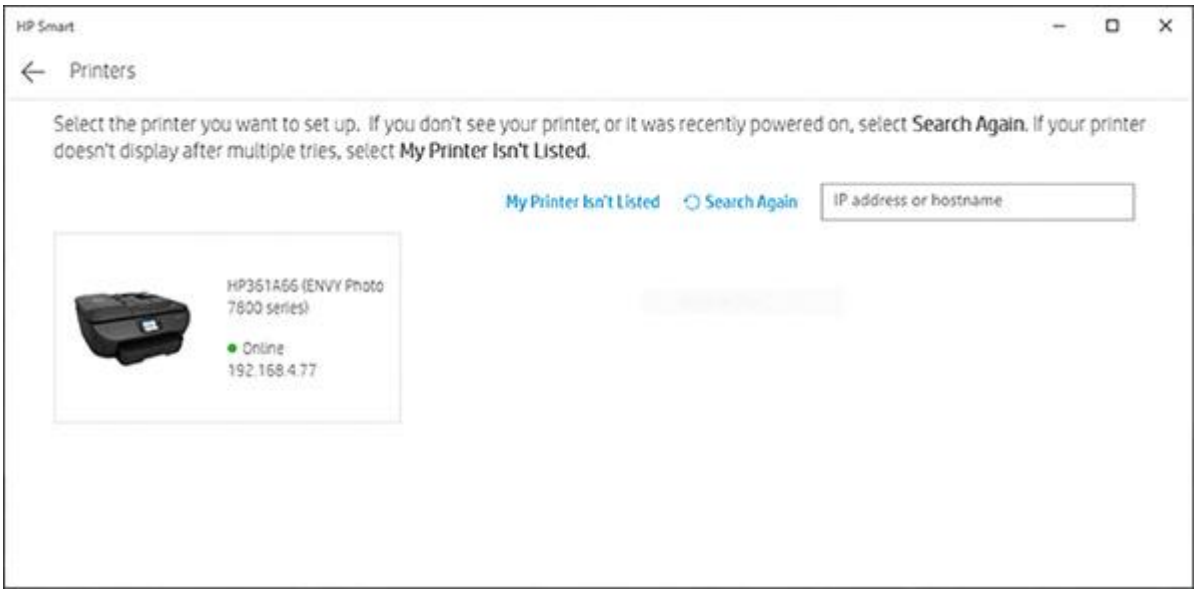
Note 9

To use Control Panel to print a test page in Windows, right-click the printer in the Devices and Printers window, and select **Printer properties**. On the General tab of the Properties dialog box, click **Print Test Page**.

Rather than using Windows tools to start a printer installation, you can also start the installation using the setup program on the CD that came bundled with the printer or using the setup program downloaded from the printer manufacturer's website. Figure 10-16 shows one such window in the setup process for an HP printer. This method might provide more customized installation options.

Figure 10-16

Installation process of a new printer automatically discovers the printer on the network.



Exam Tip

The A+ Core 1 exam might give you a scenario that requires you to install a local or network printer.

10-2e Sharing a Printer on a Network

Core 1 Objective

- 3.6

Given a scenario, deploy and configure multifunction devices/printers and settings.

Recall from the module "Networking Fundamentals" that a print server manages network printers and makes them available to computers and other devices on the network. Any time a computer sends a print job to a printer through the network, whether that printer is a shared local printer or a network printer, print server functions play a role. However, the device that provides the print server can vary depending on how the printer is set up. Let's look at the available options:

- **Integrated print server.** Most printers today include network capability—you can connect them directly to a router or switch, and devices on the network can find and access the printer. In this case, the printer is providing its own **integrated print server** embedded in the firmware on the printer's hardware. Some integrated printers allow you to manage print protocols, start or stop jobs in the print queue, reorder jobs in the queue, cancel specific jobs coming from a

particular computer on the network, monitor printer maintenance tasks, and set up your email address so the printer alerts you by email when it has a problem.

- **Computer as a print server.** When a computer shares its local printer with other computers on the network, the computer is considered to be a print server. If a network has several print servers, you might find it convenient as an IT support technician to use the Print Management console on your workstation to manage these print servers. Using Print Management, you can stop, start, and clear print jobs on any print server on the network and troubleshoot other printer problems from your workstation. Print Management is available under Windows 10 Administrative Tools or Windows 11 Windows Tools in the Control Panel.
- **Other network hardware.** Print server software might be embedded in other network devices, such as a router or firewall. Connect the printer to the network device, and use its configuration interface to manage the printer.

Applying Concepts

Configuring and Using a Shared Printer

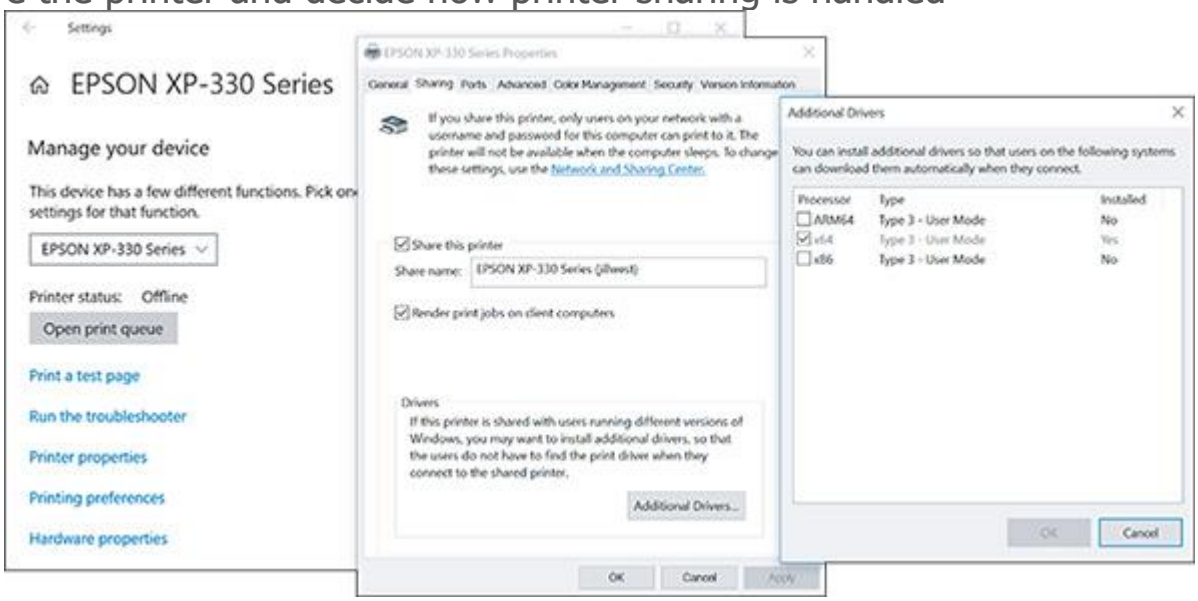
- **Est. Time:** 15 minutes
- **Core 1 Objective:** 3.6

To share an installed local or network printer with others on the network, follow these steps:

1. 1
   In the printer Properties dialog box, which you access through the Settings app or Control Panel, click the **Sharing** tab. Check **Share this printer** (see the middle box in Figure 10-17).

Figure 10-17

Share the printer and decide how printer sharing is handled



2. 2
   You can then change the share name of the printer. Notice in Figure 10-17 the option to control where print jobs are rendered. A print job can be prepared (rendered) on the remote computer (client computer) or this computer (print server). Your choice depends on which computer you think can best handle the computing burden. You can test several print jobs on remote computers with rendering at either location to see which method best uses computing resources on the network.

3. 3
   If you want to make drivers for the printer available to remote users who are using an operating system other than the OS on this computer, click **Additional Drivers**.

4. 4
   The Additional Drivers box opens (see the right side of Figure 10-17). For 32-bit operating systems, select **x86**. For 64-bit operating systems, select **x64**. Click **OK** to close the box. You might be asked for the Windows setup DVD or other access to the installation files.

5. 5
   Click **OK** to close the Properties dialog box. A shared printer shows a two-friends icon under it or in the status bar in the Devices and Printers window. The printer is listed in the Network group in File Explorer on other network computers.

For the printer share to be successful, the following requirements must be met:

- The computer sharing the printer and the computer using the shared printer must both be connected to the same network.
- The shared printer and the computer sharing it must be turned on.
- Both computers must allow file and printer sharing.

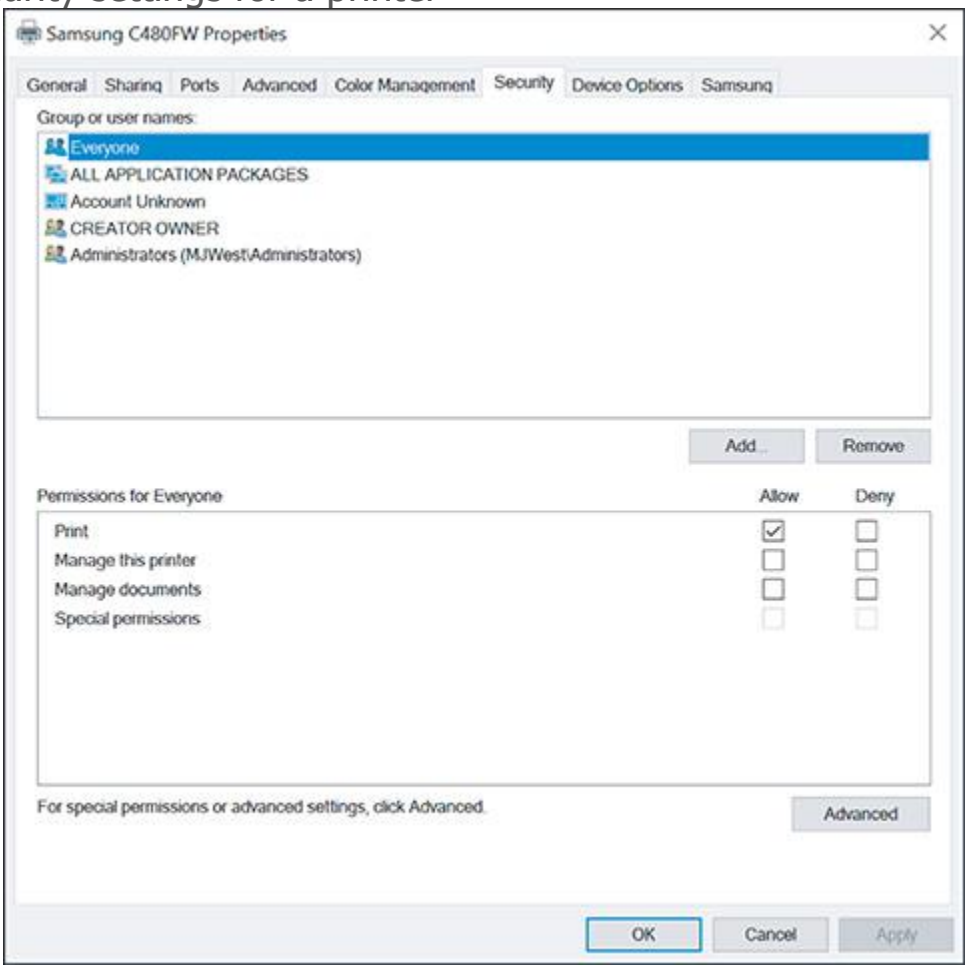
Secure a Shared Printer

Consider the following features, which can be used to ensure the security of your shared printer and the privacy of data embedded in documents to be printed:

- **User authentication.** In the printer's Properties dialog box (refer back to Figure 10-17), click the **Security** tab to manage who has access to the printer and permissions allowed. Notice in Figure 10-18 that the Everyone group can print, but it is not allowed to manage the printer or documents sent to it. Just as with shared files and folders, you can share the printer with specific users and/or set up a customized user group that is allowed to use a printer. In this way, user authentication is required before giving a user access to the printer.

Figure 10-18

Security settings for a printer



- **Secured printing.** Some larger network printers—such as those manufactured by Canon, Ricoh, and Xerox—offer features to help secure print jobs. **Secured printing** is a security feature that allows documents to print confidentially, only when the user knows the printing passcode and is ready at the printer to oversee the document as it prints. When secure print is enabled, the user enters a passcode in the Printing Preferences or the printer's Properties dialog box before printing. The print job does not start until the user goes to the printer and enters the passcode on the printer. The steps to enable secure printing vary based on the manufacturer. Refer to the printer's owner's manual to find the steps needed to use secure print. To enable secured printing, do the following:
    - On a Canon printer, change the profile to Secured Print.
    - On a Ricoh printer, change the output to Locked Print.
    - On a Xerox printer, change the job type to Secure Print.
- **Audit logs.** Windows is capable of maintaining a log of print jobs accessed in Event Viewer. These logs record when, by whom, and the type of print job processed.
- **Badging.** Special printers, such as a 3D printer at a university or public library, sometimes need to have restricted access. An

organization can use badging to limit who is able to use the printer. Badging is a process of certifying users to use special printers. The badging process can include the following:

- Attending an instructional class in person or online
- Passing an assessment on content covered in the class
- Signing an agreement about how the printer is to be used
- Using a reservation system
- Adding a badge to your credentials to access the equipment

Applying Concepts

Enable Printer Logging

- **Est. Time:** 15 minutes
- **Core 1 Objective:** 3.6

To enable printer logging in Event Viewer, follow these steps:

1. 1
   Open **Event Viewer**. Navigate to **Applications and Services Logs** > **Microsoft** > **Windows** > **PrintService**.

2. 2
   Right-click **Operational** in the left pane, and select **Properties**. The Log Properties – Operational dialog box opens.

3. 3
   Check **Enable logging**, and click **OK**.

