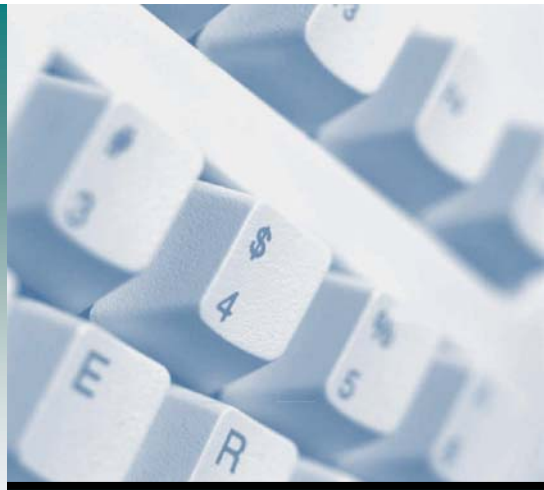


Microsoft®

Computer Basics

Student Edition Complete

CustomGuide.com
Computer Courseware

Table of Contents

Introduction

Welcome to CustomGuide: Computer Basics. CustomGuide courseware allows instructors to create and print manuals that contain the specific lessons that best meet their students' needs. In other words, this book was designed and printed just for you.

Unlike most other computer-training courseware, each CustomGuide manual is uniquely designed to be three books in one:

- Step-by-step instructions make this manual great for use in an instructor-led class or as a self-paced tutorial.
- Detailed descriptions, illustrated diagrams, informative tables, and an index make this manual suitable as a reference guide when you want to learn more about a topic or process.
- The handy Quick Reference box, found on the last page of each lesson, is great for when you need to know how to do something quickly.

CustomGuide manuals are designed both for users who want to learn the basics of the software and those who want to learn more advanced features.

Here's how a CustomGuide manual is organized:

Chapters

Each manual is divided into several chapters. Aren't sure if you're ready for a chapter? Look at the prerequisites that appear at the beginning of each chapter. They will tell you what you should know before you start the chapter.

Lessons

Each chapter contains several lessons on related topics. Each lesson explains a new skill or topic and contains a step-by-step exercise to give you hands-on-experience.

Chapter Reviews

A review is included at the end of each chapter to help you absorb and retain all that you have learned. This review contains a brief recap of everything covered in the chapter's lessons, a quiz to assess how much you've learned (and which lessons you might want to look over again), and a homework assignment where you can put your new skills into practice. If you're having problems with a homework exercise, you can always refer back to the lessons in the chapter to get help.

How to Use the Lessons

Every topic is presented on two facing pages, so that you can concentrate on the lesson without having to worry about turning the page. Since this is a hands-on course, each lesson contains an exercise with step-by-step instructions for you to follow.

To make learning easier, every exercise follows certain conventions:

- Anything you're supposed to click, drag, or press appears **like this**.
- Anything you're supposed to type appears `like this`.
- This book never assumes you know where (or what) something is. The first time you're told to click something, a picture of what you're supposed to click appears either in the margin next to the step or in the illustrations at the beginning of the lesson.

