CompTIA A+ Core 1 Exam 220-1001

CHAPTER 1: Mobile Devices
CHAPTER 2: Networking
CHAPTER 3: Hardware
CHAPTER 4: Virtualization and Cloud Computing
CHAPTER 5: Hardware and Network Troubleshooting
1.1 Given a scenario, install and configure laptop hardware and components.

- Hardware/device replacement
  - Keyboard
  - Hard drive
    - SSD vs. hybrid vs. magnetic disk
    - 1.8 in vs. 2.5 in
  - Memory
  - Smart card reader
  - Optical drive
  - Wireless card/Bluetooth module
  - Cellular card
  - Video card
  - Mini PCIe
  - Screen
  - DC jack
  - Battery
  - Touchpad
  - Plastics/frames
  - Speaker
  - System board
  - CPU
✓ 1.2 Given a scenario, install components within the display of a laptop.

- Types
  - LCD
  - OLED
- WiFi antenna connector/placement
- Webcam
- Microphone
- Inverter
- Digitizer/touchscreen

✓ 1.3 Given a scenario, use appropriate laptop features.

- Special function keys
- Dual displays
- Wireless (on/off)
- Cellular (on/off)
- Volume settings
- Screen brightness
- Bluetooth (on/off)
- Keyboard backlight
- Touchpad (on/off)
- Screen orientation
- Media options (fast forward/rewind)
- GPS (on/off)
- Airplane mode
- Docking station
- Port replicator
- Physical laptop lock and cable lock
- Rotating/removable screens
✓ 1.4 Compare and contrast characteristics of various types of other mobile devices.

- Tablets
- Smartphones
- Wearable technology devices
  - Smart watches
  - Fitness monitors
  - VR/AR headsets
- E-readers
- GPS

✓ 1.5 Given a scenario, connect, and configure accessories and ports of other mobile devices.

- Connection types
  - Wired
    - Micro-USB/Mini-USB/USB-C
    - Lightning
    - Tethering
    - Proprietary vendor-specific ports (communication/power)
  - Wireless
    - NFC
    - Bluetooth
    - IR
    - Hotspot
- Accessories
  - Headsets
  - Speakers
  - Game pads
  - Extra battery packs/battery chargers
  - Protective covers/waterproofing
  - Credit card readers
  - Memory/MicroSD
✓ 1.6 Given a scenario, configure basic mobile device network connectivity and application support.

- Wireless/cellular data network (enable/disable)
  - Hotspot
  - Tethering
  - Airplane mode
- Bluetooth
  - Enable Bluetooth
  - Enable pairing
  - Find a device for pairing
  - Enter the appropriate pin code
  - Test connectivity
- Corporate and ISP email configuration
  - POP3
  - IMAP
  - Port and SSL settings
  - S/MIME
- Integrated commercial provider email configuration
  - iCloud
  - Google/Inbox
  - Exchange Online
  - Yahoo
- PRI updates/PRL updates/baseband updates
- Radio firmware
- IMEI vs. IMSI
- VPN

✓ 1.7 Given a scenario, use methods to perform mobile device synchronization.

- Synchronization methods
  - Synchronize to the cloud
  - Synchronize to the desktop
  - Synchronize to the automobile
- Types of data to synchronize
  - Contacts
  - Applications
  - Email
  - Pictures
  - Music
  - Videos
  - Calendar
  - Bookmarks
  - Documents
  - Location data
  - Social media data
  - E-books
  - Passwords
- Mutual authentication for multiple services (SSO)
- Software requirements to install the application on the PC
- Connection types to enable synchronization
This chapter will focus on the exam topics related to mobile devices. It will follow the structure of the CompTIA A+ 220-1001 exam blueprint, objective 1, and cover the seven subobjectives that you will need to master before taking the exam. The Mobile Devices domain represents 14 percent of the total exam.

1.1 Given a scenario, install and configure laptop hardware and components.

Whether you choose to call them laptops, notebooks, tablets, or something different is mostly a matter of semantics. In this section, I’ll discuss some of the basic components of laptops and their installation (when possible and called for). In many cases, the components are the same as in a desktop computer.

The following topic is addressed in exam objective 1.1:

- Hardware/device replacement

**Hardware/device replacement**

Replacing hardware and devices in a laptop can be a challenge because of the size limitations. The best way to determine the proper disassembly method is to consult the documentation from the manufacturer.

Some models of notebook PCs require a special T-8 Torx screwdriver. Most PC toolkits come with a T-8 bit for a screwdriver with interchangeable bits, but you may find that the T-8 screws are countersunk in deep holes so that you can’t fit the screwdriver into them. In such cases, you need to buy a separate T-8 screwdriver, available at most hardware stores or auto parts stores.

---

**NOTE**

Many laptop manufacturers will consider a warranty void if an unauthorized person opens a laptop case and attempts to repair it.
Prepare a clean, well-lit, flat work surface; assemble your tools and manuals; and ensure that you have the correct parts. Shut down the PC, unplug it, and detach any external devices such as an external keyboard, mouse, or monitor. In this section, with these general guidelines for opening the laptop in mind, you’ll look at replacing various components of a laptop. Always ensure that you have grounded yourself before working with computer components of any kind. Use an antistatic wristband and attach it to the case.

**Keyboard**

When replacing the keyboard, one of the main things you want to keep in mind is *not* to damage the data cable connector to the system board.

1. With the laptop fully powered off and unplugged from the wall, remove the battery. Examine the screws on the back of the laptop. Ideally, icons indicating which screws are attached to the keyboard will be available. If not, look up the model online and determine which of the screws are attached to the keyboard.

2. Remove the screws with a T-8 or Phillips-head screwdriver. With the laptop turned back over, open it. If the keyboard is tucked under any plastic pieces, determine whether those pieces need to have screws removed to get them out of the way; if so, remove the screws and the plastic pieces. In some cases, there may just be clamps that are easily removed.

3. With any plastic covers out of the way, remove any screws at the top and remove the keyboard itself from top to bottom. There should be a thin, but wide, data cable to the system board at the bottom. This is the piece to be careful with!

4. Take a pick and lift the plastic connectors that hold this data cable in place. Remove the data cable. Take the new keyboard and slip the data cable back in between the plastic connectors on the system board. Ensure it’s all the way in.

5. Put the plastic connector back into place and make sure it’s holding the data cable in. Position the keyboard into place and refasten the keyboard in place at the top, replacing any screws that were there before.

6. Replace any plastic pieces that were covering the keyboard, turn the laptop over, and replace all of the keyboard screws. When you replace the battery and turn it on, check the functionality. If the keyboard doesn’t work, the main component to check is the data connector.

**Hard drive**

Before changing a hard drive, you should back up the old hard drive if the data is needed. Then, to change the hard drive, follow these steps:

1. Turn the laptop upside down and look for a removable panel or a hard drive release mechanism. Laptop drives are usually accessible from the bottom or side of the chassis. Release the drive by flicking a lock/unlock button and/or removing a screw that holds the drive in place.
2. You may be required to remove the drive from a caddy or detach mounting rails from its sides. Attach the rails or caddy to the new drive using the same screws and washers. If required, remove the connector attached to the old drive’s signal pins and attach it to the new drive. Make sure it’s right side up and do not force it. Damaging the signal pins may render the drive useless.

3. Reverse your steps to place the drive (and caddy if present) into the case. Replace the screws and start the laptop. The system should recognize the drive. If you or the user created a bootable backup disc or a complete image disc (before the drive failed, by the way), place it in the optical drive and follow the instructions for restoring the data. You may have to update a driver or two, but you should otherwise be ready to go.

SSD vs. hybrid vs. magnetic disk
Although many devices still use a magnetic disk hard drive, most laptop vendors are moving to using either solid-state drives or hybrid drives, which are a combination of magnetic disk and solid-state technology.

The advantage of solid-state drives is that they are not as susceptible to damage if the device is dropped, and they are generally faster because no moving parts are involved. They are, however, more expensive, and when they fail, they don’t typically display any advanced warning symptoms like a magnetic drive will do.

Hybrid storage products have a magnetic disk and some solid-state memory. These drives monitor the data being read from the hard drive, and they cache the most frequently accessed bits to the high-speed flash memory. These drives tend to cost slightly more than traditional hard drives (but far less than solid-state drives), but the addition of the SSD memory for cached bits creates a surprising improvement in performance. This improvement will not appear initially because the drive must “learn” the most frequently accessed data on the drive.

1.8 in vs. 2.5 in
The 2.5-inch hard drives are small (which makes them attractive for a laptop, where space is at a minimum), but in comparison to 3.5-inch hard drives, they have less capacity and cache, and they operate at a lower speed.

Moreover, whereas 2.5-inch drives operate from 5,400 to 7,200 rpm, 3.5-inch drives can operate from 7,200 to 10,000 rpm. However, 2.5-inch drives use about half the power (again, good for a laptop) of a 3.5-inch drive (2.5 W rather than 5 W).

The 1.8-inch drive is the smallest of the three I’m discussing here. It was originally used in subnotebooks and audio players. It has the least capacity of the three, with the largest up to 320 GB. It has only two platters, each of which can hold 220 GB maximum.

Memory
There should be a panel used for access to the memory modules. If the panels are not marked (many are not), refer to your laptop instruction manuals to locate the panel on the bottom.

1. Remove any screws holding the panel in place, remove the panel from the laptop, and set it aside. If removing an existing memory module, remove it by undoing the module
clamps, gently lifting the edge of the module to a 45-degree angle, and then pulling the module out of the slot.

2. Align the notch of the new module with that of the memory slot and gently insert the module into the slot at a 45-degree angle. With all pins in the slot, gently rotate the module down flat until the clamps lock the module in place.