4. 4
   Print a test page or print to a PDF to create an event in the printer logs.

5. 5
   Click **Action** in the Event Viewer menu bar, and select **Refresh**.

6. 6
   Review the printer logs that were recorded, and explore what information you find in the logs you just created.

Use a Shared Printer

To install a shared printer on a remote computer, you can

1. use the Settings app,
2. use the Devices and Printers window, or
3. use File Explorer.

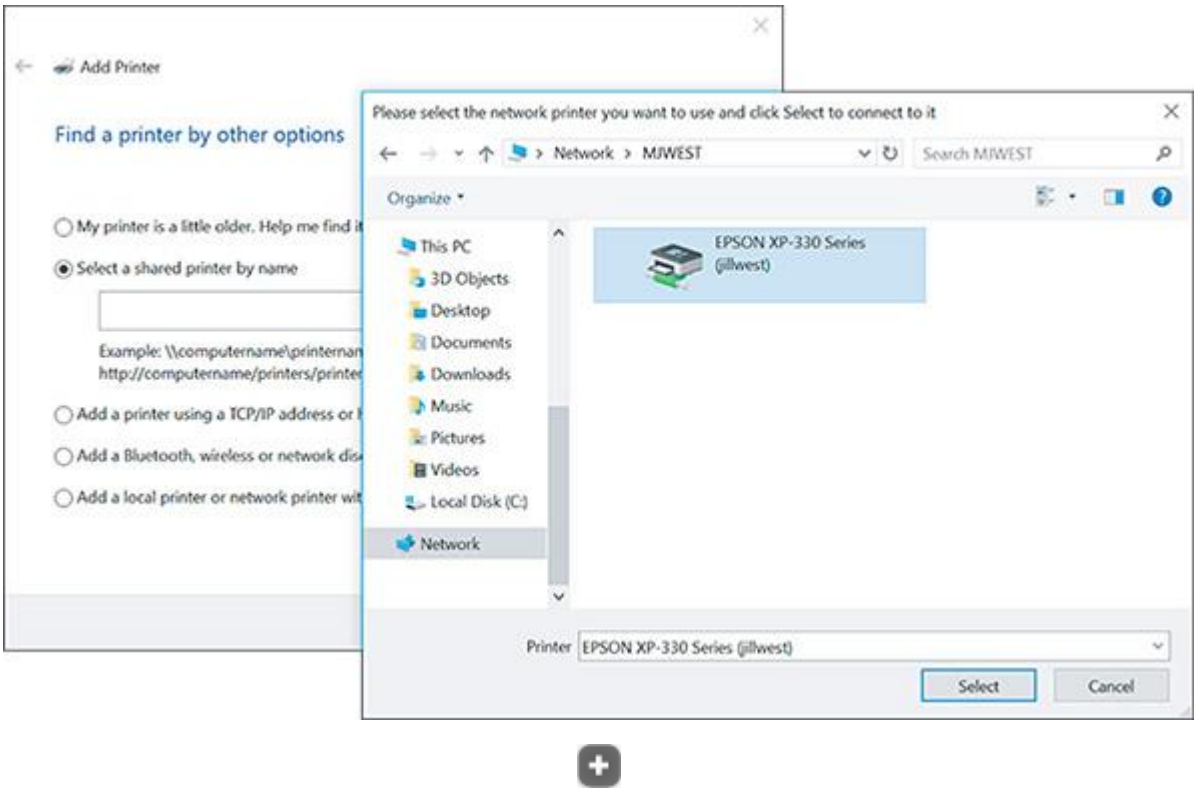
Here are the general steps for all three methods:

- **Settings app.** On a Windows 10 remote computer, open the **Printers & scanners** window, and click **Add a printer or scanner**. (For

Windows 11, in the Settings app, open **Bluetooth & devices**, click **Printers & scanners**, and click **Add device**.) Click **The printer that I want isn't listed** to tell the computer where to find the printer. Choose **Select a shared printer by name** to locate the printer by name, such as \\MJWEST\EPSON XP-330 Series (jillwest), or click **Browse** to find the printer on the network. You'll need to enter sign-in credentials for the computer sharing the printer. For the user name to work, the printer must be shared with this specific user or user group, and the password must match the password of this user on the remote computer. Then select the printer and click **Select** (see Figure 10-19). Click **Next**. Once the printer is selected, Windows attempts to use printer drivers found on the host computer. If it doesn't find the drivers, you will be given the opportunity to provide them on CD or other media.

Figure 10-19

Locate a shared printer on the network



If you don't see a shared printer in the list of printers to add, the user account might not be authorized to access resources on the remote computer. In this situation, use the Explorer method discussed later in this list, which allows the user to authenticate to the remote computer.

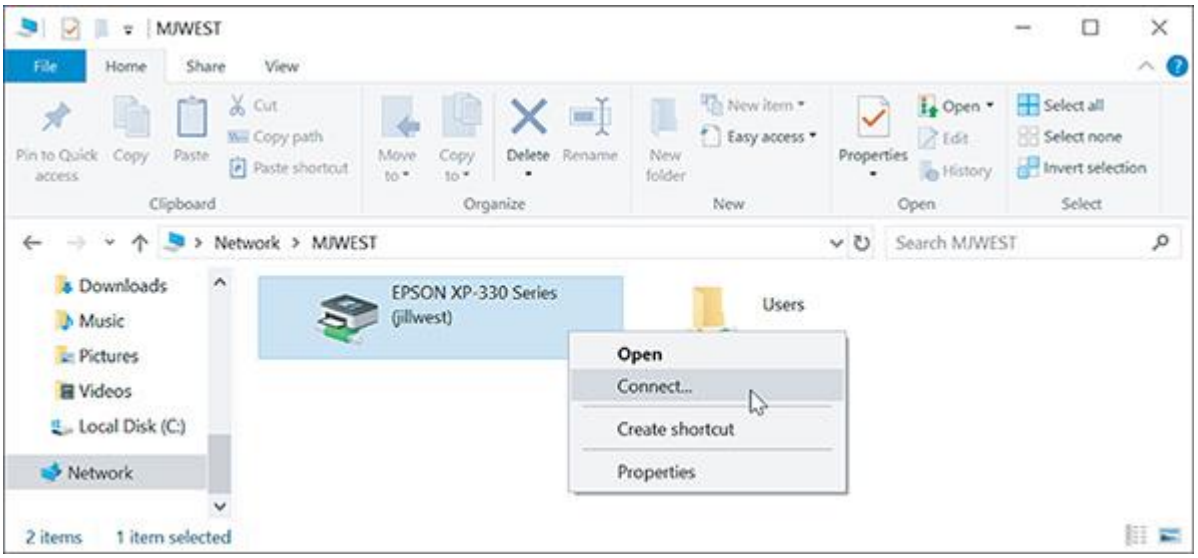
- **Devices and Printers window.** On a remote computer, open the **Devices and Printers** window, click **Add a printer**, and follow the directions on-screen to add a network printer. Select the shared

printer, which shows the sharing computer's host name and the printer name in the printer address column, or click **The printer I want isn't listed** and browse the network to find the printer. Windows attempts to use printer drivers found on the host computer. If it doesn't find the drivers, you will be given the opportunity to provide them on CD or other media.

- **File Explorer.** In the Explorer window, drill down into the computer that is sharing the printer. If required, authenticate to the remote computer with a valid user account and password on the remote computer. For the user name to work, the printer must be shared with this specific user or user group and the password must match the password of this user on the remote computer. After authentication, you can see the shared printer. Right-click the printer, and select **Connect** (see Figure 10-20). In the warning box that appears, click **Install driver**, and follow the directions on-screen.

Figure 10-20

Use File Explorer to connect to a shared printer



After the printer is installed, be sure to send a test page to the printer to verify that the installation is successful.

10-2f Network Scan Services

Core 1 Objective

- 3.6

Given a scenario, deploy and configure multifunction devices/printers and settings.

Multifunction and scanner devices typically offer a few convenient features for sending a scanned file to your desired location. The scanner might offer local destinations, such as printing a paper copy or sending a scan file to a USB flash drive connected directly to the scanner, but the scanner might also offer a few other destinations. The following scan destinations are common options on network printers/scanners:

- **Scan-to-email.** An email destination is fairly straightforward in its setup, but it can vary slightly from device to device. On the scanner, select **email** as the scan destination, and enter a valid email address. Some scanners will require an email verification before completing the email configuration. Usually this means the scanner will send a confirmation email to the email address provided with a PIN or code to verify the email address is valid. You can also choose to keep the address in a locally stored contact list for frequently used emails.
- **Scan-to-SMB.** Scan-to-SMB is a convenient way to scan files to a file server. Recall from the module "Networking Fundamentals" that SMB is a protocol used by file servers on the network. To set up scan-to-SMB, follow the specific steps from the printer's user manual. Generally, this is the information you'll need to set up scan-to-SMB:
    - Host IP address
    - File path to the SMB server or shared folder
    - User name and password for the SMB server or shared folder (Create a unique user name and password for the share folder ownership to limit access to another user's credentials.)

Core to Core

You learn more about creating and sharing a file server in the Core 2 module "Securing and Sharing Windows Resources."

- **Scan-to-cloud.** The cloud scan destination is convenient for making a scanned document available to multiple devices on different networks. Scan-to-cloud can upload directly to cloud hosting services, such as Box, Dropbox, or Google Drive. To set up a cloud scan destination, follow directions from the printer user manual and the cloud service you choose as a destination for the scan. Generally, you'll need the user name and password for the cloud service, and you'll need to choose a cloud service that is supported by the printer.

10-2g Configuring Printer Features and Add-On Devices

Core 1 Objective

- 3.6

Given a scenario, deploy and configure multifunction devices/printers and settings.

After the printer is installed, use the printer Properties dialog box to manage printer features and hardware devices installed on the printer. To access settings for the EPSON printer shown in Figure 10-21, click the **General** tab, and then click **Preferences** to open the Printing Preferences dialog box, which shows the available options (see the right side of Figure 10-21). Other printers might show a **Device Settings** tab. The options depend on the installed printer. As you can see in the figure, the **Main** tab lets you control the size of the paper, page orientation (landscape or portrait), quality of printing (for example, draft, standard, or high quality), color options (color or black/grayscale), one-sided or two-sided (called duplex printing), collated or uncollated, and various add-on devices depending on the printer, such as a printer hard drive, stapler, or stacker unit. Figure 10-22 shows an HP Printing Preferences dialog box where you can choose the paper source, which determines which paper tray is used to print.

Figure 10-21

The Printing Preferences dialog box for an EPSON printer

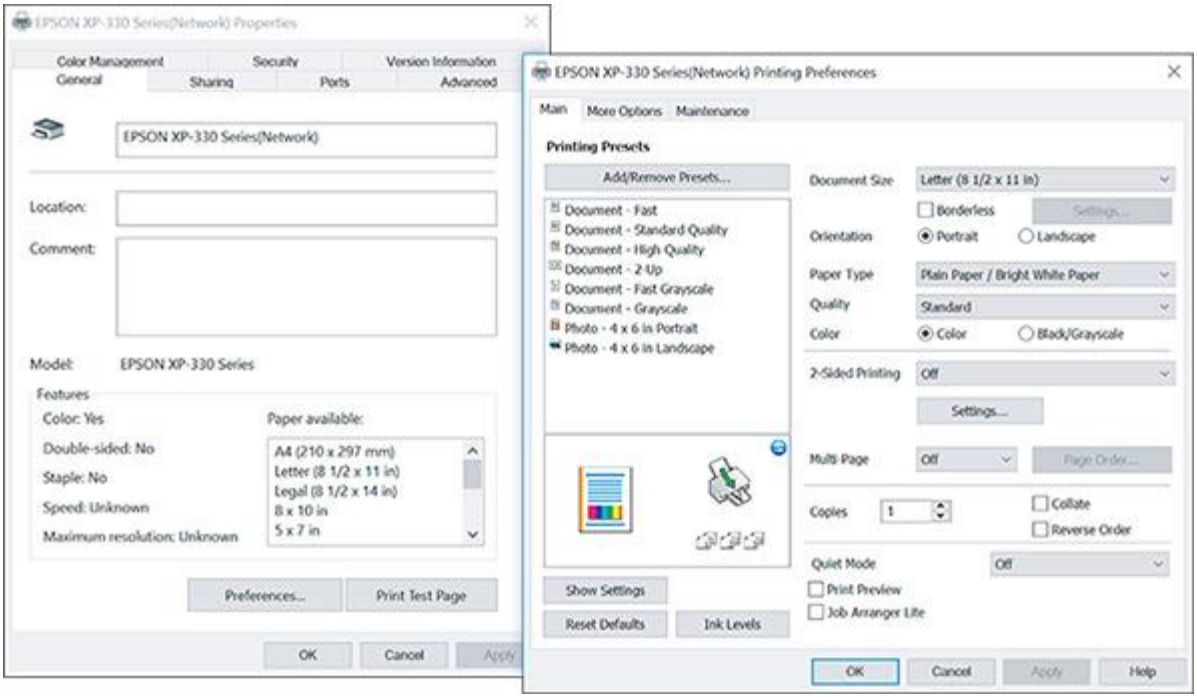
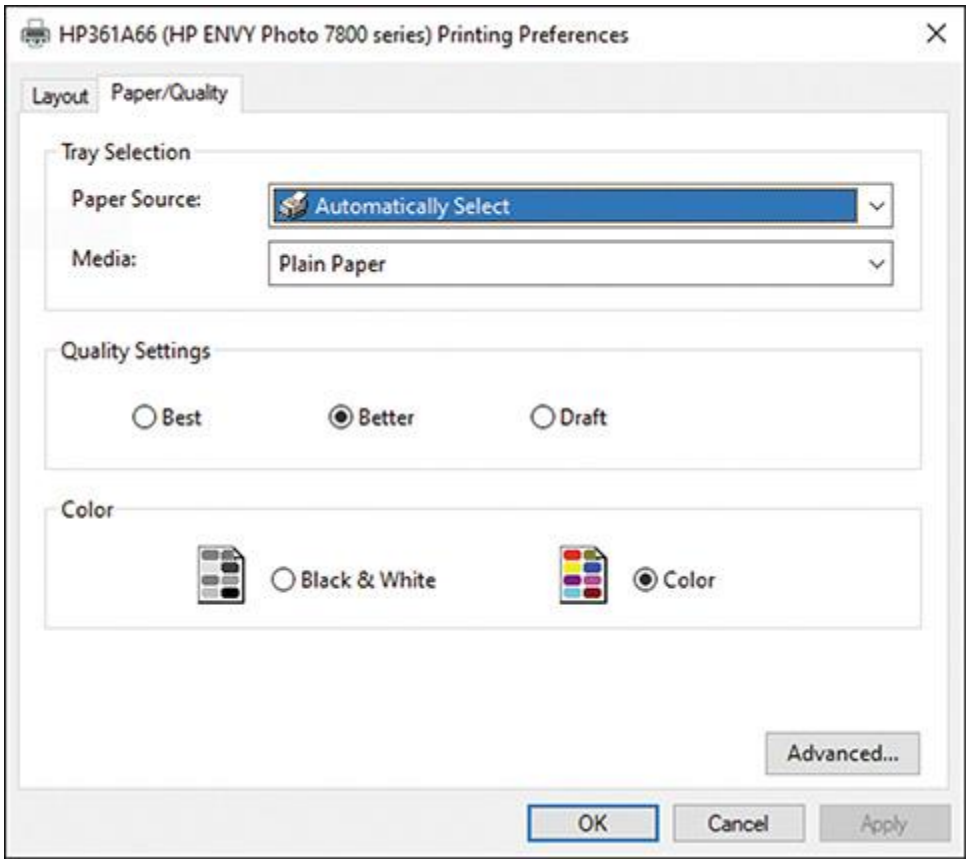