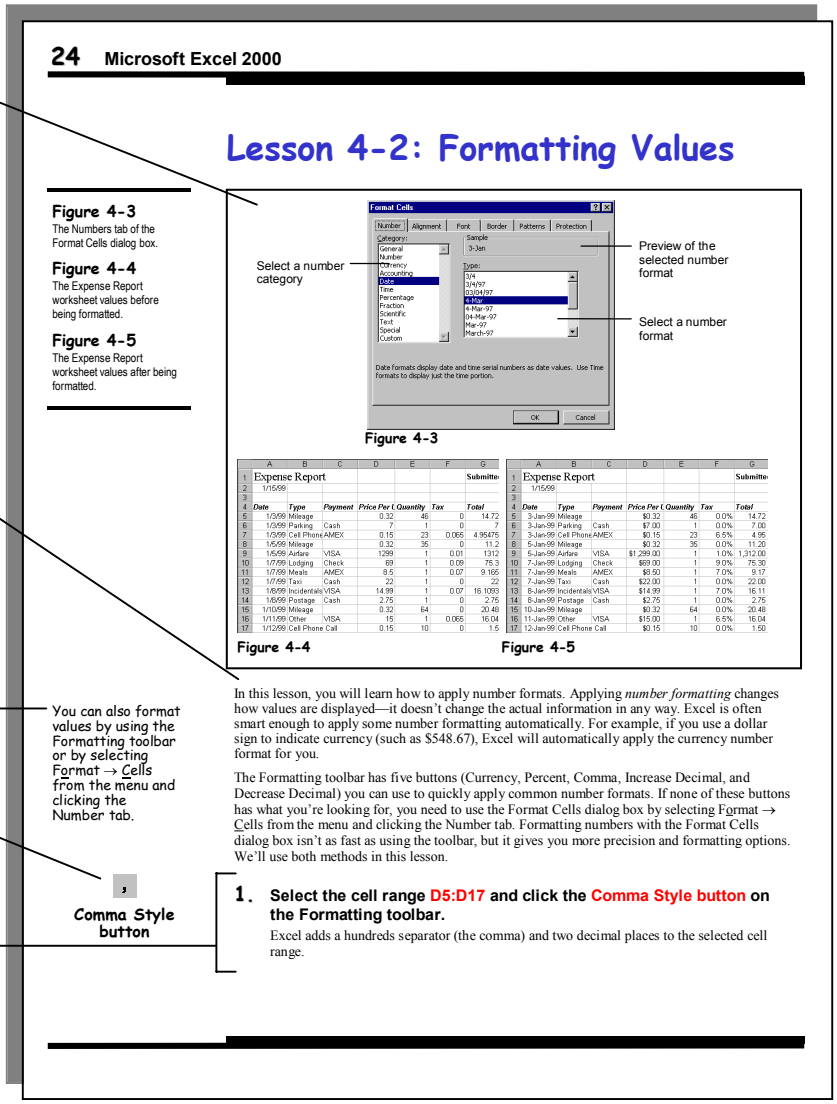
Illustrations show what your screen should look like as you follow the lesson. They also describe controls, dialog boxes, and processes.

An easy-to-understand introduction explains the task or topic covered in the lesson and what you'll be doing in the exercise.

Tips and traps appear in the margin.

Icons and pictures appear in the margin, showing you what to click or look for.

Clear step-by-step instructions guide you through the exercise. Anything you need to click appears **like this**.



24 Microsoft Excel 2000

Lesson 4-2: Formatting Values

Figure 4-3
The Numbers tab of the Format Cells dialog box.

Figure 4-4
The Expense Report worksheet values before being formatted.

Figure 4-5
The Expense Report worksheet values after being formatted.

Select a number category

Preview of the selected number format

Select a number format

Figure 4-3

Figure 4-4 Figure 4-5

In this lesson, you will learn how to apply number formats. Applying *number formatting* changes how values are displayed—it doesn't change the actual information in any way. Excel is often smart enough to apply some number formatting automatically. For example, if you use a dollar sign to indicate currency (such as $548.67), Excel will automatically apply the currency number format for you.