3. Replace the memory access panel, replace any screws, and power up the system. When the computer is powered back up, it may be necessary to go into the computer BIOS to let the system properly detect the new RAM that has been installed in the computer. Please refer to the user manual for the computer system for any additional information.

**Smart card reader**

Smart card readers come in both internal and external versions. External versions will most likely plug into a USB port, and replacing them is easy; all you do is plug them in. It is possible that you may need to install a driver for the device; and if so, you should use the installation utility that came with the device if there is one. There are also external readers that use the ExpressCard slot.

Internal readers will reside in a drive bay as a hard drive or optical drive would. Take the following steps to replace one:

1. Remove the hard drive, optical drive, and keyboard screws first, and then remove the screws that hold the bottom case on the laptop. There will also be some screws marked P or P1 inside the case to remove.

2. Once they are removed, turn the laptop over and remove the keyboard screws, keyboard, and the palm rest cables. Don’t forget to unplug both the keyboard and the palm rest cables! Underneath you will now be able to access the smart card reader.

3. Unplug the reader, remove the screw holding it in, and remove it. Place the new reader in the same place and reverse these steps.

**Optical drive**

Replacing an optical drive is usually easier than replacing a hard drive or memory. Remove the screw that secures the optical drive to the bottom of the notebook. Grasp the edge of the optical drive bezel and slide the optical drive out of the base enclosure. Insert the new optical drive into the base enclosure until the connector is seated and replace the screw that secures the optical drive to the bottom of the notebook.

**Wireless card/Bluetooth module**

Both 802.11 and Bluetooth wireless cards that are built in can be replaced if they go bad. Sometimes they reside near the memory, so you would open the same panel that holds the memory. In other cases (such as a Dell Inspiron), you have to remove the memory, keyboard, optical drive, and hand rest to get to it. The Bluetooth card may be located in the same place, or it may be located at the edge of the laptop with its own small panel to remove. Consult your documentation.
Once you've found either type of wireless card, disconnect the two antenna contacts from the card. Do not pull by the wire; pull by the connector itself. Remove any screws from the wireless card and gently pull out the card from the slot. Insert the replacement card into the slot at a 45-degree angle, replace the screws, and reconnect the antenna to the adapter. Replace the parts you were required to remove to get to the card, reversing your steps carefully.

**Cellular card**

Changing an external mobile broadband card is as simple as pulling the old USB stick out and plugging in the new one. Because USB is plug and play, you shouldn’t have to do anything, but even in the case of an issue the manufacturer usually provides a CD with the drivers or you can obtain them from the vendor website.

Changing an internal card is much like the process of changing an internal 802.11 card; follow the instructions indicated in the previous section.

**Video card**

When changing a graphics card, you must ensure that the card is supported by the laptop and the operating system. This is the process:

1. Remove the hinges using manufacturer instructions.
2. Detach the keyboard and keep track of your screws and where they go!
3. Remove the display assembly, and unplug the video and Wi-Fi cables.
4. Remove the upper shell, and keep track of your screws.
5. Remove the old card, and install the new.
6. Reverse your steps to reassemble the laptop.

**Mini PCIe**

Since many of the wireless cards are mini-PCIE, replacing any other card in this format will follow the same procedure, with the exception of removing and reconnecting the antenna cables (present only on the wireless cards). You can find the location of the card in the documentation. Make sure that the new card is firmly inserted into the slot after removing the old card.

**Screen**

The screen is one of the more involved parts to replace, which is why many people throw a laptop away when the screen gets damaged. It’s possible to replace a damaged screen, but you have to remove a lot of parts to do so. Start by removing the battery and then hold the power on for 10 seconds to drain the power out of the capacitors.

Remove all the screws on the back of the unit and then turn the laptop over. Remove the speaker bezel and you will see six wires coming from the old screen to the laptop. Remove the keyboard (see the instructions in the section “Keyboard”). Under the keyboard, locate where these six wires connect, and disconnect them. Make note of what went where so you can replace them correctly when you reconnect the new screen.
1.1 Given a scenario, install and configure laptop hardware and components.

Remove the screws that are holding the old screen to the hinges of the laptop. Position the new screen in place and screw it into the hinges. Reroute the six wires coming from the new screen through any holes or spaces that lead them to their connection points. These are usually for the video cable, mic jacks, and wireless antenna. Reconnect the keyboard and reinstall it. Replace all parts that were required to get at the keyboard and replace all screws on the back of the unit.

These are general guidelines for this replacement, and you should always check the documentation for any departures from this general approach.

**DC jack**
Replacing a bad DC jack usually requires soldering. If this is not a skill you possess, just replace the motherboard. If you want to attempt it, remove all the parts to get to the motherboard. In some cases, the old DC jack can still be used; it just needs to have the old solder removed and replaced. If that is not the case, remove the old DC jack by unsoldering it from the connector. Then put the new jack in place and solder it to the connectors. Replace all the parts and pieces you removed to get to the board. In general, a bad DC jack usually means a new board.

**Battery**
Replacing the battery in a laptop is simply a matter of removing the battery storage bay, removing the old battery from the bay, inserting the new battery into the bay, and replacing the bay. Determining the battery type for the replacement will probably take longer than the replacement procedure. In fact, many users carry extra batteries for situations where they know they will need to use the laptop for longer than the battery life (such as a long plane trip) and change the battery as needed.

If BitLocker encryption is enabled, the laptop will not boot after a battery replacement unless the BitLocker encryption key is provided.

**Touchpad**
This is another repair where many parts must be removed just to get to the piece to be replaced.

1. Remove all the covers from the back of the system first. This may include those for the hard drive, RAM, and wireless card compartments. Remove the RAM, hard drive, and wireless card. Take the screw holding the CD-ROM in place and remove it as well.

2. Turn the laptop back over, open the lid, and remove any plastic pieces in the way of the keyboard. Remove the keyboard (see the section “Keyboard”). Disconnect the video and antenna cables from the motherboard (see the section “Screen”). Remove the Phillips-head screws from the LCD hinges and then remove the LCD.

3. Disconnect the touchpad cable from the motherboard. Separate the upper casing assembly from the bottom casing and set it aside. Remove the touchpad from the upper casing assembly. Install the new touchpad by reversing the previous steps.
Plastics/frames
Several of the replacement procedures in this section have involved plastic pieces that either hold something in place or cover something. These pieces—which are important enough to be noted specifically as a component of this exam—may be held in place by screws, or they may use snaps. In either case, it is easy to damage these parts (especially the snaps) in the disassembly or assembly process. If this occurs, consult the documentation for the laptop. Even these pieces will have part numbers and can be ordered. It’s easier to just take great care not to damage them in the first place. The best way to prevent damage to these pieces is to never force a piece in place. If you meet resistance, back out and try to determine what the obstruction is. Restoring the full case is also important. Leaving open spaces can tamper with the air circulation as it was originally designed, resulting in overheating. A mobile device, particularly a laptop, will quickly overheat if the case is compromised in any way.

Speaker
To replace speakers, first follow the earlier instructions to remove the hard drive, the battery pack, and all the screws holding the body together.

1. Lift the screen up and separate it from the body (see the section “Screen”). Do not remove the wires connecting the screen to the motherboard.

2. Separate the two pieces of plastic body frame to view the inside of the laptop. Locate the speakers, using the documentation if necessary.

3. Unscrew the speakers, and note where they connect to the motherboard. Disconnect the old speakers, and connect the new ones to the same location as where the old speakers were removed.

4. Replace all the parts in the reverse order you removed them.

System board
Replacing the system board requires removing all parts discussed up to this point since they all are either in the way of or connected to the motherboard. Once that is done, take the following steps:

1. Open the processor access door if there is one on the machine. If the processor is removable and one did not come with the new motherboard, remove it, and set it aside in a safe place.

2. Disconnect any remaining wires that are connected to the motherboard.

3. Unplug any cards, such as the video card, that are not built directly into the motherboard.

4. Locate the mounting screws for the motherboard, and unscrew them. Remove the old motherboard, mount the new unit, and reassemble the parts in reverse order.
1.2 Given a scenario, install components within the display of a laptop.

CPU

If the CPU is not built into the motherboard, it can be replaced. If it is built in, then you will be replacing the motherboard as well. If you are upgrading the processor and not simply replacing it, make sure your BIOS will support the new processor. It may be that you need to flash the BIOS to support the new CPU. You can determine this at the website of either the CPU maker or the laptop. This is important!

Follow the earlier instructions to remove the case, keyboard, and display. This will allow you to separate the two parts of the case.

1. Remove the graphic card and note where it plugs back in.
2. Remove the heat sink from the top of the CPU by removing the screws holding it in place.
3. Remove the single screw holding the CPU in place and pull it out. Insert the new CPU in place, and replace the screw. (In some cases, it is not a screw but a locking bar.)
4. Place some thermal grease between the CPU and the heat sink. Replace the heat sink and its screws.
5. Reverse your steps to reattach all the other parts and pieces.

In some cases, you may encounter a laptop that allows you to get at this from the bottom without removing the keyboard and display. This is why it is best to follow the specific directions in the documentation to save unnecessary component removal.

Exam essential

List the steps to install or replace laptop components. This includes but is not limited to keyboards, hard drives, memory, optical drives, wireless cards, mini-PCIe cards, screens, DC jacks, batteries, touchpads, speakers, system boards, and CPUs.

1.2 Given a scenario, install components within the display of a laptop.

The display of a laptop contains more components than you may expect. In this section, I’ll discuss these components and, in some cases, cover competing technologies. The following topics are addressed in exam objective 1.2:

- Types
- Wi-Fi antenna connector/placement
- Webcam
- Microphone
- Inverter
- Digitizer/touchscreen
Types

Laptop displays can use any of several technologies: LCD, LED, or OLED. This section provides a quick survey of these display types and their characteristics as they apply to laptops. For more information on all three display types, see objective 3.6 in Chapter 3, “Hardware.”