Figure 10-22

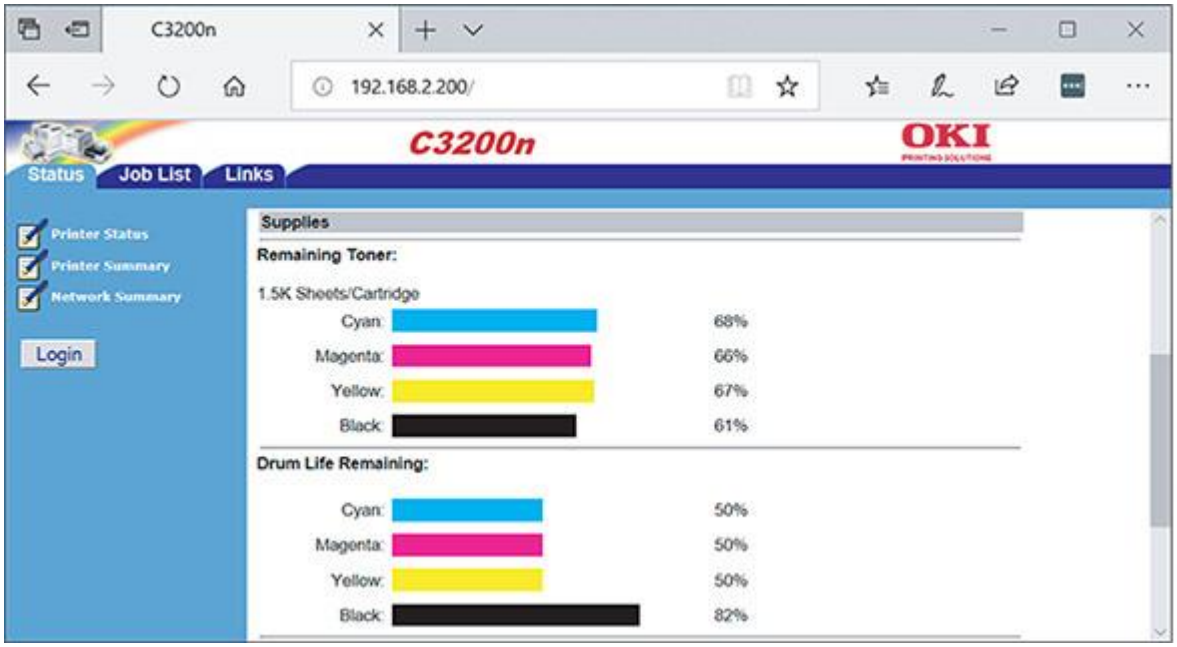
Select the paper source in Printer Preferences



You can also manage many printer settings and features through the printer's own utility, which might be installed as an application on your computer or might be a firmware utility in the printer that is accessed through your browser. For example, for one Oki Data printer, enter the IP address of the printer in a browser, and then enter the administrative password to the printer firmware. The firmware utility (see Figure 10-23) allows you to manage printer settings and features.

Figure 10-23

The user interface for a network printer accessed through a network computer's browser



Source: Oki Data

Now let's turn our attention to tasks you might be called on to do when maintaining and upgrading a printer.

10-3 Printer Maintenance

Core 1 Objective

- 3.7

Given a scenario, install and replace printer consumables.

Printers generally last for years if they are properly used and maintained. To get the most out of a printer, it's important to follow the manufacturer's directions when using the device and to perform the necessary routine maintenance. For example, the life of a printer can be shortened if you allow the printer to overheat, don't use approved paper, or don't perform maintenance when required.

10-3a Online Support for Printers

Core 1 Objective

- 3.7

Given a scenario, install and replace printer consumables.

The printer manufacturer's website is an important resource when supporting printers. Often, you can find online documentation, warranty information, a knowledge base of common problems and solutions, updated

device drivers, replacement parts available for order, and printer maintenance kits.

When working on printers, always keep in mind the following hazards:

- **Dangerous electricity.** A printer might still keep power even when it is turned off. To ensure that the printer has no power, unplug it. Even when a laser printer is unplugged, internal components might still hold a dangerous electrical charge for some time.
- **Hot to touch.** Some laser printer parts can get hot enough to burn you while in operation. Before you work inside a laser printer, turn it off, unplug it, and wait about 30 minutes for it to cool down.
- **Laser beam.** For your protection, the laser beam in a laser printer is always enclosed inside a protective case. Therefore, when servicing a laser printer, you should never have to look at the laser beam, which can damage your eyes.
- **Static electricity.** To protect sensitive memory modules and hard drives inside printers, be sure to use an ESD strap when installing them. You don't need to wear an ESD strap when exchanging consumables such as toner cartridges, fuser assembles, or image drums.
- **Working inside high-voltage equipment when no one is around.** Here's one more tip to stay safe, although we don't want it to frighten you: When you work inside high-voltage equipment such as a laser printer, don't do it when no one else is around. If you have an emergency, someone needs to be close by to help you.

Note 10

If you're working with laser printer toner cartridges and you get toner dust on your clothes or hands while exchanging the cartridge, don't use hot water to clean it up. Remember that heat sets the toner. Go outdoors, and use a can of compressed air to blow off the toner. Then use cold water to clean your hands and clothes. It's a good idea to wear a smock or apron when working on printers.

Figure 10-24 shows an ink cartridge being installed in an inkjet printer. To replace an inkjet cartridge, turn on the printer and open the front cover. The printer releases the cartridges from their parked positions. You can then open the latch on top of the cartridge and remove it. Install the new cartridge as shown in the figure.

Figure 10-24

Installing an ink cartridge in an inkjet printer

10-3bCleaning a Printer

Core 1 Objective

- 3.7

Given a scenario, install and replace printer consumables.

A printer gets dirty inside and outside as stray toner, ink, dust, and bits of paper accumulate. As part of routine printer maintenance, you need to regularly clean the printer. How often depends on how much the printer is used and the environment in which it is used. Some manufacturers suggest that a heavily used printer be cleaned weekly, and others suggest you clean it whenever you exchange the toner, ink cartridges, or ribbon.

Clean the outside of the printer with a damp cloth. Don't use ammonia-based cleaners. Clean the inside of the printer with a dry cloth and remove dust, bits of paper, and stray toner. Picking up stray toner can be a problem. Don't try to blow it out with compressed air because you don't want the toner in the air. Also, don't use an antistatic vacuum cleaner. You can, however, use a specialized vacuum cleaner designed to pick up toner, called a **toner vacuum**. This type of vacuum does not allow the toner that it picks up to touch any conductive surface.

Some printer manufacturers also suggest you use an **extension magnet brush**. The long-handled brush is made of nylon fibers that are charged with static electricity and easily attract the toner like a magnet. For a laser printer, wipe the rollers from side to side with a dry cloth to remove loose dirt and toner. Don't touch the soft, black roller (the transfer roller), or you

might affect the print quality. You can find specific instructions for cleaning a printer on the printer manufacturer's website.

10-3c Calibrating a Printer

Core 1 Objective

- 3.7

Given a scenario, install and replace printer consumables.

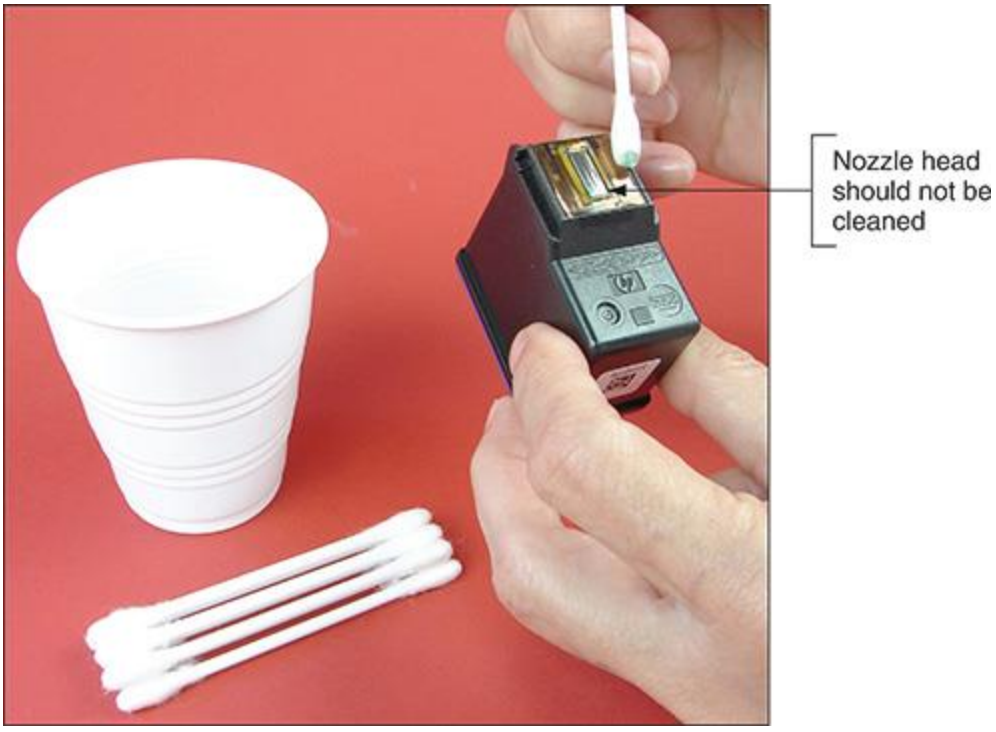
An inkjet printer might require **calibration** to align and/or clean the inkjet nozzles, which can solve a problem when colors appear streaked or out of alignment. To calibrate the printer, you might use the menu on the printer's control panel or use software that came bundled with the printer. How to access these tools differs from one printer to another. See the printer manual to learn how to perform the calibration. For some printers, a Services tab is added to the printer Properties window. Other printer installations might put utility programs in the Start menu. The first time you turn on a printer after installing ink cartridges, it's a good idea to calibrate the printer.

If an inkjet printer still does not print after calibrating it, you can try to manually clean the cartridge nozzles. Check the printer manufacturer's website for directions. For most inkjet printers, you are directed to use clean, distilled water and cotton swabs to clean the face of the ink cartridge, being careful not to touch the nozzle plate. To prevent the inkjet nozzles from drying out, don't leave the ink cartridges out of their cradle for longer than 30 minutes. Here are some general directions:

1. Following the manufacturer's directions, remove the inkjet cartridges from the printer, and lay them on their sides on a paper towel.
2. Dip a cotton swab in distilled water (not tap water), and squeeze out any excess water.
3. Hold an ink cartridge so that the nozzle plate faces up, and use the swab to clean the area around the nozzle plate, as shown in Figure 10-25. Do not clean the plate itself.

Figure 10-25

Clean the area around the nozzle plate with a damp cotton swab



4. Hold the cartridge up to the light and make sure that no dust, dirt, ink, or cotton fibers are left around the face of the nozzle plate. Make sure the area is clean.
5. Clean all the ink cartridges the same way, and replace the cartridges in the printer.
6. Print a test page. If print quality is still poor, try calibrating the printer again.
7. If you still have problems, you need to replace the ink cartridges.

Laser printers automatically calibrate themselves periodically. You can instruct a laser printer to calibrate at any time by using the controls on the front of the printer or the browser-based utility program that is included in the firmware of a network printer. To access the utility, enter the IP address of the printer in the browser address box, and sign in.

10-3dPrinter Maintenance Kits

Core 1 Objective

- 3.7

Given a scenario, install and replace printer consumables.