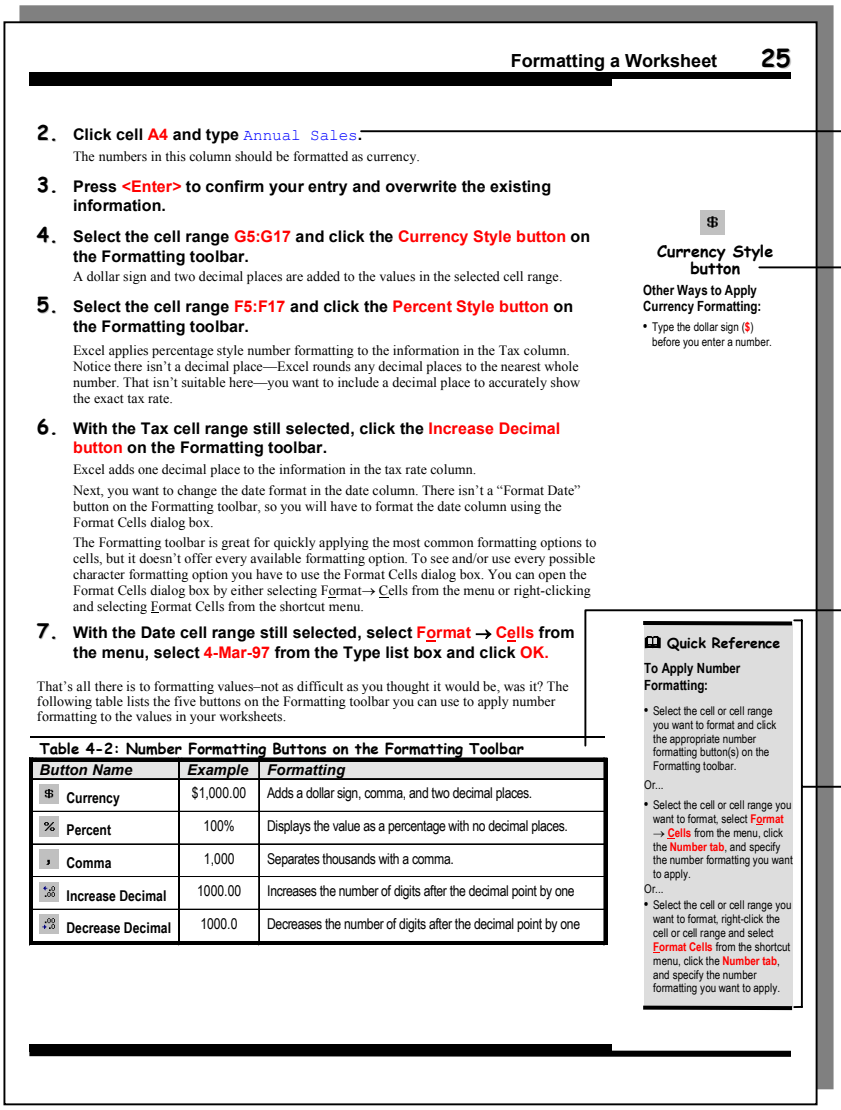
The Formatting toolbar has five buttons (Currency, Percent, Comma, Increase Decimal, and Decrease Decimal) you can use to quickly apply common number formats. If none of these buttons has what you're looking for, you need to use the Format Cells dialog box by selecting Format → Cells from the menu and clicking the Number tab. Formatting numbers with the Format Cells dialog box isn't as fast as using the toolbar, but it gives you more precision and formatting options. We'll use both methods in this lesson.

You can also format values by using the Formatting toolbar or by selecting Format → Cells from the menu and clicking the Number tab.

Comma Style button

1. **Select the cell range D5:D17 and click the Comma Style button on the Formatting toolbar.**
   Excel adds a hundreds separator (the comma) and two decimal places to the selected cell range.

- When you see a keyboard instruction like "press **<Ctrl>** + **<B>**," you should press and hold the first key (<Ctrl> in this example) while you press the second key (<B> in this example). Then, after you've pressed both keys, you can release them.
- There is usually more than one way to do something in Word. The exercise explains the most common method of doing something, while the alternate methods appear in the margin. Use whatever approach feels most comfortable for you.
- Important terms appear in *italics* the first time they're presented.
- Whenever something is especially difficult or can easily go wrong, you'll see a:
  NOTE:
  immediately after the step, warning you of pitfalls that you could encounter if you're not careful.
- Our exclusive Quick Reference box appears at the end of every lesson. You can use it to review the skills you've learned in the lesson and as a handy reference—when you need to know how to do something fast and don't need to step through the sample exercises.



Formatting a Worksheet 25

2. **Click cell A4 and type** `Annual Sales`.
   The numbers in this column should be formatted as currency.
3. **Press <Enter> to confirm your entry and overwrite the existing information.**
4. **Select the cell range G5:G17 and click the Currency Style button on the Formatting toolbar.**
   A dollar sign and two decimal places are added to the values in the selected cell range.
5. **Select the cell range F5:F17 and click the Percent Style button on the Formatting toolbar.**
   Excel applies percentage style number formatting to the information in the Tax column. Notice there isn't a decimal place—Excel rounds any decimal places to the nearest whole number. That isn't suitable here—you want to include a decimal place to accurately show the exact tax rate.
6. **With the Tax cell range still selected, click the Increase Decimal button on the Formatting toolbar.**
   Excel adds one decimal place to the information in the tax rate column.
   Next, you want to change the date format in the date column. There isn't a "Format Date" button on the Formatting toolbar, so you will have to format the date column using the Format Cells dialog box.
   The Formatting toolbar is great for quickly applying the most common formatting options to cells, but it doesn't offer every available formatting option. To see and/or use every possible character formatting option you have to use the Format Cells dialog box. You can open the Format Cells dialog box by either selecting Format→ Cells from the menu or right-clicking and selecting Format Cells from the shortcut menu.
7. **With the Date cell range still selected, select Format → Cells from the menu, select 4-Mar-97 from the Type list box and click OK.**

That's all there is to formatting values–not as difficult as you thought it would be, was it? The following table lists the five buttons on the Formatting toolbar you can use to apply number formatting to the values in your worksheets.