LCD

LCDs have completely replaced CRTs as the default display type for both laptops and desktops. Two major types of LCDs are used today: active matrix screens and passive matrix screens. Their main differences lie in the quality of the image. Both types use some kind of lighting behind the LCD panel to make the screen easier to view. One or more small fluorescent tubes are used to backlight the screen.

**Passive Matrix** A passive matrix screen uses a row of transistors across the top of the screen and a column of them down the side. It sends pulses to each pixel at the intersection of each row and column combination, telling it what to display. Passive matrix displays are becoming obsolete because they’re less bright and have poorer refresh rates and image quality than active matrix displays. However, they use less power than active matrix displays do.

**Active Matrix** An active matrix screen uses a separate transistor for each individual pixel in the display, resulting in higher refresh rates and brighter display quality. These screens use more power, however, because of the increased number of transistors that must be powered. Almost all notebook PCs today use active matrix. A variant called thin-film transistor (TFT) uses multiple transistors per pixel, resulting in even better display quality.

TN vs. IPS

There are two major LCD technologies used in LCDs. This section discusses the pros and cons of each.

**Twisted Nematic (TN)** Twisted nematic (TN) is the older of the two major technologies for flat-panel displays. While it provides the shortest response time, has high brightness, and draws less power than competing technologies, it suffers from poor quality when viewed from wide angles. It suffers color distortions when viewed from above or from the sides.

**In-Plane Switching (IPS)** This is a newer technology that solves the issue of poor quality at angles other than straight on. It also provides better color quality. However, it has much slower response time and is more expensive. Newer versions like Super-IPS (SIPS) make improvements on the response time.

Fluorescent vs. LED backlighting

LCDs can use two kinds of backlighting: LED-based and fluorescent. Fluorescent is an older technology and consists of a fluorescent tube connected to a voltage inverter board that provides power to the backlight. LED-based is a newer technology and uses a matrix of LEDs for the backlighting. Table 1.1 compares the two technologies.
### TABLE 1.1  Fluorescent and LED

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Fluorescent</th>
<th>LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Thicker and heavier</td>
<td>Thinner and lighter</td>
</tr>
<tr>
<td>Cost</td>
<td>Cheaper</td>
<td>More expensive</td>
</tr>
<tr>
<td>Power</td>
<td>High power consumption and heat generation</td>
<td>Lower power consumption and heat generation</td>
</tr>
<tr>
<td>Brightness</td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Lifespan</td>
<td>Shorter</td>
<td>Longer</td>
</tr>
</tbody>
</table>

**LED**

LED-based monitors are still LCDs (they still use liquid crystals to express images on-screen), but they use a different type of backlight than what is normally used. Several types of backlights are used with LED.

The most common for computers is white LEDs (WLEDs). Using a special diffuser, the light is spread to cover the entire screen. A more expensive type is RGB LED. Instead of using WLEDs on one edge of the screen, with RGB LCD layers, like the previous technology, RGB LEDs are aligned all over the panel matrix. Each LED is capable of red-, green-, or blue-colored light. This gives the display more accurate color than WLEDs. Finally, there is WLED on a flat array, covering the entire screen (like an RGB LED using only WLEDs). Currently, it’s used only in LED-backlit HDTVs. As you’ve seen, however, computer output can be directed to the HDTV screen.

**OLED**

An organic light-emitting diode (OLED) is another type of LED technology. It uses an emissive electroluminescent layer of organic compounds that emit light in response to an electric current. An interesting characteristic of these displays is their flexibility and transparency. This means they can roll up for storage (like a mat), and you can see through the display to objects behind the display. These displays are now available but quite expensive.

**WiFi antenna connector/placement**

The wireless antenna is located in the display. You may recall that when replacing a laptop screen, you encountered a number of wires coming from the screen to the laptop body. One of these is the cable that connects the wireless antenna (located in the display) with the wireless card located in the body of the laptop.
The antennas built into the display usually work quite well. In any specific situation you may improve your signal by moving the laptop around. This changes the polarization of the antenna and may cause it to line up better to the incoming signal.

**Webcam**

Many displays today, especially laptop displays, have a webcam built in. They come ready to go with all drivers preinstalled and nothing to configure or set up. If you need to replace the webcam, you will have to disconnect the laptop lid (which holds the display) from the base, remove the screw covers and screws holding the display bezel in place, and remove the bezel. After removing the screws holding the mounting rails to the hinges, remove the LED screen from the lid assembly. Now you can get at the camera, but first carefully remove the tape that holds the camera cable in place and remove it and the camera. Attach the replacement cable to the new camera, install the new camera, and reverse these steps.

**Microphone**

While many desktop systems lack a built-in microphone, almost all laptops have one. In some cases this microphone will be located on the laptop bottom, but in many cases it will be in the display next to the webcam or off to the side. If you need to replace it, you will need to take the same steps to get inside the display that you took for the webcam.

When you unhook the lid from the bottom, you will need to unplug several things from the board, and one of those will be the microphone cable. If the microphone is not working (which it probably isn’t or you wouldn’t be replacing it), take a moment to inspect the cable. Sometimes the cable can be cut by the constant opening and closing of the case (it shouldn’t, but sometimes it does happen). You may be able to repair the cable without replacing the microphone.

If that is not the case, remove the microphone and cable and replace both with the new mic and cable. Reverse the steps to get into the display, reconnect the cables to the board, and put the back on the bottom.

**Inverter**

An inverter is a component that takes DC power and converts it to an AC form that can be used by the LCD screen. It is implemented as a circuit board that is located behind the LCD. If problems with flickering display or dimness occur, the inverter is a prime suspect.

If the inverter needs to be replaced, you should be aware that it may contain stored energy, so it may need to be discharged to be safe.

**Digitizer/touchscreen**

Digitizers read pressure applied to the surface of the display and are what make touchscreens work. In some cases, they work with a stylus or small pen-like device; in others, you
simply touch the screen with your finger. The digitizer is a thin piece of clear material that fits on top of the display. It has its own cable just as the display itself does. If it gets cracked, which often happens, it can be replaced without replacing the display itself. Typically when you perform this replacement, you will have to open the display lid, as I covered earlier, and separate the digitizer from the display. It is usually glued to the display, and you can use a hair dryer to heat the glue to make removing it easier. When you put the new digitizer in, you may need to reheat the glue on the display to stick them back together.

**Exam essentials**

Differentiate the types of displays available in laptops. Two major types of LCDs are used today: active matrix screens and passive matrix screens.

Describe the location and operational characteristics of the wireless antenna in a laptop. The wireless antenna is located in the display. Moving the laptop changes the polarity of the antenna and may result in a better signal.

Identify the location and function of the inverter. An inverter is a component that takes DC power and converts it to a form that can be used by the LCD screen. It is implemented as a circuit board behind the LCD.

### 1.3 Given a scenario, use appropriate laptop features.

Because of the nature of their physical implementation, laptops have some features not found in desktops and some issues that need to be handled differently than with desktops. In this section, I will discuss some of these features and issues along with the use of some special function keys. The following topics are addressed in exam objective 1.3:

- Special function keys
- Docking station
- Port replicator
- Physical laptop lock and cable lock
- Rotating/removable screens

**Special function keys**

Special function keys exist in both desktops and laptops, but in older laptops function keys have extra functions that may not be present in desktops. These functions are indicated by icons below the letters (F1, F2, and so on), and in the lower-left corner of the keyboard is a key marked Fn. When this key is held down, a function key will perform
the function of its icon instead of its usual function. This section describes some of the most common uses of these keys, although manufacturers sometimes implement these keys differently, and some special functions don’t use F_n keys, so you should consult the documentation.

**Dual displays**
When additional displays are connected to the laptop (for example, a projector or second monitor), holding down the F_n key and pressing the function key with an icon of a monitor (or sometimes a laptop display and second screen) will move the active screen from display to display (or display to a projector) and then to a setting where all monitors have the same output. This is valuable when making a presentation or to direct the image to the projector or the laptop screen. It is also worth noting that various laptop keyboards implement this function on different keys, including F_1, F_4, and F_8.

**Wireless (on/off)**
There is also a function key that will turn the wireless off and on; this key usually has an antenna icon, or perhaps an airplane for airplane mode, and you may not have to hold the F_n key to use it. If wireless does not work (especially if the system is telling you to turn the wireless on), check this setting. It is easy to hit this key and disable the wireless!

**Cellular (on/off)**
Just as you can turn off the wireless (802.11) connection, you can also turn off the cellular (WWAN) connection (if one exists on the device). You will probably need to refer to the device’s documentation to identify the exact key.

**Volume settings**
On the top row where the keys labeled F_1–F_12 are located, there are usually a couple of keys (typically F_8 and F_9) with icons that look like speakers. These keys can be used to raise and lower the volume of the sound. If the icon is blue, you have to hold down the F_n key. Otherwise, you do not need to use the F_n key to activate them. (As a matter of fact, if you hold down the F_n key and use the F_8 key, you may be changing the location of the display output, as described in the section “Dual displays.”) If these keys are not present, consult the documentation for the key to use in conjunction with F_n to lower and raise the volume. Most laptops also include a mute button marked as such.

**Screen brightness**
There are usually a couple of function keys (often F_4 and F_5) with sun icons with arrows pointing up and down, respectively. They could also be located on the lower right on the keyboard. These keys can be used to increase and decrease the brightness of the display. As with the volume settings described in the previous section, you do not need to use the F_n
1.3 Given a scenario, use appropriate laptop features.

key to activate them. If these keys are not present, consult the documentation for the key to use in conjunction with Fn to increase and decrease the brightness.