Manufacturers of high-end printers provide **printer maintenance kits**, which include specific printer components, step-by-step instructions for performing maintenance, tips for how often maintenance should be done, and information on any special tools or equipment you need to do maintenance. For example, the maintenance plan for the HP Color LaserJet 4600 printer says to replace the transfer roller assembly after printing 120,000 pages and to replace the fusing assembly after 150,000 pages. The

plan also says the black ink cartridge should last for about 9000 pages and the color ink cartridge should last about 8000 pages. HP sells the image transfer kit, the image fuser kit, and the ink cartridges designed for this printer.

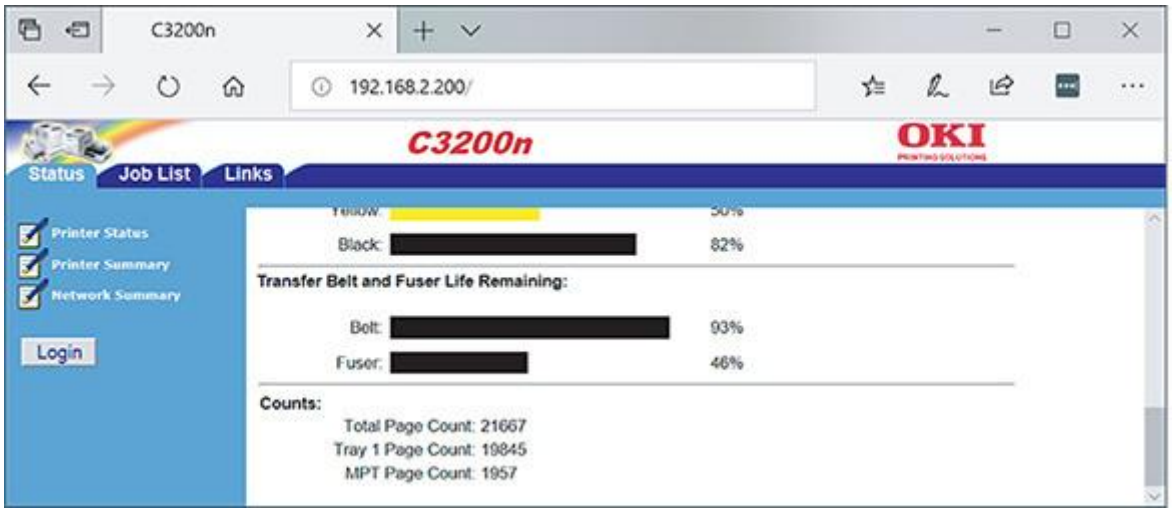
To find out how many pages a printer has printed to determine if you need to do the maintenance, have the printer give you the page count since the last maintenance. You can tell the printer to display the information or print a status report by using buttons on the front of the printer (see Figure 10-26), or you can use utility software using a computer connected to the printer. See the printer documentation to know how to get this report. For network printers that offer a browser-based utility, enter the IP address of the printer in your browser, and use the utility to find the counters. (Figure 10-27 shows such a utility for an Oki Data network printer.)

Figure 10-26

Use buttons on the front of the printer to display information, including the page count

Figure 10-27

Use the web-based printer utility to read the printer counters



Source: Oki Data

After you have performed the maintenance, be sure to reset the page count so it will be accurate when you need to do the next routine maintenance. Keep a written record of the maintenance and other service done.

As examples of replacing printer consumables, let's look at how to replace a toner cartridge, image drum, and fuser for an Oki Data color laser printer.

Exam Tip

The A+ Core 1 exam might give you a scenario that requires you to replace a toner cartridge or apply a maintenance kit for a laser printer.

A toner cartridge for this Oki Data printer generally lasts for about 1500 pages. Here are the steps to replace a color toner cartridge:

1. Turn off and unplug the printer. Press the cover release button on the upper-left corner of the printer, and open the printer cover (see Figure 10-28).

Figure 10-28

Open the printer cover

Source: Oki Data

2. Figure 10-29 shows the cover up. Notice the four erase lamps on the inside of the cover. Look inside the printer for the four toner cartridges and the fuser assembly labeled in Figure 10-30. Push or pull the blue toner cartridge release button forward to disconnect and release the cartridge from the image drum below it (see Figure 10-31).

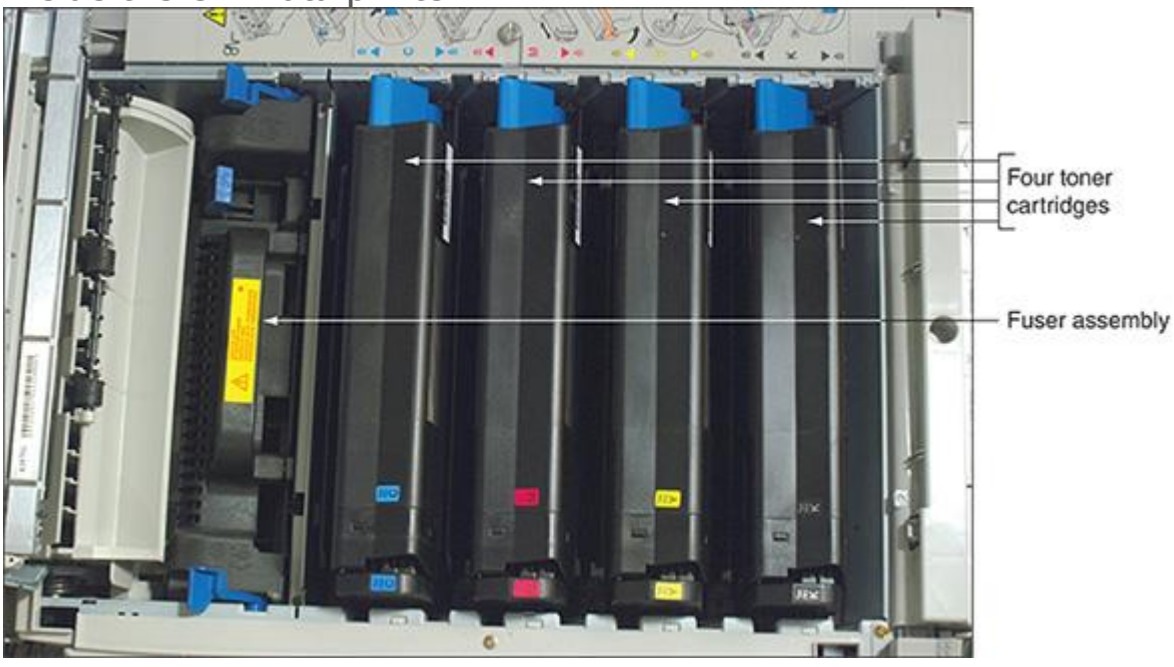
Figure 10-29

The cover is lifted

Source: Oki Data

Figure 10-30

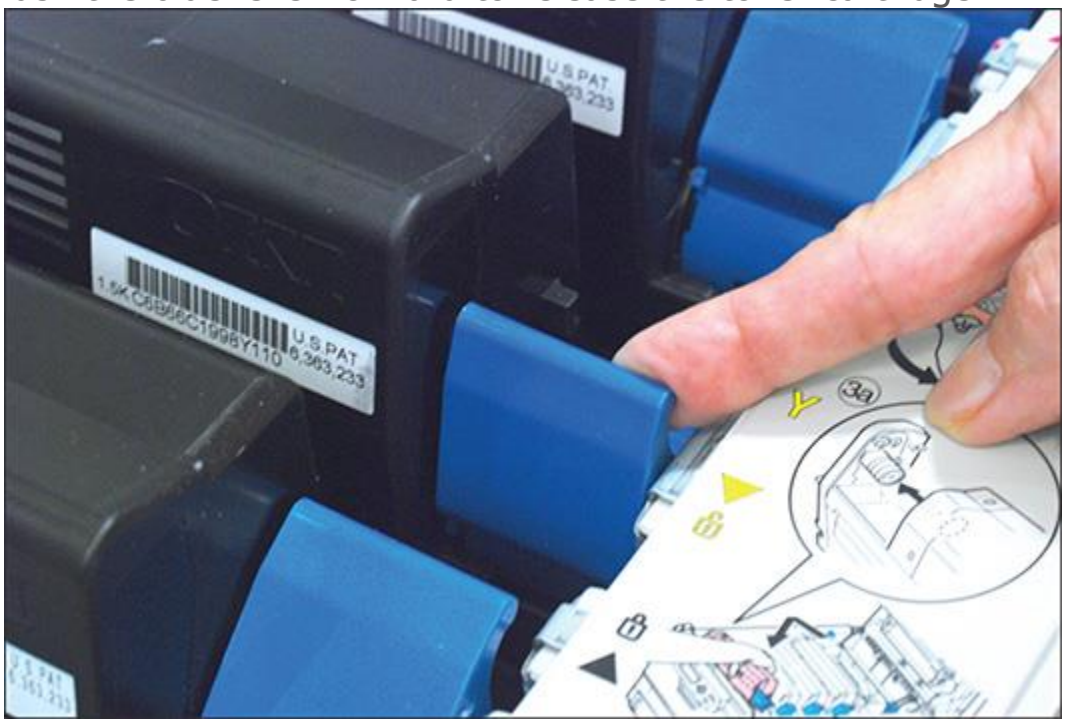
Inside the Oki Data printer



Source: Oki Data

Figure 10-31

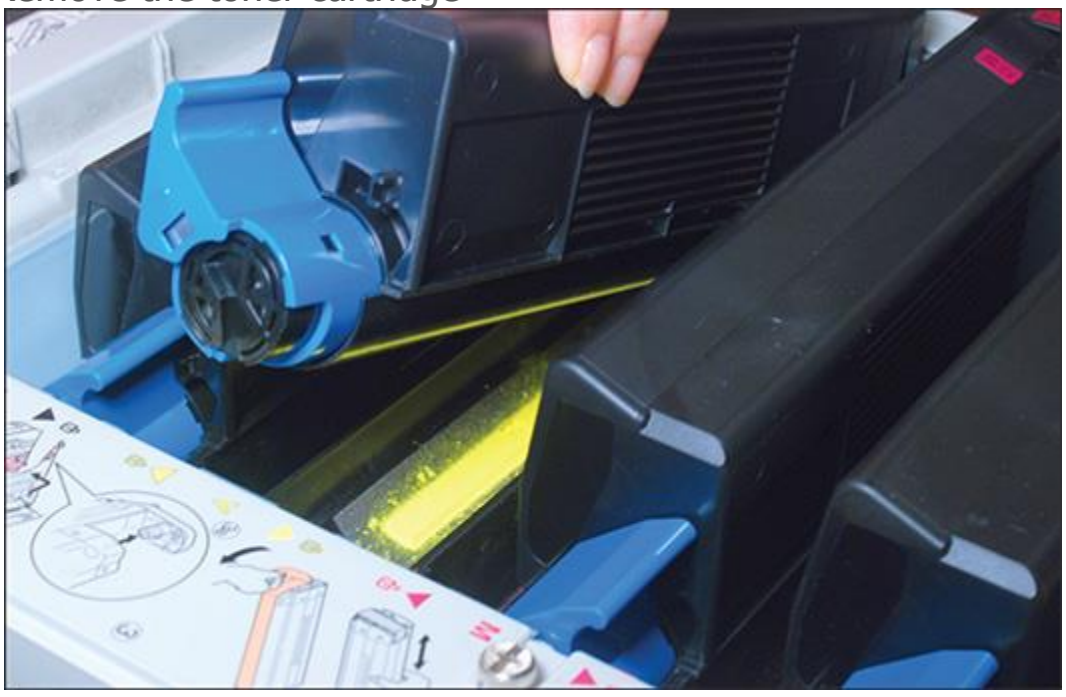
Push the blue lever forward to release the toner cartridge



3. Lift the cartridge out of the printer, lifting up on the right side first and then removing the left side (see Figure 10-32). Be careful not to spill loose toner.

Figure 10-32

Remove the toner cartridge



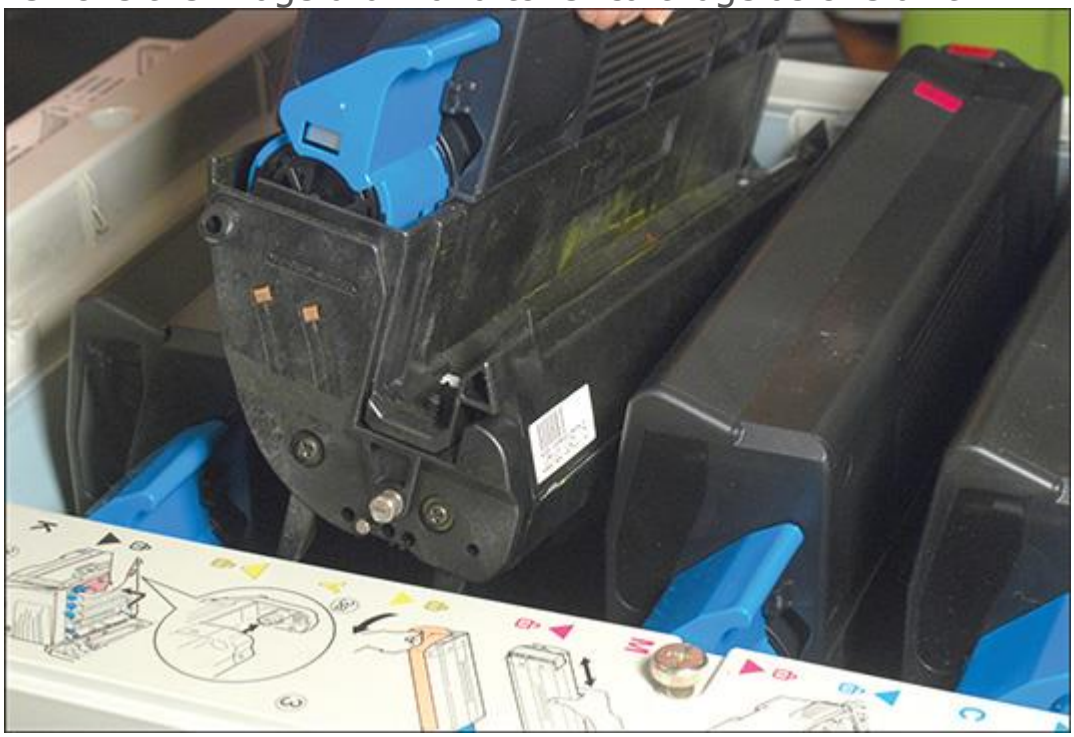
4. Unpack the new cartridge. Gently shake it from side to side to loosen the toner. Remove the tape from underneath the cartridge, and place the cartridge in the printer by inserting the left side first and then the right side. Push the cartridge lever back into position to lock the cartridge in place. Close the printer cover.