Table 4-2: Number Formatting Buttons on the Formatting Toolbar

Button Name	Example	Formatting
Currency	$1,000.00	Adds a dollar sign, comma, and two decimal places.
Percent	100%	Displays the value as a percentage with no decimal places.
Comma	1,000	Separates thousands with a comma.
Increase Decimal	1000.00	Increases the number of digits after the decimal point by one
Decrease Decimal	1000.0	Decreases the number of digits after the decimal point by one

Currency Style button

Other Ways to Apply Currency Formatting:

- Type the dollar sign ($) before you enter a number.

Quick Reference

To Apply Number Formatting:

- Select the cell or cell range you want to format and click the appropriate number formatting button(s) on the Formatting toolbar.

Or...

- Select the cell or cell range you want to format, select Format → Cells from the menu, click the Number tab, and specify the number formatting you want to apply.

Or...

- Select the cell or cell range you want to format, right-click the cell or cell range and select Format Cells from the shortcut menu, click the Number tab, and specify the number formatting you want to apply.

Anything you need to type appears `like this`.

Whenever there is more than one way to do something, the most common method is presented in the exercise and the alternate methods are presented in the margin.

Tables provide summaries of the terms, toolbar buttons, or shortcuts covered in the lesson.

CustomGuide's exclusive Quick Reference is great for when you need to know how to do something fast. It also lets you review what you've learned in the lesson.

Chapter One: The Essentials

Chapter Objectives:

- **Learn the difference between hardware and software**
- **Discover the various types of computers and their roles**
- **See what's on the front, back, and inside of a computer**
- **Learn about the various ports on a computer**
- **Understand what determines a computer's performance**
- **See what you should look for when buying a computer**

☑ Prerequisites

- A desire to learn about computers.

Computers are useful: they help us write letters, find information on the Internet, and even create our own music CDs. Some people *love* computers—they speak a different language that includes nonsensical words like *IP address* and *gigabytes*. But most of us are somewhat clueless when it comes to computers. We know how to turn our computer on, how to surf the Internet (maybe), and how to write a quick letter on a word processor. But that's about it—we have to ask our kids or friends for help when something goes wrong, which is all the time.

This guide takes some of the mystery out of computers. In this chapter we'll take a good hard look at a computer from the front, back, and yes, even inside. You'll understand what all those confusing ports on the back of the computer are for and why it's important for your computer to have a fast *CPU*. Best of all, we'll explain all of this in simple terms, so you won't need an engineering degree to understand everything.

Ready to tackle your computer? Great—turn the page and let's get started…

Lesson 1-1: Hardware, Software, and Information Technology (IT)

Figure 1-1

A typical computer setup.

Figure 1-2

Microsoft Word is an example of a software application.