**Bluetooth (on/off)**

In most cases, the same key that turns 802.11 wireless off and on also does the same for Bluetooth. See the section “Wireless (on/off).”

**Keyboard backlight**

Some keyboards come with backlighting. These models will usually allow you to turn the backlighting on and off by using the Fn key in combination with another key, such as the Z key on some models. Consult the documentation to determine which key combination will perform this function.

**Touchpad (on/off)**

While touchpads provide you with a way to operate without a mouse, there are cases when you don’t want to use the touchpad, and it gets in your way when typing. In other cases, the touchpad does not work, simply because it has been turned off. So, how do you enable and disable the touchpad? It can be done using either software or hardware.

In some cases, you may find there is a touchpad icon in the notification area. If there is, you can right-click or double-click it, and in the settings you should find an enable/disable feature. If there is no icon, it may be possible to go to the mouse settings in Control Panel and find touchpad settings. Finally, you can always open Device Manager and enable and disable the touchpad from there.

There also is usually a way to physically enable and disable the touchpad. This varies from laptop to laptop. For example, on a Lenovo, you hit a location in the upper-right corner of the touchpad, and it acts as a toggle switch between on and off. Consult the documentation that came with the laptop, or look on the vendor’s website.

**Screen orientation**

The screen orientation refers to the position of the image on the screen. This is changed by “rotating” the screen. For example, if you rotated the screen 180 degrees, the image would be upside down. Rotating the screen can be done either by using the display settings or in some cases by using a special key combination. In most cases, if you right-click the desktop, you will find the option to rotate in various ways in the menu. It may also be under the Graphics Options menu, as shown in Figure 1.1.

**Media options (fast forward/rewind)**

Many laptops also offer keys that are used with media players. For example, you can fast-forward (or go to the next track), rewind (go to the previous track), and stop the player. These keys may have a special location, or they may be included as function keys at the top of the keyboard. If they are in the function keys, you will need to hold down the Fn key as usual. In Figure 1.2, they are located at the top of the keyboard.
Many devices now come with a built-in GPS feature. You can enable and disable the GPS using the privacy settings in Windows. While you will probably find it is enabled by default,
you can disable it in Windows 10 by bringing up the Charms bar. At the bottom, choose the Settings charm. Tap or click the Change PC Settings link and then select Privacy on the left. Choose Location. On this page you can select to either turn it off completely or turn it off for certain applications, as shown Figure 1.3.

**FIGURE 1.3** Location tracking

---

**Airplane mode**

Airplane mode suspends many of the device’s signal-transmitting functions. It’s called airplane mode because it disables the transmission of signals that interfere with aircraft signaling (or so they say). Enabling and disabling this mode can be done either in Windows or in some cases by using a special key on the keyboard.

To enable and disable it in Windows 10, navigate to the PC settings, as discussed in the “GPS (on/off)” section. In the PC settings, select Network. Then select Airplane Mode. On the right you will see a button to toggle between on and off, as shown in Figure 1.4. There will be separate controls for Wi-Fi and Bluetooth.

On many laptops this can also be done using one of the function keys. If this feature is present on the laptop, the key will have an airplane icon on it. Use it as you would any function key to toggle between off and on.
Docking station

Some notebook PCs have optional accessories called docking stations or port replicators. They let you quickly connect/disconnect with external peripherals and may also provide extra ports that the notebook PC doesn’t normally have.

A docking station essentially allows a laptop computer to be converted to a desktop computer. When plugged into a docking station, the laptop has access to things it doesn’t have stand-alone—the network, a workgroup printer, and so on. The cheapest form of docking station (if it can be called that) is a port replicator. Typically, you slide a laptop into the port replicator, and the laptop can then use a full-sized monitor, keyboard (rather than the standard 84 keys on a laptop), mouse, and so on. Extended, or enhanced, replicators add other ports not found on the laptop, such as PC slots, sound, and more. The most common difference between port replicators and docking stations is that port replicators duplicate the ports the laptop already has to outside devices, and the docking station expands the laptop to include other ports and devices that the laptop does not natively have.

Laptops can support plug and play at three levels, depending on how dynamically they’re able to adapt to changes.

**Cold Docking**  The laptop must be turned off and back on for the change to be recognized.

**Warm Docking**  The laptop must be put in and out of suspended mode for the change to be recognized.

**Hot Docking**  The change can be made and is recognized while running normal operations.

Each docking station works a little differently, but there is usually a button you can press to undock the notebook from the unit. There may also be a manual release lever in
1.3 Given a scenario, use appropriate laptop features.

case you need to undock when the button is unresponsive. Moreover, the docking station must be purchased from the same vendor you purchased the laptop from because docking stations are vendor-and model-specific.

**Port replicator**

Port replicators are a form of docking station and were discussed in the previous section.

**Physical laptop lock and cable lock**

Laptops can be easily stolen. Therefore, they come with a lock slot to which a cable lock can be attached. Figure 1.5 shows the lock slot, and Figure 1.6 shows the connected lock (sometimes called a Kensington lock).

**FIGURE 1.5**  Lock slot

![Lock slot](image1)

**FIGURE 1.6**  Connected lock

![Connected lock](image2)
Rotating/removable screens

Many mobile devices today have a removable screen. While it appears that the screen is removable, you are actually unhooking the keyboard because the computer is contained in the display. With the keyboard detached, you can use the device as a tablet, and with the keyboard attached, you can interact with the device as you would a laptop.

Many of these same devices also allow for the rotation of the screen when it is attached to the keyboard. This might be a rotation within the frame of the screen, or it could be a rotation in a circle.

Exam essentials

Describe the purpose of special function keys. In the lower-left corner of the keyboard is a key with blue text that says Fn. When this key is held, other keys with a similar blue marking (such as F1–F12) will perform a different function than their normal function.

Differentiate between docking stations and port replicators. A docking station essentially allows a laptop computer to be converted to a desktop computer. Extended, or enhanced, replicators add other ports not found on the laptop, such as PC slots, sound, and more. The most common difference between port replicators and docking stations is whether the peripheral provides network access and expands the laptop’s capabilities.

Describe approaches to the physical security of a laptop. Laptops come with a lock slot to which a cable lock can be attached. Also, there is a lock on some models for the lid of the laptop.

1.4 Compare and contrast characteristics of various types of other mobile devices.

At one time, the term mobile devices referred only to notebook laptops, tablets, and PDAs. Today this category includes all sort of devices that at one time were only ideas. In this section, you’ll look at digital devices that have had their capabilities greatly expanded, such as smart cameras that have become essentially computers with a lens, and smart watches and fitness monitors that almost become part of their owner. The following are the topics covered in exam objective 1.4:

- Tablets
- Smartphones
- Wearable technology devices
- E-readers
- GPS
Tables

Tablet devices have been in existence in some form or fashion since the early 1990s. Early on they were proprietary devices that didn’t have a lot in common with desktop computers, but increasingly the two form factors have gravitated toward one another; now, many new tablets run the same operating systems that are run on desktop systems. Most tablet computers run one of three operating systems: Android, iOS, or Windows 10.

The tablet market was changed significantly with the release of the iPad by Apple. It was the most successful tablet ever at its time of release, and it set the standard for others to meet. Today, typical features of tablets include the following:

- Cameras (in some cases dual)
- GPS
- Handwriting recognition
- Solid-state hard drives
- 3G and 4G mobile support

Tablet devices today use touchscreen displays rather than keyboards, although keyboards can be attached. Some, such as the Microsoft Surface, can be attached and detached at will from a keyboard that also acts as a stand and a cover for the device. In most cases, tablets require applications written for the platform, although the Surface can run the Windows 10 operating system and thus can also run regular desktop applications.

Smartphones

As phones have become smarter and smarter, they more and more resemble computers rather than phones. Today’s smartphones are really computers that can make calls. They have touchscreen interfaces, an on-screen keyboard that can be brought up to input data, and sometimes even motion sensors and mobile payment mechanisms.

Moreover, the drive by organizations and individuals to create applications for these devices has exploded. Every week it seems someone has designed and created an application that turns the phone into some new gadget! Because of this phenomenon, the smartphone has become almost part of the body to several younger generations of users.

Most of these devices run either the iOS or Android operating system, although Microsoft continues to release Windows phones that run a special Windows OS for the device. The latest is Windows 10.

Wearable technology devices

Since the days of Dick Tracy’s futuristic phone watch, we have waited for wearable technology to arrive, and it has. In this section, I’ll survey some of the latest examples of digital devices created to be worn.
Smart watches

Smart watches that are computers on your wrist have arrived! Although the jury is still out on the long-term viability of the smart watch, when Apple introduced one in 2015, most in the industry began to take the devices seriously. These devices run either proprietary operating systems or Android. The Apple model runs an operating system called Watch OS.

These devices are typically paired to a smartphone for the purpose of accessing calls and messages, and they contain GPS features as well. The following are some of the features you may find in these smart watches:

- Anti-lost alert
- Time display
- Call vibration
- Caller ID
- Answer call
- Micro-USB input port

Fitness monitors

While many smart watches can also act as fitness monitors, there is a class of devices that specializes in tracking your movement. Fitness monitors read your body temperature, heart rate, and blood pressure. They do this while also tracking where you are for the purpose of determining the distance you ran or walked and the time it took to do so.

Some of the devices, called *fitness trackers*, are wrist bands that can track the information discussed and communicate wirelessly to an application located on a computer. One of these is shown in Figure 1.7. Other, more sophisticated units combine a strap that goes around the chest with a watch or band that collects the information gathered by the sensors in the band.

**Figure 1.7** Fitness tracker
**VR/AR headsets**

*Extended reality* is an exciting new field that includes both augmented reality and virtual reality. Both concepts involve wearing special headsets that deliver the visual experience. While reality immerses the user into a virtual environment, much like a four-dimensional game, augmented reality involves glasses that while permitting a clear vision of the real world, can project graphics and text onto this view using a small side screen. A virtual reality headset is shown in Figure 1.8.