This printer has four image drums, one for each color. The drums are expected to last for about 15,000 pages. When you purchase a new drum, the kit comes with a new color toner cartridge. Follow these steps to replace the cartridge and image drum. In these steps, we are using the yellow drum and cartridge:

1. Turn off and unplug the printer. Wait about 30 minutes for it to cool down, then open the printer cover. The toner cartridge is connected to the image drum. Lift the drum together with the toner cartridge out of the printer (see Figure 10-33). Be sure to dispose of the drum and cartridge according to local regulations.

Figure 10-33

Remove the image drum and toner cartridge as one unit



2. Unpack the new image drum. Peel the tape off the drum and remove the plastic film around it. As you work, be careful to keep the drum upright so as not to spill the toner. Because the drum is sensitive to light, don't allow it to be exposed to bright light or direct sunlight. Don't expose it to normal room lighting for longer than five minutes.
3. Place the drum in the printer. Install the new toner cartridge in the printer. Close the printer cover.

The fuser should last for about 45,000 pages. To replace the fuser, follow these steps:

1. Turn off and unplug the printer. Allow the printer to cool, and open the cover.
2. Pull the two blue fuser levers forward to unlock the fuser (see Figure 10-34).

Figure 10-34

Pull the two fuser levers forward to release the fuser

3. Lift the fuser out of the printer using the handle on the fuser, as shown in Figure 10-35.

Figure 10-35

Remove the fuser

4. Unpack the new fuser, and place it in the printer. Push the two blue levers toward the back of the printer to lock the fuser in place.

As a last step whenever you service the inside of this printer, always carefully clean the LED erase lamps on the inside of the top cover (see Figure 10-36). The printer maintenance kits you've just learned to use all include a wipe to clean these strips.

Figure 10-36

Clean the LED strips on the inside top cover

10-4 Troubleshooting Printers

Core 1 Objectives

- 3.7

  Given a scenario, install and replace printer consumables.

- 5.6

  Given a scenario, troubleshoot and resolve printer issues.

In this part of the module, you learn some general and specific printer troubleshooting tips. As with all computer problems, begin troubleshooting by interviewing the user, finding out what works and doesn't work, and making an initial determination of the problem. When you think the problem is solved, ask the user to check things out to make sure they are satisfied with your work. After the problem is solved, be sure to document the symptoms of the problem and what you did to solve it.

10-4a Printer Does Not Print

Core 1 Objectives

- 3.7

  Given a scenario, install and replace printer consumables.

- 5.6

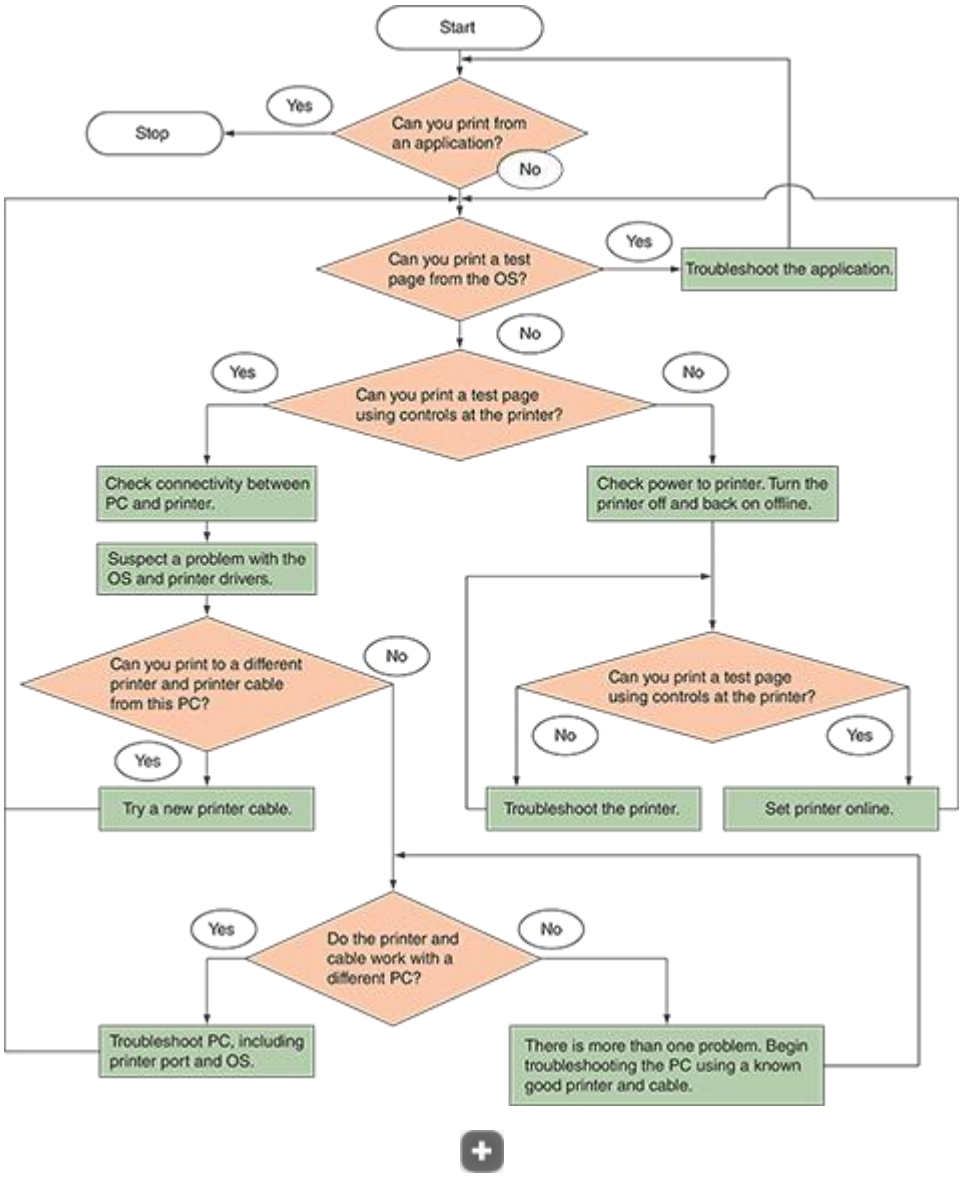
Given a scenario, troubleshoot and resolve printer issues.

When a printer does not print, the problem can be caused by any number of things. As you can see in Figure 10-37, the problem can be isolated to one of the following areas:

- The application attempting to use the printer
- Windows, Windows settings, or printer drivers
- The printer itself
- Connectivity between the computer and its local printer or a network printer

Figure 10-37

How to isolate a printer problem



In addition, if this is the first time you have tried to use the printer after installing it, the printer drivers or the printer installation might be the

problem. The following sections address printer problems caused by all of these categories, starting with the application trying to use the printer.

Problems Printing from Windows

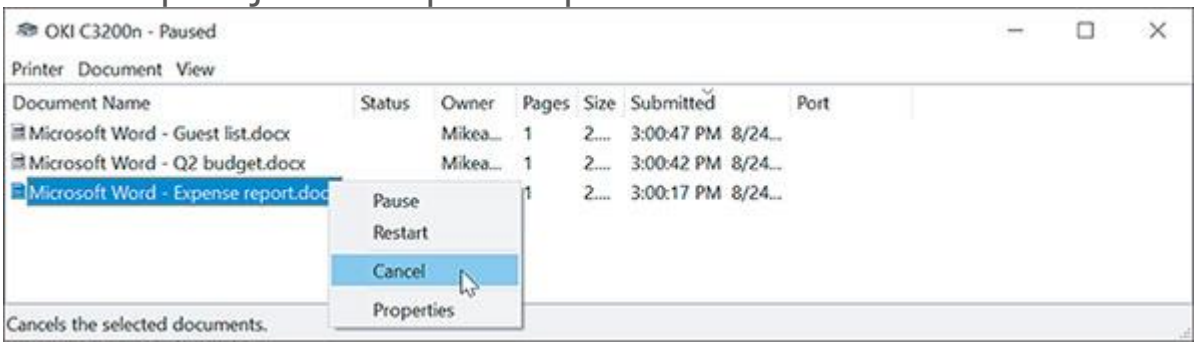
On the client computer, try to print a Windows test page. If the Windows test page does not print, do the following:

- 1.

  Check to see if the print spool is stalled. Open the printer's queue, and try deleting all print jobs in the queue. To cancel one document, right-click it, and click **Cancel** in the shortcut menu (see Figure 10-38). To cancel all documents, click **Printer**, and then click **Cancel All Documents**. Try printing a Windows test page again.

Figure 10-38

Cancel a print job in the printer queue



Exam Tip

The A+ Core 1 exam might give you a scenario that requires you to solve problems with the print queue.

- 2.

  If the Windows test page also stalls in the queue, go to the printer, and check the following at the printer:

  1. Is the printer on? Is it getting power?
  2. Is there paper in the printer?
  3. Does the control panel on the printer show an error code?
  4. Can you print a **printer self-test page** by using controls at the printer? For directions to print a self-test page, see the printer's user guide. For example, you might need to hold down a button or combination of buttons on the printer's front panel. If this test page prints correctly, then the printer is working. If the test page does not print, solve the problem with the printer itself.

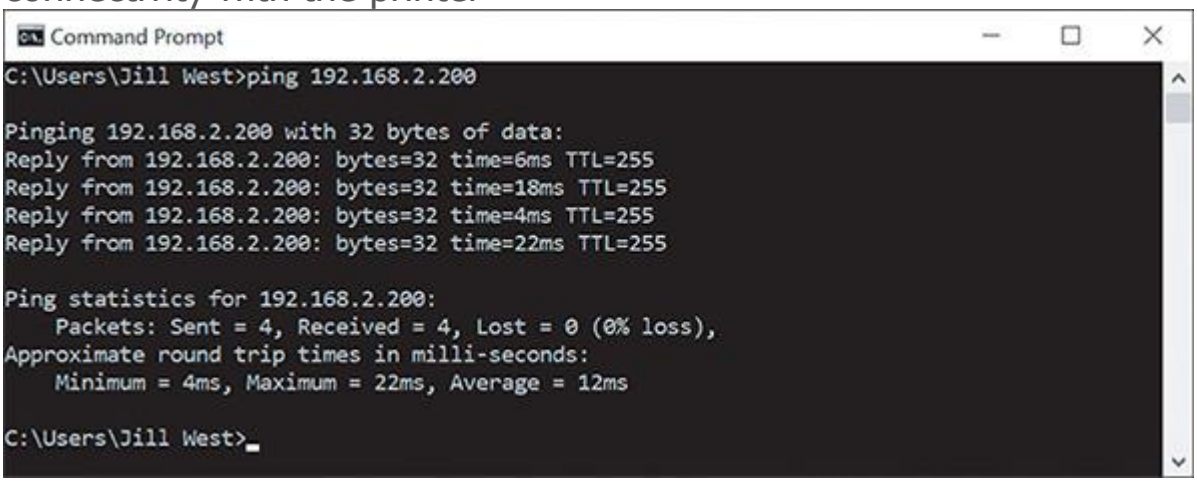
- 3.

If the printer is working, do a quick check to be sure you have communication with the printer before you continue troubleshooting. Do the following:

1. Try pinging the printer. Open a command prompt window, enter **`ping`**, and then enter the IP address of your printer. In Figure 10-39, the address is **192.168.2.200**. If the printer replies (see Figure 10-39), the problem is not network connectivity.

Figure 10-39

Use the ping command to determine if you have network connectivity with the printer



2. If the ping does not work, move on to steps covered in the section, "Problems with Connectivity for a Network Printer or Shared Printer."
3. For a USB printer, check the cable connection between the computer and the local printer.

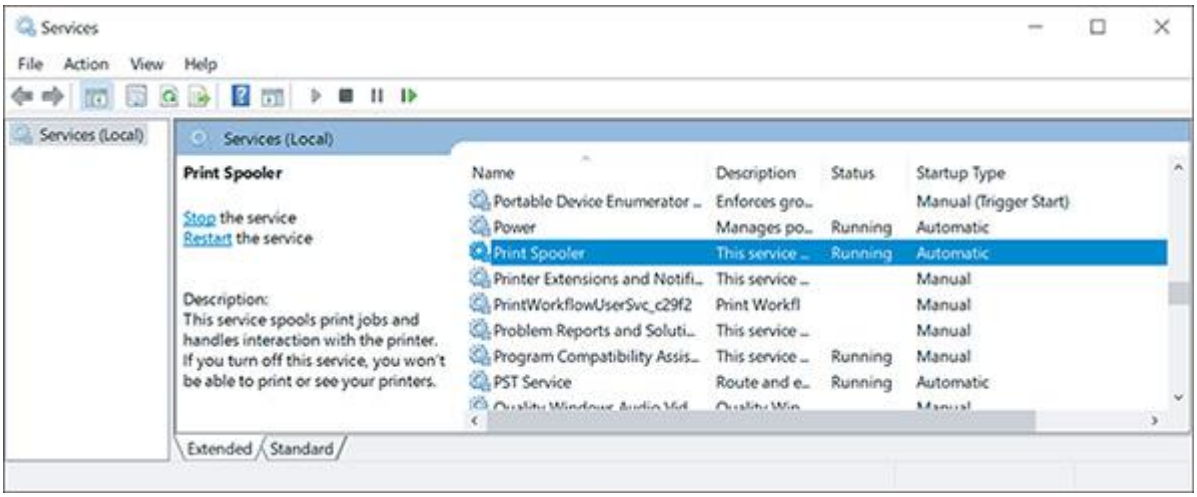
- 4.