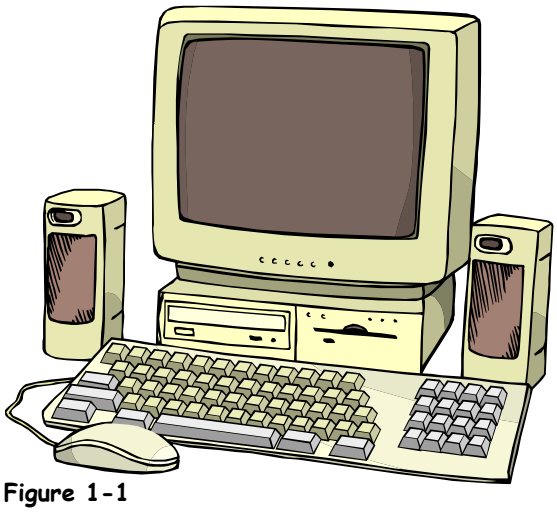


Figure 1-1

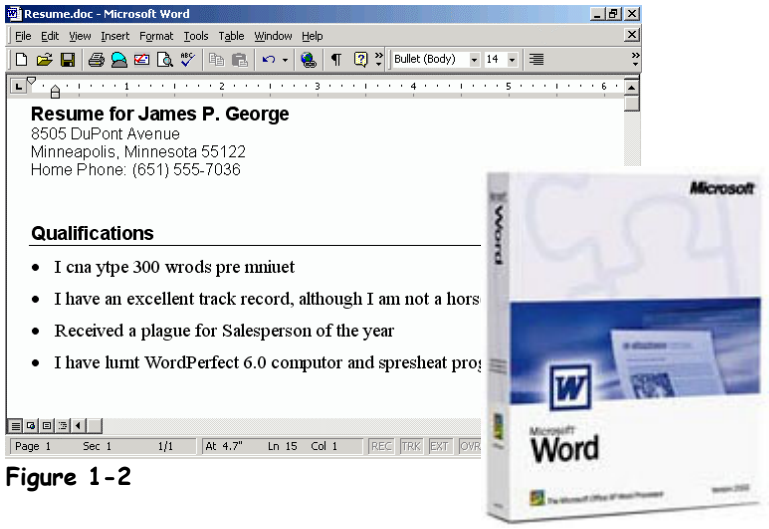


Figure 1-2

Your desk probably contains a jumble of equipment commonly known as a computer. But what is all that stuff? What does a computer do? Unlike many other tools or appliances that have limited purposes, a computer can do any number of things:

- Write letters
- Browse the Internet
- Send e-mail messages to people around the world
- Play games
- Help you balance your budget

…and that's just the beginning of what you can do with a computer!

Two basic components make up a computer: *hardware* and *software*. You simply can't have one without the other. All computer parts that you can physically see or touch are called *hardware*. Hardware includes the computer's monitor, case, keyboard, mouse, and printer. Computer programs that tell hardware how to operate are called *software*. You may have used software such as Microsoft Excel or Corel WordPerfect in the past. So breathe a giant sigh of relief—you don't have to know how to program a computer to use one. A computer programmer has already done the work for you by writing the program (software). All you have to do is tell the software what you're trying to do, and the software then directs the work of the hardware.

Figure 1-1 shows an example of a typical computer setup and its components, but don't worry if your setup is different. More than likely, you have all the parts that you need, and those parts are properly connected. In any case, Table 1-1: *Parts of a Computer*, provides more details about each individual component.

IT, short for *Information Technology*, is the broad subject related to computers and managing and processing information, especially within large organizations. Many large companies have departments full of computer experts called *IT departments*.

Your computer setup may differ from the one shown in Figure 1-1. For example, you might have a computer case that is tall and skinny (tower case) or a flat screen monitor.

Table 1-1: Parts of a Computer

Component	*Description*
Case or System Unit	The main computer box, technically known as the *system unit*, is the most important part of a computer. It contains the guts and brains of the computer—something we'll talk about later. The system unit contains a lot of holes or *ports* where you plug in the rest of the computer system.
Monitor	The monitor resembles a television set, and is where the computer displays information.
Keyboard	The keyboard is the thing you type on to tell your computer what to do.
Mouse	Like the keyboard, the mouse is another *input device* that you use to communicate with your computer.
Speakers	Most computers can make sounds, just like a stereo system. In fact, you can even listen to audio CD's on most computers or watch DVDs.
Printer	A printer is where a computer writes down information or *output*, onto paper, or a *hardcopy*.

🕮 Quick Reference

A typical computer includes the following:

- System unit
- Monitor
- Keyboard
- Mouse
- Speakers
- Printer

Hardware:

- A computer item you can physically see or touch.

Software:

- A computer program that tells computer hardware how to operate.

IT:

- Information Technology is the broad subject related to computers and managing and processing information.

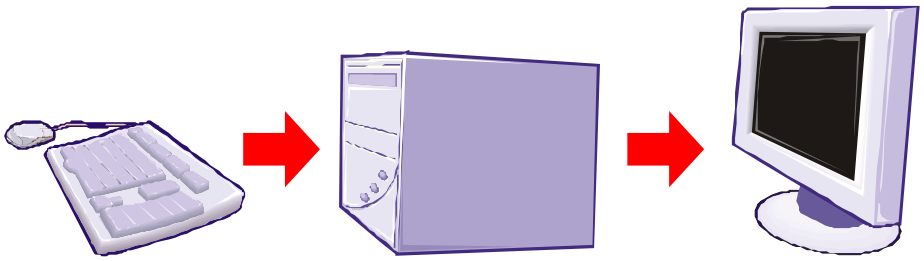
Lesson 1-2: Computer Overview

Figure 1-3

How a computer works.

Figure 1-4

Comparing a TV to a PC.



Input
You communicate with the computer via an input device such as a mouse, a keyboard, or a joystick.

Process/Storage
The computer processes data, makes calculations, directs the work of the hardware, and stores your files.

Output
The computer communicates its results to you via an output device such as a monitor, a printer, or speakers.

Figure 1-3

Input
The remote control talks to the TV; the mouse and the keyboard talk to the computer.