**FIGURE 1.8** VR headset

By now, everyone has heard about and probably seen Google Glass, the most well-known and recognizable computing device worn as glasses. Just in case you haven’t, Figure 1.9 shows a drawing of the glasses.

**FIGURE 1.9** Google Glass
While worn as glasses, they also have a small screen just to the side of one of the eyes that houses the computer screen (think Cyborg). The user can view the screen at any time by just casting a glance at it. Many promising uses have been proposed for the devices, with a number in the healthcare field. Although sale of the devices to individuals was halted, sales to organizations that have or are working to find ways to use the glasses continue.

Another similar device that is not based on glasses but around a headset format is the HC1 headset computer by Zebra. It can respond to voice commands and body movements. One of these is shown in Figure 1.10.

**FIGURE 1.10** Headset computer

---

**E-readers**

While these devices typically have Internet access and can be used for Internet browsing, the main job e-readers were created for is reading. These devices have proven to be more popular with older users because younger users seem to have grown up reading everything on a computer and see no reason for another device. Older users, on the other hand, who are still struggling with the move from reading printed material to reading on a device, like the idea of a device dedicated to enhancing their reading experience.

The Kindle was the first of these devices to garner widespread acceptance. The Nook soon followed. Both enjoyed good sales until other rivals began to enter the market. Sales
of these devices are now in decline because of the aging of the main customer base. The following are some of the features found in these devices:

- Touchscreens
- Buttons for turning pages
- Editing tools
- Wireless networking
- Text-to-speech support
- Digital rights management support

**GPS**

A global positioning system (GPS) uses satellite information to plot the global location of an object and use that information to plot the route to a second location. GPS devices are integrated into many of the mobile devices discussed already and are used for many things, but when I use the term for a stand-alone device, I am usually referring to a navigation aid.

These aids have grown in sophistication over time and now not only can plot your route but also help you locate restaurants, lodging, and other services along the way. Another use for these devices is tracking delivery vehicles and rental cars.

**Exam essentials**

Describe the common features of tablets. These features include cameras (in some cases dual), GPS, handwriting recognition, and solid-state hard drives support.

Describe some items that are considered wearable technology. Wearable technology includes smart watches, fitness monitors, Google Glass, and headset computers.

1.5 Given a scenario, connect, and configure accessories and ports of other mobile devices.

Mobile devices in many cases have the same connection types and ports as laptop and desktop computers, but the accessories can vary somewhat. In this section, you'll look at the types of ports and accessories you will find on mobile devices. Specifically, I will cover the following topics:

- Connection types
- Accessories

**Connection types**

Mobile devices possess both wireless and wired connection options. In this section, I'll cover both types.
Wired

While mobile devices may not have as many wired options as desktop devices, they still can have a wide range of physical port types.

Micro-USB/Mini-USB/USB-C

The two most common ports found on mobile devices are micro-USB and mini-USB. Both are small–form-factor implementations of the USB standard, the latest of which is USB 3.1. In Figure 1.11, the mini-USB and micro-USB connectors are compared to the regular USB connector.

**FIGURE 1.11** USB form factors

![USB form factors](image)

The USB-C is a new port type that can accept either end of its cable, and it doesn’t matter if it’s upside down! USB-C, also known as USB Type-C, is a 24-pin USB connector system, which is distinguished by its two-fold rotationally symmetrical connector. All Thunderbolt 3 cables will work as USB-C cables as well.

The data rates for various types of USB are in Table 1.2.

**TABLE 1.2** USB speeds

<table>
<thead>
<tr>
<th>Type</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>187.5 KB to 1.5 MB</td>
</tr>
<tr>
<td>2.0</td>
<td>60 MB</td>
</tr>
<tr>
<td>3.0</td>
<td>625 MB (super speed)</td>
</tr>
<tr>
<td>3.1</td>
<td>1.25 GB</td>
</tr>
<tr>
<td>3.2</td>
<td>2.5 GB (super speed)</td>
</tr>
</tbody>
</table>
Lightning

The Lightning connector from Apple is an eight-pin connector that while not standard has advantages over USB, according to Apple. The following are some of these advantages:

- It can supply more power.
- It can be inserted either way.
- It is physically more durable than USB.
- It can detect and adapt to connected devices.
- It operates at USB 3.0 speeds.

Figure 1.12 shows a Lightning connector next to a USB cable.

**FIGURE 1.12** Lightning connector and USB

Tethering

When one device is connected to another device for the purpose of using the Internet connection, it is said to be *tethered* to the device providing the access. While use of this connection can be done by using 802.11, it can also be done connecting through Bluetooth or a USB cable between the devices. Even with unlimited data programs, the tethering (or mobile hotspot as it is also called) has a limited amount of data, and then the hotspot function only is throttled (max speed reduced).

Proprietary vendor-specific ports (communication/power)

Many mobile devices have proprietary ports that they use either for power or for communication. While this was widespread at one point, vendors have gradually moved toward using standard physical implementations of both power and communication ports. While I can’t cover all of these, the best examples are the ports used by Apple in its devices.
Apple uses what it calls the Lightning connector for power. Although it makes an adapter for this connector to convert it to mini-USB, it doesn’t encourage its use, because of the limitations the adapter places on the functionality of the proprietary connector.

The following are other examples of proprietary connectors:

- The Sony-Ericsson power connector looks like USB but is not.
- Nokia and Motorola have used coaxial in some power connectors.

For the most part, you will find that many vendors have chosen to adopt standard connection types for both power and communication.

**Wireless**

Mobile devices can have several types of wireless connection options. In this section we’ll look at those.

**NFC**

Near Field Communication (NFC) is a short-range technology that allows mobile devices to establish radio communication by touching one another or by coming in close proximity to one another. The technology was first used in Radio Frequency ID (RFID) tagging and was implemented on mobile devices first as a way to share short-range information and later as a method to make payments at a point of sale. It operates by reading tags, which are small microchips with antennas that can in some cases only be read and other cases can be read and written to.

NFC is a wireless technology that allows smartphones and other equipped devices to communicate when very near one another or when touching. NFC operates at slower speeds than Bluetooth but consumes far less power and doesn’t require pairing. It also does not create a PAN like Bluetooth; rather, the connections are point to point. NFC can operate up to 20 cm at a transfer rate of 0.424 Mbps.

NFC is also a standard managed by the ISO and uses tags that are embedded in the devices. NFC components include an initiator and a target; the initiator actively generates an RF field that can power a passive target. This enables NFC targets to take simple form factors such as tags, stickers, key fobs, or cards that do not require batteries.

These devices connect either using USB or in some rare cases using a serial connection. Consult the documentation to determine whether you need a special driver installed.

A mobile device must have the support for NFC built in, and many already do. Special applications are available that make it easy to use the technology in various ways.

- Making point-of-sale payments
- Reading information stored in tags in posters and advertisements
- Communication between toys used in gaming
- Communication with peripherals
Bluetooth

Mobile devices also support Bluetooth wireless connections. Bluetooth is an infrared technology that can connect a printer to a computer at a short range; its absolute maximum range is 100 meters (330 feet), and most devices are specified to work within 10 meters (33 feet). When printing with a Bluetooth-enabled device (like a PDA or mobile phone) and a Bluetooth-enabled printer, all you need to do is get within range of the device (that is, move closer), select the print driver from the device, and choose Print. The information is transmitted wirelessly through the air using radio waves and is received by the device. Bluetooth speed depends on version. Table 1.3 shows this for the latest versions.

<table>
<thead>
<tr>
<th>Version</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>2.1 MB</td>
</tr>
<tr>
<td>2.1</td>
<td>2.1 MB</td>
</tr>
<tr>
<td>3.0</td>
<td>24 MB (over Wi-Fi connection)</td>
</tr>
<tr>
<td>4.0</td>
<td>2.1 MB over Bluetooth and 24MB over Wi-Fi</td>
</tr>
<tr>
<td>4.1</td>
<td>2.1 MB over Bluetooth and 24MB over Wi-Fi</td>
</tr>
<tr>
<td>4.2</td>
<td>2.1 MB over Bluetooth and 24MB over Wi-Fi</td>
</tr>
<tr>
<td>5.0</td>
<td>2.1 MB over Bluetooth and 24MB over Wi-Fi</td>
</tr>
</tbody>
</table>

IR

While infrared (IR) connectors were once common on mobile devices, they disappeared only to reappear recently. Infrared technology requires direct line of sight and has been used for printers in the past. It can operate at a distance of 5 meters and can offer up to 4 Mbps. It is being replaced with Bluetooth over time.

Hotspot

Another way that many mobile devices can connect to other devices is through a hotspot or when tethered to another device. Many mobile devices have the ability to act as 802.11 hotspots for other wireless devices in the area. There are also devices dedicated solely to performing as mobile hotspots.
Accessories

Mobile devices require a lot of accessories to take advantage of many of the features they provide. While many of these are also commonly used with desktop and laptop devices, some are much more likely to be used with mobile devices. In this section, you’ll take a brief look at the types of accessories you may find attached to a mobile device.

Headsets

Headsets provide the ability to take your conversation offline or to listen to your music in private. They can be connected both through a wired connection, usually a 3.55 mm audio connector or USB, and by using Bluetooth to pair the device with the headset.

Speakers

Speakers are used in the same fashion as headsets. They can also be connected using the same options that include using USB, using a 3.55 mm audio plug, or by pairing the speakers with the devices using Bluetooth. This includes the speaker systems in many cars, which can now be paired with the devices using Bluetooth as well.

Game pads

People seem to love to kill time playing games on their smartphones and other mobile devices, but they may find their level of enjoyment increased by connecting the devices to a game controller offering them many more input options. These controllers look like any game controller, which can differ based on the game being played and the type of input required for the game.