If you have concluded you have connectivity with the printer, stop and restart the Windows Print Spooler service. Windows uses the **Services console** to stop, start, and manage background services used by Windows and applications. Do the following:

1. Enter **`services.msc`** in the Windows Run box. In the Services console, select **Print Spooler** (see Figure 10-40). Click **Stop** to stop the service.

Figure 10-40

Use the Services console to stop and start the print spooler



2. To delete any print jobs left in the queue, open **Explorer**, and delete all files in the C:\Windows\System32\spool\PRINTERS folder.
3. Restart the print spooler. Return to the Services console, make sure Print Spooler is selected, and click **Start**. Close the Services console window.

- 5.

  If you still cannot print, reboot the computer. Try deleting the printer and then reinstalling it.

- 6.

  Check the printer manufacturer's website for an updated printer driver. Download and install the correct driver.

Problems with the Printer Itself

To eliminate the printer as the problem, check these things:

- 1.

  Is the printer on? Is it getting power? If there's no image on the printer's control panel display, the printer is not getting power or it is turned off.

- 2.

  Does the printer have paper?

- 3.

  Look for an error message or error code in the control panel on the front of the printer. If the control panel reports "Ready" or "Online," then you can assume a network printer is communicating with the network.

Note 11

If you see an error code you don't understand, search the printer documentation or website to find out its meaning. Follow the directions on the printer manufacturer's website to address the error code.

- 4.

  Can you print a printer self-test page, as described earlier? If this test page prints correctly, then the printer is working.

Note 12

A printer self-test page might tell you the printer resolution and how much memory is installed. If this information is not correct, try upgrading firmware on the printer.

- 5.

  Try resetting the printer. (For some printers, press the Reset button on the printer.) Try powering down or unplugging the printer and starting it again. As it starts up, look for any new error messages that appear.

- 6.

  Is there a grinding noise? Typically a grinding noise means there is a problem with a gear, so look for damage done to moving parts of the printer. Next, try the following:

  - The carriage holding the ink cartridges could be stalled. Try a simple reset.
  - Look for a paper jam. (Clearing a paper jam is covered next.)
  - Reseat and possibly replace toner cartridges.
  - Reseat both the charge roller and the transfer roller.
  - If none of these steps stop the grinding noise, then consult with the printer's manufacturer for further help.

- 7.

  Is the paper installed correctly? Are the printer cover and rear access doors properly closed and locked? Is there a paper jam?

- 8.

  If paper is jammed inside the printer, follow the directions in the printer documentation to remove the paper. Don't jerk the paper from the printer mechanism, but pull evenly on the paper, with care. You don't want to leave pieces of paper behind. Check for jammed paper from both the input tray and the output bin. Check both sides. Laser and inkjet printers likely have a door in the back that you can open to gently clear the jammed paper, as shown in Figure 10-41.

  Figure 10-41

Open the door on the back of an inkjet printer to remove jammed paper

- 9.

  Is the paper not feeding? Remove the paper tray and check the metal plate at the bottom of the tray. Can it move up and down freely? If not, replace the tray. When you insert the tray in the printer, does the printer lift the plate as the tray is inserted? If not, the lift mechanism might need repair.

- 10.

  Damp paper can cause paper jams, creases, and wrinkles. Is the paper in the printer dry? Paper that is too thin can also crease or wrinkle in the printer.

- 11.

  For an inkjet printer, check if nozzles are clogged. Sometimes, leaving the printer on for a while will heat up the ink nozzles and unclog them.

- 12.

  If the print head of an impact printer moves back and forth but nothing prints, check the ribbon. Is it installed correctly between the plate and print head? Is it jammed? If the ribbon is dried out, it needs to be replaced.

- 13.

  Is there an error with the printer finisher? Some printers have a printer finisher, which staples or hole-punches papers at the end of a

print job. If the stapler is malfunctioning, try resetting the finisher by power cycling the printer while the cable to the finisher is disconnected. Next, reseat or replace the staple cartridge, and remove any jammed staples. If the hole puncher is malfunctioning, dispose of the punch scraps, make sure all the paper sizes are the same for the hole-punch job, and make sure the paper type is appropriate for hole punching. Finally, check to make sure an administrator hasn't disabled one or both of the finishing features.

- 14.

  Check the service documentation and printer page count to find out if routine maintenance is due or if the printer has a history of similar problems. Check the user guide for the printer and the printer manufacturer's website for other troubleshooting suggestions.

If you still cannot get a printer to work, you might need to take the printer to a certified repair shop. Before you do, though, try contacting the manufacturer. You might also be able to open a chat session on the printer manufacturer's website.

Problems with Connectivity for a Network Printer or Shared Printer

If the printer's self-test page prints correctly (the printer is working) but you cannot ping the printer from the computer where the print job was issued, the next step is to suspect no connectivity between the printer and computer. We call this computer the client computer in the following steps for a network printer:

1. Consider that the entire network might be down or the client computer is offline. Can the client computer communicate with other devices or computers on the network? Can another computer on the network communicate with the printer?
2. Consider that the IP address of the printer might have changed, which can happen if the printer is receiving a dynamic IP address. Using Windows, delete the printer, and then install the printer again. If this solves the problem, assign a static IP address to the printer to keep the problem from reoccurring.
3. Can you print to another network printer? If so, there might be a problem with the first printer's configuration. Try uninstalling and installing the printer at the client computer.
4. Check the network port on the printer and the switch or router to which the printer connects. Do the network status indicator lights indicate connectivity and network activity? If not, try replacing the network cable to the printer.
5. Use the printer's browser-based utility, and check for status reports and error messages. Run diagnostic software that might be available

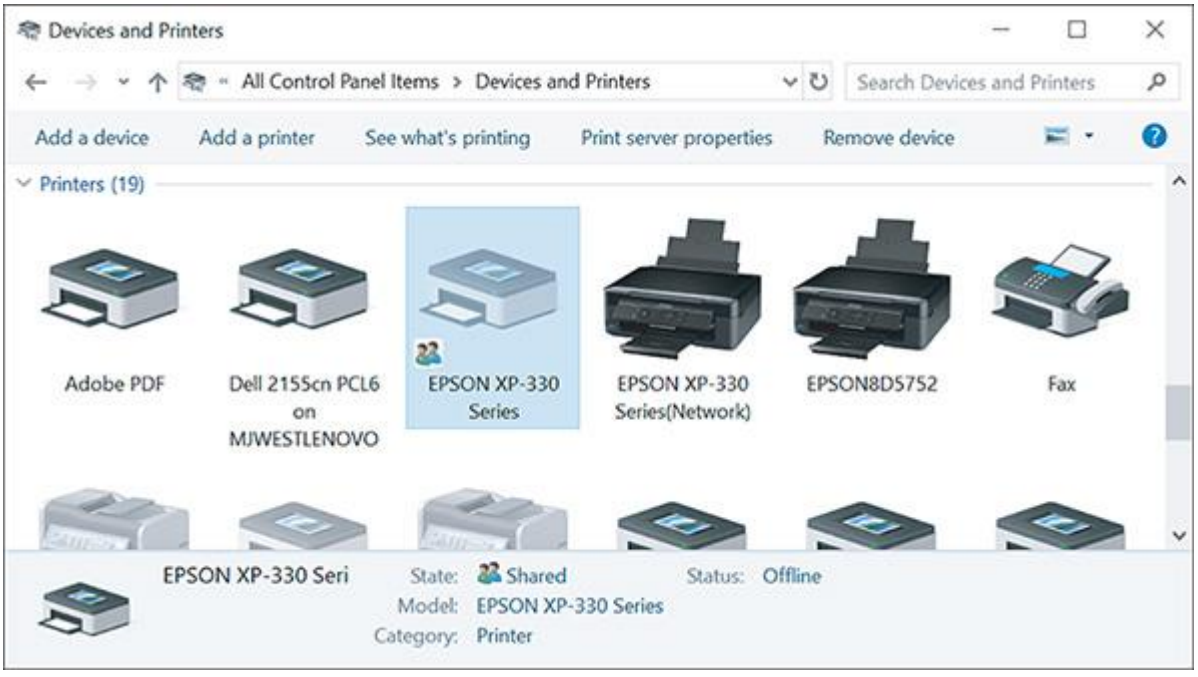
on the utility menu. Try flashing the printer's firmware if updates are recommended by the manufacturer.

6. Is the printer installed directly on the client computer or on another host computer that is acting as a print server?

Even though you are using a network printer, it might have been installed as a printer that is shared on the network by the host computer. Let's look at an example of this situation. Figure 10-42 shows a Devices and Printers window with several installed printers. Notice the two installations of the EPSON XP-330 Series printer. The first installation was done by using a printer that was shared by another computer on the network. The second installation was done by installing the Epson printer as a network printer addressed by its IP address. When you print using the second installation of the Epson printer, you print directly over the network to the printer. When you print to the first installation of the Epson printer, you print by way of the other computer on the network. If this computer is offline, the print jobs back up in the print queue until the computer is available.

Figure 10-42

A network printer installed using two methods



When a computer has shared a local or network printer with others on the network, follow these steps to solve problems with the shared printer:

1. Is enough hard drive space available on the client or host computer?
2. Did you get an "Access denied" message when you tried to print from the client computer? If so, you might not have access to the host computer. On the client computer, go to Explorer and attempt to drill

down into resources on the printer's computer. Perhaps you have not entered a correct user account and password to access this computer; if that is the case, you will not be able to use the computer's resources. Make sure you have a matching Windows user account and password on each computer.

3. On the host computer, open the printer's Properties dialog box, and click the **Security** tab. Select **Everyone** and make sure Permissions for Everyone includes permission to print (refer back to Figure 10-18).
4. Using Windows on the client computer, delete the printer, and then install the printer again. For best results, install the printer directly over the network and not through another computer. Watch for and address any error messages that might appear.

10-4b Poor Print Quality

Core 1 Objectives

- 3.7

  Given a scenario, install and replace printer consumables.

- 5.6

  Given a scenario, troubleshoot and resolve printer issues.

Poor print quality can be caused by the printer drivers, the application, Windows, or the printer. Let's start by looking at what can cause poor print quality with laser printers and then move on to other problems that affect printouts.

Exam Tip

The A+ Core 1 exam might give you a scenario that requires you to resolve problems with faded prints, echoes, vertical lines or garbled characters on a page, wrong paper size, print appearing sideways on a page, and wrong print colors. All these problems are covered in this part of the module.

Poor Print Quality for Laser Printers

For laser printers, poor print quality can include printing blank pages or faded, smeared, wavy, speckled, or streaked printouts with vertical lines down the page. These problems often indicate that the toner is low. All major mechanical printer components that normally create problems are conveniently contained within the replaceable toner cartridge. In most cases, the solution to poor-quality printing is to replace this cartridge.

Follow these general guidelines to fix poor print quality with laser printers:

- 1.

If you suspect the printer is overheated, unplug it and allow it to cool for 30 minutes.

- 2.

  The toner cartridge might be low on toner, or it might not be installed correctly. Remove the toner cartridge, and gently rock it from side to side to redistribute the toner. Replace the cartridge. To avoid flying toner, don't shake the cartridge too hard.

- 3.

  If this doesn't solve the problem, try replacing the toner cartridge immediately.

- 4.

  Econo Mode (a mode that uses less toner) might be on; turn it off.

- 5.

  The paper quality might not be good enough. Try a different brand of paper. Only use paper recommended for a laser printer. Also, be aware that some types of paper can receive print only on one side.

- 6.

  The printer might need cleaning. Clean the inside of the printer with a dry, lint-free cloth. Don't touch the transfer roller, which is the soft, spongy black roller.

- 7.

  If the transfer roller is dirty, the problem will probably correct itself after several sheets print. If not, take the printer to an authorized service center.

- 8.

  Does the printer require routine maintenance? Check the website of the printer's manufacturer to see how often to perform maintenance and to purchase the required printer maintenance kit.

Note 13

Extreme humidity can cause the toner to clump in the cartridge and give a Toner Low message. If this is a consistent problem in your location, you might want to invest in a dehumidifier for the room where your printer is located.

- 9.

  Streaking is usually caused by a dirty developer unit or corona wire. The developer unit is contained in the toner cartridge. Replace the cartridge or check the printer documentation for directions on how to

remove and clean the developer unit. Allow the corona wire to cool, and clean it with a lint-free swab.

- 10.

  Speckled printouts can be caused by the laser drum. If cleaning the printer and replacing the toner cartridge don't solve the problem, replace the laser drum.

Note 14

If loose toner comes out with your printout, the fuser is not reaching the proper temperature, and toner is not being fused to the paper. Professional service is required.

- 11.

  Distorted images can be caused by foreign material inside the printer that might be interfering with the mechanical components. Check for debris that might be interfering with the printer operation.

- 12.

  If the page has a gray background or gray print, the image drum is worn out and needs to be replaced.

- 13.