These controllers can also be small, some fitting on a keychain. They typically are paired to the mobile device using the Bluetooth connection. Some of the newer game controllers for this purpose can be set on a table and the mobile device plugs physically into a slot or holder on the controller, making a connection with the controller. Figure 1.13 shows the layout of a typical game controller.
Extra battery packs/battery chargers

Batteries are the lifeline of mobile devices. For a device to stay constantly connected, many users purchase extra battery packs that can be used to power the devices when the battery is dead and no power outlet is available. Some of these packs simply provide power to the device, while others store power used to charge the device’s battery. Figure 1.14 shows an example of a battery pack that can be charged while providing power to the device.
Protective covers/waterproofing

While much work has been done to make mobile devices sturdier and more durable, they are still somewhat delicate pieces of electronics. For this reason, an entire industry has sprung up to provide protective covers for the devices. Some are made of a hard plastic material and protect the device from all but the worst impacts, while others go further and provide waterproofing as well.

Credit card readers

Mobile devices can also accept connections from external credit card readers. Some of these physically connect to the smartphone, and others can communicate with the phone using Bluetooth. Many of them use the same jack used for the headphones. There is usually software that has to be installed on the device as well and a processing agreement established with a provider. Figure 1.15 shows the Square reader.

FIGURE 1.14 Battery pack

FIGURE 1.15 Square credit card reader
Memory/MicroSD
Secure digital (SD) cards are a type of flash memory. Micro-SD is the smallest of three standards. Many mobile devices have MicroSD slots or ports on them that allow you to connect one to the device. This allows you either to access data on the memory card or to move information to the memory card from the smartphone. For more information on MicroSD, see the section “Solid-state drives” in Chapter 3.

Exam essentials
Describe the most common connection types found on mobile devices. These include Near Field Communication, proprietary ports, Lightning, Bluetooth, and infrared.

Identify the most common mobile device accessories. Mobile devices will accept game-pads, headsets, speakers, docking stations, battery packs and chargers, and credit card readers. They can also use protective covers and waterproof containers to protect them.

1.6 Given a scenario, configure basic mobile device network connectivity and application support.

For mobile devices to deliver the functionality that most expect, they must be connected to a network. To use email (one of the most important functions to many users), the device must be set up properly. The subobjectives covered in this section include the following:
- Wireless/cellular data network (enable/disable)
- Bluetooth
- Corporate and ISP email configuration
- Integrated commercial provider email configuration
- PRI updates/PRL updates/baseband updates
- Radio firmware
- IMEI vs. IMSI
- VPN

Wireless/cellular data network (enable/disable)
Like most computing devices, mobile devices provide more robust functionality when connected to a network (especially if that network is the Internet). Two types of networks can be used to gain access to the Internet: cell phone networks and Wi-Fi networks.
Cell phone networks have in the past been the second choice because the performance is not as good as an 802.11 Wi-Fi connection. With the introduction of 4G Long Term Evolution (LTE) technologies, however, the performance delivered by the cell network may become more competitive.

In either case, most mobile devices will have the ability to make an 802.11 connection or use the cell network. If you want to disable the automatic connection to the cell phone network or if it was somehow turned off and needs to be turned back on, you can do this through the settings. One example of the steps to access these settings is Settings ➢ Wireless ➢ Mobile ➢ Enable Data (select or deselect this). This is only one navigational example, and you should consult the documentation that came with the device.

Making a Wi-Fi connection is much like doing so with a laptop. In the settings of the device will be a section for Wi-Fi (in iPhone it’s called Wi-Fi, and in Android it’s called Wireless And Networks). When you access it, you will see all the Wi-Fi networks within range. Just as you would do with a laptop, select one and attempt to connect to the Wi-Fi network. If the connection requires a password, you will have to supply it. You also can preconfigure a wireless profile for commonly used secure wireless networks as well as those where the service set identifier (SSID) has been hidden.

**Hotspot**

Hotspots are publicly provided points of access to an 802.11 wireless network connected to the Internet. They typically have little or no security configured to make it as easy as possible for users to connect. Vendors have also created devices that allow a single device to act as a hotspot for other devices in the area. Sometimes these are called mobile hotspots. Some mobile devices can be turned into mobile hotspots with a software upgrade or an addition to the service plan.

**Tethering**

Tethering is the process of sharing the Internet connection of one device with another device. Connection of the phone or tablet with other devices can be done over wireless LAN (Wi-Fi), over Bluetooth, or with a physical connection using a cable, for example through USB. It also may be done by using a mobile hotspot or by using a similar feature on a mobile device.

**Airplane mode**

Since airlines do not permit enabling the wireless connection on mobile devices during takeoff and landing, vendors created a mode called Airplane mode in which this function is turned off but all other functionality (games and other applications not requiring Internet access) is still fully functional.

**Bluetooth**

Bluetooth is a short-range wireless technology that is used to create a wireless connection between digital devices. One of its applications is to create connections between mobile
devices and items such as speakers, headphones, external GPS units, and keyboards. Before you can take advantage of this technology, the devices must be configured to connect to one another. This section will discuss how to configure a Bluetooth connection.

**Enable Bluetooth**

On Android mobile devices, follow these steps:
1. From the Home screen, select the Menu button. From the menu, choose Settings ➢ Connections ➢ Bluetooth.
2. Once Bluetooth is selected, wait until a check mark appears next to Bluetooth. Bluetooth is now enabled.

On iOS mobile devices, follow these steps:
1. On the main page, choose Settings ➢ Bluetooth.
2. Tap the slider to enable Bluetooth.

**Enable pairing**

Pairing a mobile device with an external device (speaker, headphone, and so forth) will enable the two devices to communicate. The first step is to enable pairing. This is much simpler than it sounds. For either mobile operating system, simply turn the external device on and you are ready for the next step. In some cases, you may need to make the external device discoverable. Check the documentation for the external device to see whether this is the case and how you do this.

**Find a device for pairing**

Now that the external device is on and transmitting a signal, the mobile device is ready for pairing.

On an Android mobile device, follow these steps:
1. Swipe up on an empty spot on the Home screen to open the Apps tray.
2. Select Settings and then Connections.
3. Turn on the Bluetooth switch by tapping it.
4. If the mobile device stops scanning before the Bluetooth device is ready, tap scan again.
5. In the list of Available devices, tap the Bluetooth device to pair it with the phone.
6. Follow any on-screen instructions.
7. If a password is required, consult the documentation or try either 0000 or 1234 (common passcodes).

On an iOS mobile device, when Bluetooth is enabled, it automatically starts scanning for Bluetooth devices. When your device appears in the list, select it. If a PIN is required, move on to the next step.
Enter the appropriate pin code
Many external devices will ask for a PIN when you select the external device from the list of discovered devices. In many cases, the PIN is 0000, but you should check the manual of the external device.

Test connectivity
Once the previous steps are complete, test communication between the two devices. If you’re using a headset, turn on some sound and see whether you can hear it in the headphones.

Corporate and ISP email configuration
Email is one of the most important functions that people access on their mobile devices. This section will discuss how to configure email on the device. The following procedures are common examples, and your specific device may differ slightly. Please consult the documentation for your device.

Before you can access email on your mobile device, you must know the settings for the email server of your email provider. There are two protocols that can be used to access email accounts: POP3 and IMAP. If your account offers the use of IMAP, you should select it in the following steps because IMAP accounts have more functionality.

You will need the following information to complete this setup:

- The FQDN of your POP3 server or IMAP server (This server receives the emails sent to you, so it’s sometimes called incoming.)
- The FQDN of your SMTP server (This server sends your email to the recipient’s email server, so it’s sometimes called outgoing.)
- The port numbers used for both server types
- The security type used (if any)

POP3
On an Android mobile device, follow these steps:
1. In Settings, select Clouds And Accounts and then Accounts.
2. In Accounts, select Add An Account and select Email as the type.
3. Enter the email address and password and select Sign In.
4. After your account is recognized and set up, select Pop3 as the account type.
5. Enter the name of the incoming POP3 server, and if desired, select to enable encryption.
6. Enter 110 as the incoming port, and if desired, select Delete Email Off The Server.
7. Enter the name of the outgoing PO3 server and enter port number 25.
8. Finally, if desired, turn on SMTP authentication.
On an iOS mobile device, follow these steps:

1. Select Settings ➢ Accounts And Passwords ➢ Add Account.
2. Select Other.
3. Select Add Mail Account. Fill in your name, your email address, your password, and a description. Click Next.
4. Select POP. Verify that the name, address, and description carried over from the last page.
5. Under Incoming Email Server, enter the FQDN of the POP3 server, your email address, and your password.
6. Under Outgoing Mail Server, enter the FQDN of the SMTP server and your email address.
7. Click Next. Click Save in the upper-right corner.

**IMAP**

On an Android mobile device, follow these steps:

1. In Settings, select Accounts then Add an account.
2. Click the appropriate account type.
3. If prompted for an account subtype, select the type.
4. After entering the email address, tap Next.
5. After entering the password, tap Next.
6. If prompted, enter either the username, password, or server.
7. After configuring any account options desired (Sync Frequency, Inbox Download Size, and so on), click Next.
8. Complete any account options based on the account type chosen.
9. Enter the account name and, if prompted, the name for outgoing messages.

On an iOS mobile device, follow these steps:

1. Select Settings ➢ Accounts And Passwords ➢ Add Account.
2. Select Other.
3. Select Add Mail Account. Fill in your name, your email address, your password, and a description. Click Next.
4. Select IMAP. Verify that the name, address, and description are carried over from the last page.
5. Under Incoming Email Server, enter the FQDN of the IMAP server, your email address, and your password.
6. Under Outgoing Mail Server, enter the FQDN of the SMTP server and your email address.
7. Click Next. Click Save in the upper-right corner.
Port and SSL settings

With either operating system, you can (and should) select to use security if your email server supports it. This will encrypt all traffic between the mobile device and the email server. The choices offered are usually SSL or TLS, so you will need to know which of these is in use.

S/MIME

With respect to the S/MIME configuration, you need the following:

- A digital encryption certificate for yourself as the sender
- A copy of the digital public key from your intended recipient
- An email program capable of handling S/MIME email

Exchange supports S/MIME, so that part is taken care of. Once you have obtained your certificate, you must import it into your device and make it available to the email program. Your certificate must be obtained from a certificate authority company such as VeriSign. The steps to this process will vary from organization to organization. Once you have downloaded the certificate, place it at a location on the device where you can find it during the import process.

Typically, the certificate will come to you in an email that you should open on the Android device. When you click the enrollment link in the email, you will be required to enter the password you set when you requested the certificate. Then you will create another password (called a PKCS#12 passphrase) that you will need during the certificate installation.

When the certificate downloads to the device, it will go into the Downloads folder. Now you have to add it to your credentials. Follow these steps:

1. Navigate to Settings ➢ Security and select Install From Storage.
2. Locate your downloaded certificate file (it’s a .pfx file).
3. Enter your PKCS#12 passphrase (this is the one you created just before the downloads, not the one you created during enrollment).
4. Set the certificate name and its use (email).

The certificate is now available to use to encrypt email.

For iOS, follow the organizational steps to request a certificate. When the email arrives, open it on the iOS device as you did in Android. Then follow these steps:

1. Open the Mail app and find the message that contains the .p12 file. Tap the file icon to load it.
2. An Install Profile pop-up will appear for the identity certificate. Tap Install.
3. A warning that this is an unsigned profile may appear. If that happens, tap Install Now to acknowledge it.
4. You will be prompted for your passcode. Enter the passcode you use to unlock your iPad or iPhone when it’s at the lock screen.
5. You’ll then be asked for the password for the certificate. Enter the passphrase you came up with when you created the .p12 file on your Mac.

6. You may see a note that the certificate is Not Trusted. That’s OK.
7. Push the Home button. Find the Settings app and start it.
8. In Settings, find Accounts And Passwords.
9. In the list of accounts, find the account for this email address and tap it.
10. Tap the Account line.
11. Scroll down until you see Advanced. Tap it.
12. Scroll down until you see the S/MIME section.
13. Make sure S/MIME is turned on.
14. Tap Sign. Make sure that the certificate for this account is selected and that Sign is turned on. (If you tap the icon, you should see that the certificate is Trusted.)
15. Tap Advanced or Back to go back to the Advanced screen.
16. Tap Encrypt By Default. Again, select the correct certificate, and make sure Encrypt By Default is turned on.
17. Back out until you’re at the Account screen and then tap Done to accept the changes.

**Integrated commercial provider email configuration**

You probably also want to set up your personal email on a device from a commercial provider. This section will look at some of the major email systems you may encounter.

**iCloud**

To set up iCloud email on an Android device, follow these instructions:

1. Swipe up or done in the Home screen to access the Apps screen.
2. In Settings, select Accounts then Add an account.
3. Click the account type.
4. If prompted, select the account subtype.
5. After entering the email address, select Next.
6. After entering the password, select Next.
7. If promoted for the username, password, or server name, enter them and select Next.
8. Enter the SMTP server, port number, and outgoing server, and select Next.
9. After configuring any account options desired (Sync frequency, Inbox download size, and so on), click Next.
10. Address any additional options you encounter and select Next.
11. Enter an account name for outgoing messages.
As you can imagine, setting up iCloud email on an iOS device is simple because the applications all reside in the Apple ecosystem. First set up an iCloud email account. If you have an email address that ends with @mac.com or @me.com, you already have an equivalent address that's the same except it ends with @icloud.com. On your iOS device, go to Settings, tap your name, and then select iCloud. Choose the apps—such as Photos, Contacts, Calendars, and third-party apps—that you want to use with iCloud.

**Google/Inbox**

On an Android mobile device, follow these steps:

1. Select the Gmail icon.
2. Select Already Have A Google account.
3. In the Sign In With Your Google Account field, enter your username and password and select Sign In.

On an iOS mobile device, follow these steps:

2. Select Gmail.
3. Fill in your name, address, password, and description if desired. Click Next.
4. Verify that the address carried over from the last page. Click Next.
5. Select the items you want to sync automatically with the email server and click Done.

**Exchange Online**

To set up Outlook on Android, first, if required, install Outlook for Android. Follow these steps:

1. On the Android device, select Email icon.
2. After entering the email address and password, select Manually Setting.
3. Complete the Domain\username field.
4. After entering the password for the Exchange server, select Use Secure Connection (SSL) and then Next.
5. In the Account Options interface, select a frequency for checking email and click Next.
6. Finally, if desired, enter a name for the account in the Give This Account A Name field and select Done.

On iOS, follow these steps:

2. Enter your address.
3. Choose either Configure Manually or Sign In to connect to your Exchange Server.
If you select Configure Manually, you can set up an Exchange account with Basic authentication. Enter your email password. You might also be prompted to enter additional server information.

If you select Sign In, your email address is sent to Microsoft to discover your Exchange account information. If your account uses multifactor authentication, you'll be guided through a custom authentication workflow.

**Yahoo**

Because Yahoo recommends using IMAP as an email client, these are the instructions for setting up IMAP on Android systems:

1. Swipe up or done on the Home screen to access the Apps screen.
2. In Settings, select accounts and then add an account.
3. After selecting the account type, select the subtype if required.
4. Enter the email address and then select Next.
5. After entering the password, select Next.
6. If prompted, enter the username, password, or server and click Next.
7. Configure the SMTP server, port number, and outgoing server and click Next.
8. Select any account options desired, such as Sync Frequency, Inbox Download Size, and so on, and select Next.
9. If prompted, enter an account name and an account for outgoing messages.

On an iOS device, use these instructions:

1. Tap Select Settings ➢ Accounts & Passwords.
2. Tap Add Account.
3. Tap Yahoo.
4. Enter your name, your email address, your email password, and a description; then tap Next.
5. Optionally, disable aspects of Yahoo Mail from syncing.
6. Tap Save.

**PRI updates/PRL updates/baseband updates**

The product release information (PRI) is the connection between the mobile device and the radio. From time to time this may need updating, which may add features or increase data speed.

The preferred roaming list (PRL) is a list of radio frequencies residing in the memory of some kinds of digital phones. It lists frequencies the phone can use in various geographic areas. Each area is ordered by the bands the phone should try to use first. Therefore, it's a priority list for which towers the phone should use.
When roaming, the PRL may instruct the phone to use the network with the best roaming rate for the carrier, rather than the one with the strongest signal at the moment. As carrier networks change, an updated PRL may be required.

The baseband is the chip that controls all the GSM and 3G phone RF waves. An update makes the code in the chip current.

All mobile devices may require one or more of these updates at some point. In many cases, these updates will happen automatically, or “over the air.” In other cases, you may be required to disable Wi-Fi and enable data for these to occur.

**PRL**

In Android phones, the location of the PRI update option will differ, but you'll generally find it in one of a few places in the Settings menu.

- Settings ➢ System Updates ➢ Update PRL
- Settings ➢ Sprint System Updates ➢ Update PRL
- Settings ➢ About Phone ➢ Update PRL

In iOS, there is no separate PRL update command on iOS devices, but running a software update will force an update of the PRL.

**PRI**

A PRI update is a flash process. This usually occurs in over-the-air updates. When done manually, it involves acquiring the file and then performing a flash process with the bootloader, which in many cases also updates the radio (see the next section). The flash process can result in a useless device (bricked), so follow the vendor instructions.

**Radio firmware**

The radios in mobile devices are equipped with firmware that, like all firmware, may need an update from time to time. In Android, follow these steps:

1. Download the Radio zip file.
2. Rename it to update.zip.
3. Copy it to the root of your phone’s SD card.
4. Turn off your phone.
5. Start up in Recovery mode by holding Home and pressing Power.
6. Press Alt+S to apply the update.
7. Once the update is applied, press Home+Back to reboot the phone. The phone will start to boot up and then continue applying the update. Once this is completed, the Recovery menu will ask you for the second time to reboot the phone via Home+Back.
8. Double-check the baseband has been updated properly via choosing Menu ➢ Settings ➢ About Phone. Scroll down until you see the baseband version. You should see the radio version on this row. If not, you will need to update the radio again.
In iOS, follow these steps:

1. After downloading the desired firmware, connect the device to your computer and select it in iTunes. Mac users hold down the Option key, while Windows users hold down the Shift key.

2. Click the Update or Restore button, select the IPSW file you recently downloaded, and click Choose. Your device should now begin to update. Take note that certain browsers may change the .ipsw file into a .zip file. If this should occur, just rename it to end in .ipsw, and iTunes will recognize it.

IMEI vs. IMSI

International Mobile Equipment Identification (IMEI) is used to identify a physical phone device, while International Mobile Subscriber Identification (IMSI) is used to identify a Subscriber Identification Module (SIM) card.

VPN

Many users need to use the mobile devices to connect to the corporate network. This should be done using a VPN connection. To set up a VPN connection in Android, follow these steps:

1. Swipe up or down on the Home screen to select the Apps screen.

2. In Settings, select Connections and then More Connection Settings.

3. After tapping VPN, select the plus icon.

4. If desired, set up a lock screen PIN.

5. In the Name field, enter the name, and in the Type field, select the VPN type.

6. Complete the information in the fields provided for the selected VPN type and click Save.

7. Select any advanced options by selecting Show Advanced Options and complete the provided fields.

Exam essentials

Enable Bluetooth and pair a Bluetooth device with a mobile network. Describe the process for both the iOS and Android operating systems.