  If an echo or ghost image appears as a double a few inches below the actual darker image on the page, the problem is usually with the image drum or toner cartridge. The drum is not fully cleaned in the cleaning stage, and toner left on it causes the ghost image. If the printer utility installed with the printer offers the option to clean the drum, try that first. The next solution is to replace the toner cartridge. If the problem is still not solved, replace the image drum.

Poor Print Quality for Inkjet Printers

To troubleshoot blank pages or poor print quality for an inkjet printer, check the following:

1. Is the correct paper for inkjet printers being used? The quality of paper determines the final print quality, especially with inkjet printers. In general, the better the quality of the paper you use with an inkjet printer, the better the print quality. Don't use less than 20-pound paper in any type of printer unless the printer documentation specifically states that a lower weight is satisfactory.
2. Is the ink supply low, or is there a partially clogged nozzle?
3. Remove and reinstall the cartridge(s).
4. Follow the printer's documentation to clean each nozzle. Is the print head too close to or too far from the paper?
5. In some printers, there is a little sponge near the carriage rest that can become clogged with ink. It should be removed and cleaned.

6. If you are printing transparencies, try changing the fill pattern in your application.
7. Missing lines or dots on the printed page can be caused by the ink nozzles drying out, especially when the printer sits unused for a long time. Follow the directions given earlier in the module for cleaning inkjet nozzles.
8. Streaks or lines down the page can be caused by dust or dirt in the print head assemblage. Follow the manufacturer's directions to clean the inkjet nozzles.

Garbled Characters on Paper

If scrambled or garbled characters print on all or part of a page, the problem may be caused by the document being printed, the application, connectivity between the computer and the printer, or the printer. Follow these steps to zero in on the problem:

1. First, cancel all print jobs in the print queue. Then try printing a different document from the same application. If the second document prints correctly, the problem is with the original document.
2. Try printing using a different application. If the problem is resolved, try repairing or reinstalling the application.
3. For a USB printer, the problem might be with a USB hub, port, or cable. Is the USB cable securely connected at both ends? If you are using a USB hub, remove the hub, connecting the printer directly to the computer. Try a different USB cable or USB port.
4. Recycle the printer by powering it down and back up or by pressing a Reset button.
5. Update the printer drivers. Go to the website of the printer manufacturer to find the latest drivers and follow the directions to install them.
6. If the problem is still not solved, the printer might need servicing. Does the printer need maintenance? Search the printer manufacturer's website for other solutions.

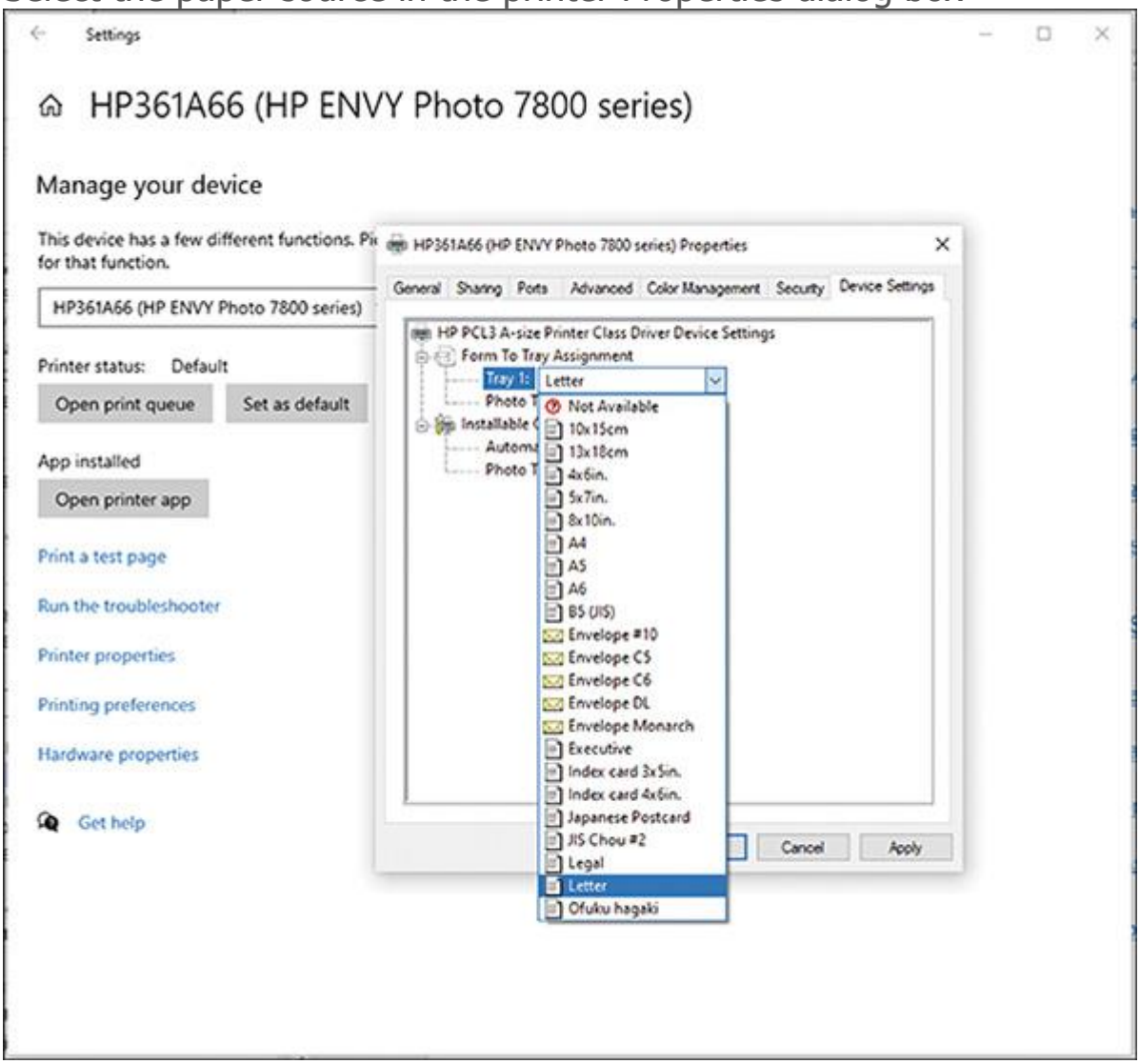
Paper Size Mismatch Errors

A printer gives a paper size error or paper mismatch error when the size of the paper, envelope, or other media in the paper tray or feeder doesn't match the paper size chosen in the printer's settings for the current print job. This error message prevents wasting toner or ink. To resolve the paper size mismatch error, do the following:

1. Check the paper size setting in the printer Properties or Printing Preferences dialog box, as shown in Figure 10-43. Make sure the size selected is the same size as the paper or envelope loaded in the tray or feeder.

Figure 10-43

Select the paper source in the printer Properties dialog box



2. Remove and reload the paper in the tray or feeder. When reseating the paper, adjust the paper width guides to gently touch the sides of the paper. Confirm the tray setting indicates the correct tray.
3. Reset the printer to clear any errors. Unplug the printer, wait at least a minute, and then reconnect the power cord. Turn on the printer and wait for it to fully power on.

Print Comes Out Sideways

Some printers try to fill the page with the print by automatically rotating from portrait mode to landscape mode or vice versa. If the print comes out rotated but doesn't fill the page, then use the printer's Property dialog box to change the setting to the opposite orientation. Another problem could be that the margins are set too small for the printer capabilities, causing it to automatically rotate to try fit the content on the page. Adjust the margins to what the printer can handle or use a different printer.

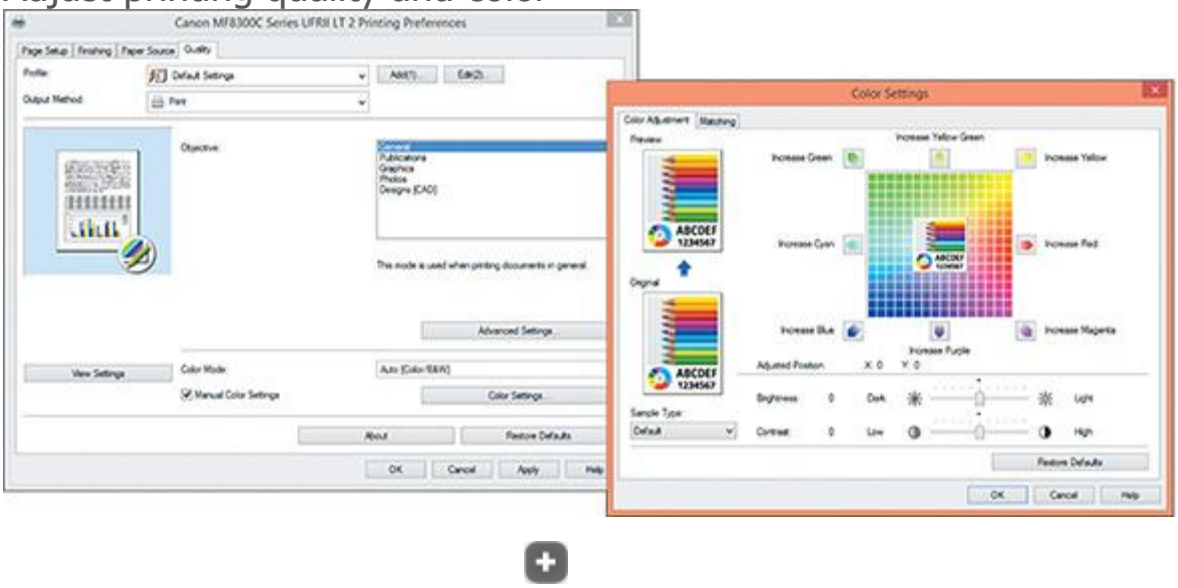
Wrong Print Colors

For a printer that is printing the wrong colors, sometimes called the chroma display, do the following:

1. Check to see if the paper you are using is designed to print on only one side. You might need to flip the paper in the printer.
2. Try adjusting the print quality. These adjustments vary by printer. For one color laser printer, open the **Printing Preferences** dialog box, and click the **Quality** tab (see the left side of Figure 10-44). You can try different selections on this tab. To manually adjust the color, check **Manual Color Settings**, and then click **Color Settings**. The Color Settings dialog box appears, as shown on the right side of Figure 10-44.

Figure 10-44

Adjust printing quality and color



Source: Canon

3. For an inkjet printer, try cleaning the ink cartridges and calibrating the printer. One step in this process prints a self-test page. If the self-test page shows missing or wrong colors, the problem is with the ink cartridges. Try cleaning the ink nozzles. If that doesn't work, replace the ink cartridges.
4. For a laser printer, try calibrating the printer if that option is available.

Applying Concepts

Solving Problems with Printer Installations

- **Est. Time:** 30 minutes
- **Core 1 Objectives:** 3.7,5.6

Here are some steps you can take if the printer installation fails or installs with errors:

1. 1
   If you have problems, consider that Windows might be using the wrong or corrupted printer drivers. Try removing the printer and then installing it again. To remove a printer in the Windows 10 Settings app, select a printer, and click **Remove device**. (In Windows 11, click **Remove**.) To use Control Panel, right-click the printer in the Devices and Printers window, and click **Remove device**. Try to install the printer again.

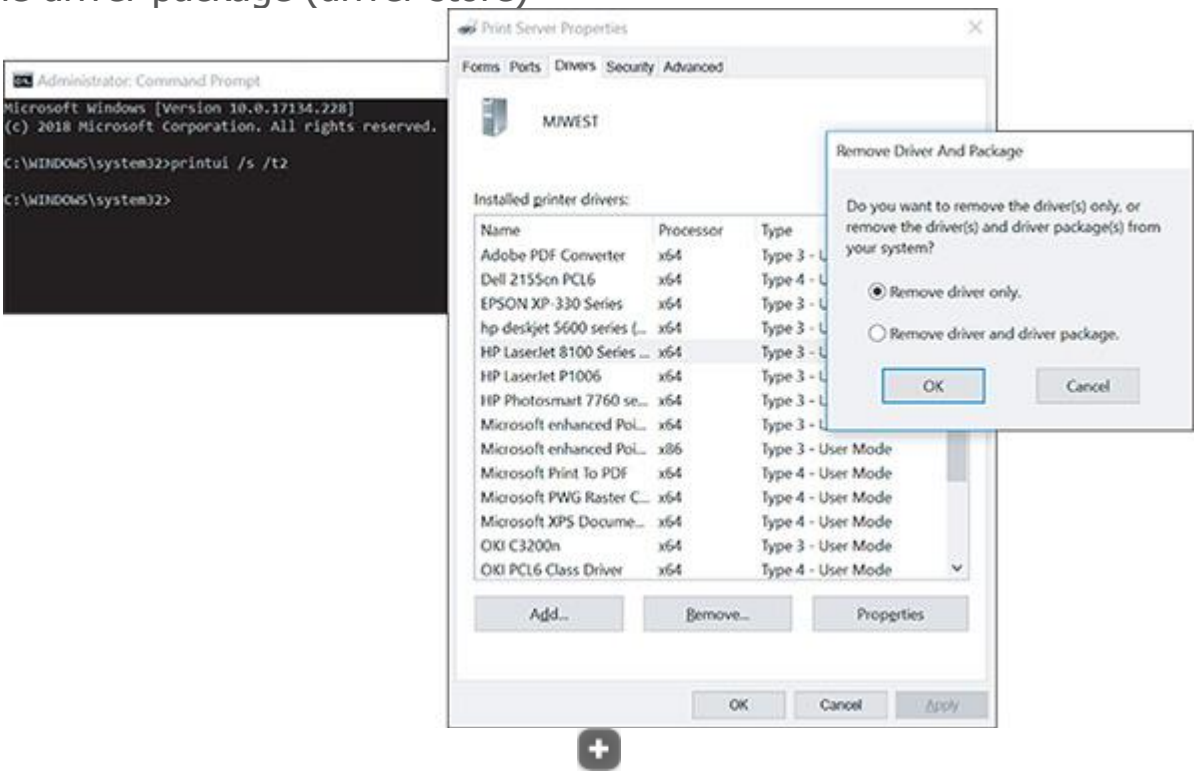
2. 2
   If the problem is still not solved, completely remove the printer drivers by using the printui command. The Printer User Interface command, **printui**, is used by administrators to manage printers and printer drivers on remote computers. You can also use it to delete drivers on the local computer. Follow these steps:

   1. a
      If the printer is listed in the Settings app or the Devices and Printers window, remove it. (Sometimes Windows automatically puts a printer there when it finds printer drivers are installed.)

   2. b
      Before you can delete printer drivers, you must stop the print spooler service. Open the **Services** console, and use it to stop the Print Spooler (refer to Figure 10-45). To delete any print jobs left in the queue, open **Explorer** and delete all files in the C:\Windows\System32\spool\PRINTERS folder.

      Figure 10-45

      Use the printui command to delete printer drivers and possibly delete the driver package (driver store)



3. c
   You can now start the print spooler back up. Because the printer is no longer listed in the Settings app or the Devices and Printers window, starting the spooler will not tie up these drivers.

4. d
   Open an **elevated command prompt window**, which is a window used to enter commands that have administrator privileges. To open this window, type **cmd** in the Windows 10/11 search box, and then click **Run as administrator**. Respond to the UAC box.

5. e
   At the command prompt (see the left side of Figure 10-45), enter the command **`printui /s /t2`**. In the command line, the /s causes the Print Server Properties dialog box to open, and the /t2 causes the Drivers tab to be the selected tab.

6. f
   The Print Server Properties dialog box opens, as shown in the middle of Figure 10-45. Select the printer and click **Remove**. In the Remove Driver And Package dialog box (see the right side of Figure 10-45), select **Remove driver only**, and click **OK**. It is not necessary to remove the driver package. (This driver package, also called the driver store, can be installed on this computer or a remote computer; it holds a backup of the printer drivers.)

7. g
   When a warning box appears, click **Yes**. Close all windows.

3. 3
Try to install the printer again. Start the installation from the CD that came bundled with the printer or by using the printer setup program downloaded from the printer manufacturer's website.

10-5a Module Summary

Printer Types and Features

- The two most popular types of printers are laser and inkjet. Other types of printers are impact printers (dot matrix), thermal printers, and 3D printers. Laser printers produce the highest quality, followed by inkjet printers. Dot matrix printers have the advantage of being able to print multicopy documents. 3D printers use a plastic filament or a resin to build a 3D model of a digital image.
- The seven steps that a laser printer performs to print are processing, charging, exposing, developing, transferring, fusing, and cleaning. The charging, exposing, developing, and cleaning steps take place inside removable cartridges, which makes the printer easier to maintain.

- Inkjet printers print by shooting ionized ink at a sheet of paper. The quality of the printout largely depends on the quality of paper used with the printer.
- Dot matrix printers are a type of impact printer. They print by projecting pins from the print head against an inked ribbon that deposits ink on the paper.
- Direct thermal printers use heat to burn dots into special paper, and thermal transfer printers melt the ribbon or foil during printing.
- If you want to design your own images for three-dimensional printing, you'll need a 3D modeling program.

Using Windows to Install, Share, and Manage Printers

- A printer is installed as a local printer connected directly to a computer or as a network printer that works as a device on the network. Local printers can connect to a computer via a USB, Bluetooth, or Wi-Fi connection. Network printers can connect to the network via an Ethernet or Wi-Fi connection. USB printers are installed automatically in Windows.
- When a printer offers a choice of drivers between PCL or Postscript, choose PCL for general applications and speed, and choose Postscript for graphic-intense applications printing.
- Windows installs, manages, and removes a printer using the Printers & scanners window in the Settings app or the Devices and Printers window in Control Panel. You can also install a printer using a setup program provided by the printer manufacturer. Always print a test page after installing a printer.
- A print server can be a computer on the network, firmware embedded in a network printer, or other network hardware such as a router or firewall.
- A printer can be shared in Windows so others on the network can use it. To use a shared printer, the printer drivers must be installed on the remote computer.
- Network printers are identified on the network by their IP address.
- The Windows print queue is managed from the Printers & scanners window or from the Devices and Printers window.
- Secure a shared printer with user authentication, secured printing, audit logs, and badging.
- Network scan services include scan-to-email, scan-to-SMB, and scan-to-cloud.
- Printer features—such as duplexing, collating, and page orientation—are managed in a printer Properties dialog box.

Printer Maintenance

- An inkjet or laser printer can be calibrated to align the color on the page. The nozzles of an inkjet printer tend to clog or dry out, especially

when the printer remains unused. The nozzles can be cleaned automatically by means of printer software or buttons on the front panel of the printer.
- Check the page count of the printer to know when service is due and you need to order a printer maintenance kit. The page count can be reported on the printer panel or through a web-based utility in the printer firmware.

Troubleshooting Printers

- When troubleshooting printers, first isolate the problem. Narrow the source to the printer, connectivity between the computer and its local printer, the network, Windows, printer drivers, the application using the printer, or the printer installation. Test pages printed directly to the printer or within Windows can help narrow the source of the problem.
- Poor print quality can be caused by the printer drivers, the application, Windows, or the printer. For a laser printer, consider that low toner can be the problem. For an inkjet printer, consider that the ink cartridges need cleaning or replacing. The quality of paper can also be a problem.

10-5c Thinking Critically

These questions are designed to prepare you for the critical thinking required for the A+ exams and may use information from other modules and the web.

1. You're responding to a troubleshooting ticket about a laser printer in HR that isn't working. According to the ticket, the printer runs the print job and successfully sends the paper through with the text printed correctly. However, the toner smudges easily and sticks to other papers, equipment, and clothes. Which part in the printer probably needs replacing?

    1. Fuser assembly
    2. Imaging drum
    3. Transfer roller
    4. Toner cartridge
2. You are not able to print a Word document on a Windows computer to a printer on the network. The network printer is connected directly to the network, but when you look at the Devices and Printers window, you see the name of the printer as \\BRYANT\HP LaserJet Pro MFP. In the following list, select the possible sources of the problem. (Choose all that apply.)

    1. The BRYANT computer is not turned on.
    2. The HP LaserJet printer is not online.
    3. The BRYANT computer does not have file and printer sharing enabled.
    4. The Windows computer has a stalled print spool.

3. You are not able to print a test page from your Windows computer to your local, USB-connected Canon Pixma printer. Which of the following are possible causes of the problem? (Choose all that apply.)

    1. The network is down.
    2. The printer cable is not connected properly.
    3. The Windows print spool is stalled.
    4. File and printer sharing is not enabled.

4. What should you do if an inkjet printer prints with missing dots or lines on the page?

    1. Change the toner cartridge.
    2. Clean the heating element.
    3. Replace the image drum.
    4. Clean the inkjet nozzles.

5. Why might you assign a static IP address to a printer?
6. You left a receipt on a desk. You decide to eat lunch at your desk, and you set your hot plate on top of the receipt. When you pick up your plate, you notice that the receipt has turned black. What likely happened to the receipt?
7. Why does a 3D resin printer print objects upside down?
8. You've been certified through badging to use a 3D printer at your university. You design your first object to print. What file type do you bring with you to the 3D printer to print your object?
9. When unboxing a new printer, why is it important to remove all protective tapes or films from the printer?
10. You work at a print shop that produces marketing materials, and your manager asks you to install a new printer. The printer comes with two options for drivers. One uses PCL, and the other uses Postscript. Which driver is the best option and why?
11. An accounting agency needs a recommendation for a new printer. What feature included with a printer would provide an extra level of confidentiality to protect client financial information?
12. You have some documents that you need to scan and make available to different device platforms on different networks. Which network scan service is the best solution?
13. When you are working with a laser printer, toner spills and gets on your hands, clothes, and floor. What is the best way to clean up?
14. A laser printer is printing images with ghost images. What part(s) of the laser printer are the most likely source of the problem?
15. You created a flyer for an event to post around campus. You changed the margins so they are as narrow as possible to create more space for the contents of the flyer. When you go to print the flyer, however, it comes out sideways. What likely caused the flyer to print sideways?

10-5d Hands-On Projects

Hands-On Project 10-1

Researching Printer Support

- **Est. Time:** 30 minutes
- **Core 1 Objectives:** 3.7,5.6

Your company plans to purchase a new printer, and you want to evaluate the printer manufacturers' websites to determine which site offers the best support. Research three websites listed in Table 10-1, and answer these questions, supporting your answers with pages that you have saved or printed from the websites:

1. Which website made it easiest for you to select a new printer, based on your criteria for its use?
2. Which website made it easiest for you to find help for troubleshooting printer problems?
3. Which website gave you the best information about routine maintenance for its printers?
4. Which website gave you the best information about how to clean its printers?

Hands-On Project 10-2

Selecting a Color Printer for a Small Business

- **Est. Time:** 30 minutes
- **Core 1 Objectives:** 3.6,3.7

Jack owns a small real estate firm and has come to you asking for help with his printing needs. Currently, he has a color inkjet printer that he is using to print flyers, business cards, brochures, and other marketing materials. However, he is not satisfied with the print quality and wants to invest in a printer that produces more professional-looking materials. He expects to print no more than 8000 sheets per month and needs the ability to print envelopes, letter-size and legal-size pages, and business cards. He wants to be able to automatically print on both sides of a legal-size page to produce a three-column brochure. Research printer solutions, and do the following:

1. 1
   Save or print webpages to present to Jack showing three printers that satisfy his needs. Include at least one laser printer and at least one printer technology other than laser in your selections.
2. 2
   Save or print webpages showing the routine maintenance requirements of these printers.
3. 3
   Save or print webpages showing all the consumable products (other than paper) that Jack should expect to have to purchase in the first year of use.
4. 4
   Calculate the initial cost of the equipment and the total cost of consumables for one year (other than paper) for each printer solution.
5. 5
   Prepare a list of advantages and disadvantages for each solution.
6. 6
   Based on your research, which of the three solutions do you recommend? Why?

Hands-On Project 10-3

Printing in the Cloud

- **Est. Time:** 45 minutes

- **Core 1 Objective:** 3.6

To practice cloud printing using PaperCut Mobility Print, you'll need a computer with an installed printer and another computer somewhere on the Internet or on the same network.

On the computer with an installed printer, do the following to register your printer as a cloud printer:

1. 1
   If you don't already have PaperCut Mobility Print, go to papercut.com/products/free-software/mobility-print, download the software, and install it. During set up, create a local account.

2. 2
   After creating an account, the utility page to configure PaperCut Mobility Print opens. Click **Select printers**. The list of installed printers appears. Turn on publishing for only the printers you want to use for cloud printing. Close the Published printers menu.

3. 3
   To enable cloud printing from beyond the local network, click **Enable Cloud Print**. Click **Enable**. Next, you'll need to configure an invitation link to share with anyone you want to be able to print on your selected printer. PaperCut Mobility Print suggests setting an expiration date for the invitation.

4. 4
   Send the link to another computer anywhere on the Internet or on the local network.

On a computer anywhere on the Internet or on the local network, do the following:

1. 1
   Open the link received from PaperCut Mobility Print. Click **Open**. The link opens the Set up webpage for client printing.

2. 2
   Click **Download and run Mobility Print**. Open and run the installer package. Follow the on-screen instructions to install PaperCut Mobility Print Client.

3. 3
   Return to the Set up website for client printing. Click **Connect and get my printers**. Click **Open**. This automatically retrieves the printers that were shared in the invitation link.

4. 4
   Navigate to a webpage you want to print. In the browser menu, select **Print**.

5. 5
   On the Print page, select the shared printer. The printer name includes an IP address and the label Mobility. The page prints over the web to your printer. Did your print job print correctly? Describe any problems with the print job.

10-5e Real Problems, Real Solutions

Real Problem 10-1

3D Printer Badging

- **Est. Time:** 30 minutes
- **Core 1 Objective:** 3.6

3D printer badging is an interesting process. If you've never had access to a 3D printer before, consider taking a class to explore using a 3D printer. Completing such a class could be useful for you if you ever need to support a 3D printer. Research class options at your local library or university, and find out if they have a 3D printer available for community use. If you don't have a class available locally, you can find an online class available for free, such as the one offered by Pikes Peak Library District in Colorado. Go to their website (research.ppld.org/3dprinting/badging), and complete steps 1 and 2, which are to watch the video and take the assessment quiz. What was your score on the quiz?

Real Problem 10-2

Practicing Troubleshooting Printers

- **Est. Time:** 1 hour
- **Core 1 Objective:** 3.7

To practice troubleshooting printers, gather in a group or work individually on a printer available to you. On small pieces of paper, write down 10–15 printer problems that you have learned how to fix in this module. Fold up the pieces of paper, and put them in a pile. Take turns drawing a paper with a printer problem. Write down the problem you need to solve as well as possible causes. Then, on the printer, perform the steps you would take to resolve that issue. If you don't have a printer to practice with, then write down the steps you would take, and compare answers with your classmates. Possible problems you could use include the following:

- Lines down the printed pages
- Garbled print on the page
- Toner not fusing to the paper
- Paper jams
- Faded print
- Incorrect paper size
- Multipage misfeed
- Multiple prints pending in the queue
- Speckling on printed pages
- Ghost images
- Incorrect colors printing
- Grinding noise
- Finisher malfunctions
- Incorrect page orientation