Configure email on a mobile device. Describe the process of configuring email, including both Exchange and Gmail for both the iOS and Android operating systems.
1.7 Given a scenario, use methods to perform mobile device synchronization.

Keeping information in sync between your desktop or laptop and your mobile device is one of the features that many users want to take advantage of. There are many types of information that can be synced, applications that can be installed to perform the synchronization, and connection methods that can be used to do this. This section discusses mobile device synchronization. The topics addressed in this section include the following:

- Synchronization methods
- Types of data to synchronize
- Mutual authentication for multiple services
- Software requirements to install the application on the PC
- Connection types to enable synchronization

Synchronization methods

When synchronizing the various data types we will discuss shortly, there are three basic ways to make this happen: You can synchronize to the cloud, a desktop, or an automobile’s computer system. In this section, you’ll look at all three approaches.

Synchronize to the cloud

One synchronization method that is gaining in popularity (along with all things “cloud”) is synchronizing all your devices to a cloud server. This provides a central location for your data, settings, and all other items listed in the “Types of data to synchronize” section next. This can be set up such that all devices update with the cloud as soon as they attain Internet access.

Synchronize to the desktop

Another approach is to set up a sync process directly between two devices such as a smartphone and a desktop computer. In this case, the two devices will sync with one another at any time they find themselves on the same network such as a home wireless network.

Synchronize to the automobile

Yes, cars now have computing systems and as such can be synced to the mobile device either by using Bluetooth or by using cables designed by the vendors to connect to the car system.
Types of data to synchronize

Users may be interested in maintaining a consistency between the state of data that exists on the laptop or desktop and the state of the same data on a mobile device. This section discusses common types of data.

Contacts

No one wants to enter a long list of contacts into a mobile device when that same list already exists in your email account. Using push synchronization (push means it’s automatic and requires no effort on the part of the user), you ensure that any changes made to the contact list either on the mobile device or on the desktop will be updated on the other device the next time you make a connection to the email account from the other device. It will also update if the mobile device makes a direct connection to the desktop (covered later in “Connection types to enable synchronization”).

Applications

Program data from applications such as databases can also be synchronized between servers and mobile devices. A good example is the synchronization of the data entered into handheld devices used by the wait staff in restaurants and the server in the back room of the restaurant. Another example is the synchronization of data from handheld scanners in a warehouse with a server that may or may not be on-site. This seamless automatic updating makes the entire operation more productive.

Email

Even more important to users than their contacts is the state of their email. The mobile device will synchronize the contacts, calendar items, and email each time the mobile device makes contact with the email account. This results in a consistent state between what is seen on the desktop and what is seen on the mobile device. Push synchronization will usually allow you to configure the push schedule, such as every 30 minutes. To preserve battery life, push sync should take place less frequently.

Pictures

Pictures are another item that users frequently want to view from their mobile device without going through the process of manually downloading them to the device. Synchronization allows the pictures stored on the desktop (or even a share on a server) to be available on the mobile device, even the one you just added an hour ago.

Music

Music files can also be included in the sync process. This helps to keep your library available on the mobile device. When you start talking about music and video files (see the next section), a word of caution is in order. These large files can quickly add up and fill the hard drive and also add significantly to your data usage if the sync is happening
over a wireless cell phone connection using a data plan. They can also be hard on the battery.

**Videos**

Video libraries can be kept consistent across devices using synchronization. Be aware of the effect of these large files on your drive space, battery level, and data usage if you are syncing wirelessly through a cell phone network.

**Calendar**

The calendar is a critical application for both work and play. All mobile devices support syncing the calendar between devices. In some cases, it may require a small application, especially when the email system of which the calendar is part of is in a different ecosystem (for example, Google Mail and an iPhone).

**Bookmarks**

Bookmarks of frequently visited websites make everyone’s day easier, and when the same ones are available in the browser of all your devices, including your mobile devices, it doubles the benefit. Bookmarks are another item that can be configured to sync automatically.

**Documents**

Technology to sync documents located in multiple locations has been around for some time now. Users have come to expect this functionality, and it is present in modern mobile devices as well. Users want to be able to work anywhere on any device and this facilitates that.

**Location data**

In some cases, users may decide to allow an application to track their location for the purpose of tailoring search results. When this is done, it can be a onetime thing or the users can give the application ongoing permission to do so. Most device browsers will indicate this with some sort of icon or indicator on that page. These settings can also be synchronized between devices as well.

**Social media data**

While social media was once a guilty distraction, today even businesses and organizations use social media. When users have multiple accounts, many mobile platforms such as Google and Apple offer applications that can allow them to track and post to multiple accounts at once, reducing the time required to “check and update” the accounts.

**E-books**

Many users have accounts that give them access to books in digital format, or e-books. Naturally, they want to have access to these books (and other content types) on all their devices. Not only can this be done, but the sync process can keep their various devices up-to-date with the latest position of a bookmark in the book or of new items that have been highlighted or notes that have been made.
1.7 Given a scenario, use methods to perform mobile device synchronization.

**Passwords**

Finally, passwords can also be synchronized across devices. For example, when you change your Gmail password on one device it automatically updates it on all other devices.

**Mutual authentication for multiple services (SSO)**

Mutual authentication is a process whereby not only does the server verify the credential of the client but the client also verifies the credential of the server. It adds additional security to the process. Both Android and iOS devices support this type of authentication, typically using SSL. One of the challenges presented to performing this type of authentication in mobile devices is their relative lack of processing power when compared with desktop and laptop systems.

**Software requirements to install the application on the PC**

Some devices come with a sync feature installed, but for the most robust functionality (for example, syncing between devices with different operating systems such as iPhone to Android and Android), synchronization applications that will do a much better job than the built-in applications can be purchased either at the Apple Store site or in other app marketplaces.

When obtaining one of these, ensure that your device meets all the requirements of the application. These applications will call for certain minimum requirements on the mobile device to operate correctly, so observe these guidelines to ensure a successful installation and operation.

**Connection types to enable synchronization**

The synchronization process can be carried out over several methods of connection between the devices. In some cases, you can connect the mobile device to the laptop or desktop using a USB connector. In other cases, you can establish a Bluetooth connection from the mobile device and the desktop. Finally, an 802.11 WLAN can also be used to establish this connection. In some instances, the synchronization application will allow you to introduce a shared folder into the scenario (like Dropbox, for example), which then allows you to use the Internet to sync from the laptop to the Dropbox and then from the Dropbox to the mobile device.

**Exam essentials**

**Identify synchronization methods.** These include synchronizing to the cloud, synchronizing to the desktop, and synchronizing to the automobile.

**Identify type of data to sync.** These include contacts, applications, email, pictures, music, videos, calendars, bookmarks, documents, location data, social media data, e-books, and passwords.
Review Questions

You can find the answers in the Appendix.

1. What is the maximum transmission speed of an ExpressCard in PCIe2 mode?
   A. 280 Mbps
   B. 512 Mbps
   C. 1.6 Gbps
   D. 3.2 Gbps

2. Which interface is natively found only in Apple devices?
   A. USB
   B. Serial
   C. Thunderbolt
   D. PS/2

3. What special screwdriver is typically required to work on a notebook?
   A. Phillips head
   B. T-8 Torx
   C. Hex
   D. Metric

4. What is the easiest thing to damage when removing a laptop keyboard?
   A. The keys
   B. The data cable
   C. The plastic cover
   D. The plastic screws

5. Which component if damaged can render the hard drive useless?
   A. The caddy
   B. The rails
   C. The signal pins
   D. The chassis

6. What size hard drive goes in a laptop?
   A. 1.5 inch
   B. 2.0 inch
   C. 2.5 inch
   D. 3.5 inch
7. Which is not an advantage of solid-state drives?
   A. Cheaper
   B. Not as susceptible to damage
   C. Faster
   D. No moving parts

8. Which display uses a row of transistors across the top of the screen and a column of them down the side?
   A. Passive matrix
   B. Active matrix
   C. Twisted nematic
   D. In-plane switching

9. Which display is a newer technology that solves the issue of poor quality at angles other than straight on?
   A. Passive matrix
   B. Active matrix
   C. Twisted nematic
   D. In-plane switching

10. Which of the following lets you quickly connect/disconnect with external peripherals and may also provide extra ports that the notebook PC doesn’t normally have?
    A. Docking station
    B. Laptop lock
    C. Table lock
    D. Hot dock

11. In what mode of plug and play must the laptop be turned off and back on for the change to be recognized?
    A. Hot docking
    B. Warm docking
    C. Cold docking
    D. Open docking

12. Which of the following is a class of devices that specializes in tracking your movement?
    A. Fitness monitor
    B. Extended reality
    C. Smartphones
    D. Tablets
13. Which of the following uses satellite information to plot the global location of an object and uses that information to plot the route to a second location?
   A. GPS
   B. Geofencing
   C. Remote wipe
   D. Local wipe

14. Which interface is the most common port found on mobile devices?
   A. USB
   B. Serial
   C. Thunderbolt
   D. PS/2

15. Which is the most common pin code when selecting discovered Bluetooth devices?
   A. 0000
   B. 5555
   C. 1111
   D. 0135

16. Which of the following is the connection between the mobile device and the radio?
   A. PRI
   B. PRL
   C. IEMI
   D. IMSI

17. Which of the following is a process whereby not only does the server verify the credential of the client but the client also verifies the credential of the server?
   A. Mutual authentication
   B. SSO
   C. Multifactor authentication
   D. Biometrics

18. Which of the following is the use of physical factors of authentication?
   A. Mutual authentication
   B. SSO
   C. Multifactor authentication
   D. Biometrics