Process/Storage
The cable box deciphers which channel you want to watch; the CPU translates your instructions (via software) to the hardware.

Output
The television displays the channel; the monitor displays the results.

Figure 1-4

Computers are not really as complicated as they initially seem. You just have to learn the basic functions of the various parts, and then you can separate them into three categories:

- **Input**
  Any device that lets you talk to the computer (such as a mouse or keyboard).
- **Process/Storage**
  Main functions of a computer, which happen inside the computer case. Not surprisingly, the Central Processing Unit (CPU) does all the processing; the storage function is handled by any number of drives (hard, floppy, Zip, tape-backup, CD/DVD-ROM) or disks (compact discs or floppy diskettes).
- **Output**
  Any device that lets the computer talk to you (such as a monitor or speakers).

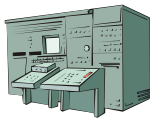
If you're having trouble understanding this input/output stuff, think of your home television (TV) set. Televisions and computers are similar in several ways:

- The remote control is comparable to the mouse (or any other input device such as a mouse or joystick).
- The cable box (while not nearly as powerful as a computer) is similar to a computer in that it can process information (such as deciphering which channel you want to watch) and, if programmable, store information (such as when to show the film using a built-in timer).
- The TV displays the channel much like a monitor displays information.

A remote control communicates with a television much like a mouse communicates with a computer.

There are several different types of computer systems out there. Here's a very brief description of the most common ones…

Table 1-2: Types of Computers

Computer	Description
 Mainframe	A mainframe is a big, powerful, expensive computer that can support many users at the same time. Large businesses and organizations use mainframes. **Capacity:** Enormous - the capacity of several hundred or even thousands of PCs **Speed:** Very fast - much, much faster than a PC **Cost:** Very, very expensive - can usually only be afforded by large organizations **Users:** Only used by large businesses and organizations
 PC	A PC is a *personal computer*, originally designed by IBM way back in 1981. Many different companies make PCs, but all of them are IBM-compatible. What this means, according to Bill Gates, is that they will all run Microsoft Windows. **Capacity:** Average hard disk size is 20 GB to 80 GB **Speed:** Fast. Average speed is from 1 GHz to 3 GHz **Cost:** Fairly inexpensive - under $1,000 - and getting cheaper every day! **Users:** Just about everyone uses a PC! Homes, offices, schools…
 Mac	Developed by Apple, a Macintosh is a computer, but it is NOT a PC. Macs have a different operating system and use their own software and hardware. **Capacity:** Average hard disk size is 20 GB to 80 GB **Speed:** Fast. Average speed is from 500 MHz to 2 GHz **Cost:** Fairly inexpensive, but usually more than an equivalent PC **Users:** Just about everyone, especially in the education and design fields
 Networked Computer	A network is a group of computers that are connected so that they can share equipment and information. Most people on a network use *workstations*, which are simply PCs that are connected to the network. A *server* is a central computer where users on the network can save their files and information. **Capacity:** (Workstation) Same as a PC, only needs an inexpensive network card (Server) Greater than a PC, often more than 100 GE **Speed:** (Workstation) Same as a PC (Server) Generally faster than a PC, may use multiple CPUs **Cost:** (Workstation) Same as a PC (Server) More expensive than a PC but not as costly as a mainframe **Users:** (Workstation) People in a networked office or organization (Server) Generally a network administrator or engineer
 Laptop	A laptop, or notebook, is a lighter and more portable version of a PC or Mac that can run on batteries. **Capacity:** Average hard disk size is 10 GB to 40 GB **Speed:** Fast, but slightly less than a PC. Average speed is from 700 MHz to 2 GHz **Cost:** Fairly inexpensive, but more than an equivalent PC **Users:** People on the move, especially business people and students
 Palmtop/PDA	A PDA (Personal Data Assistant) is a handheld computer that is generally used to keep track of appointments and addresses. **Capacity:** Much smaller than a PC - 8 MB to 64 MB of storage space **Speed:** Much slower than a PC - 8 MHz to 266 MHz **Cost:** Expensive when compared to the capacities of a PC **Users:** Business people and others who need to be organized

Quick Reference

The Basic Computer Processes Are:

1. Input
2. Processing
3. Output

Different Types of Computers Include:

- Mainframes
- PCs
- Macs
- Servers
- Laptops
- Palmtops or PDAs

Lesson 1-3: The Front of a Computer and Peripheral Devices

Figure 1-5

The front of a computer case.

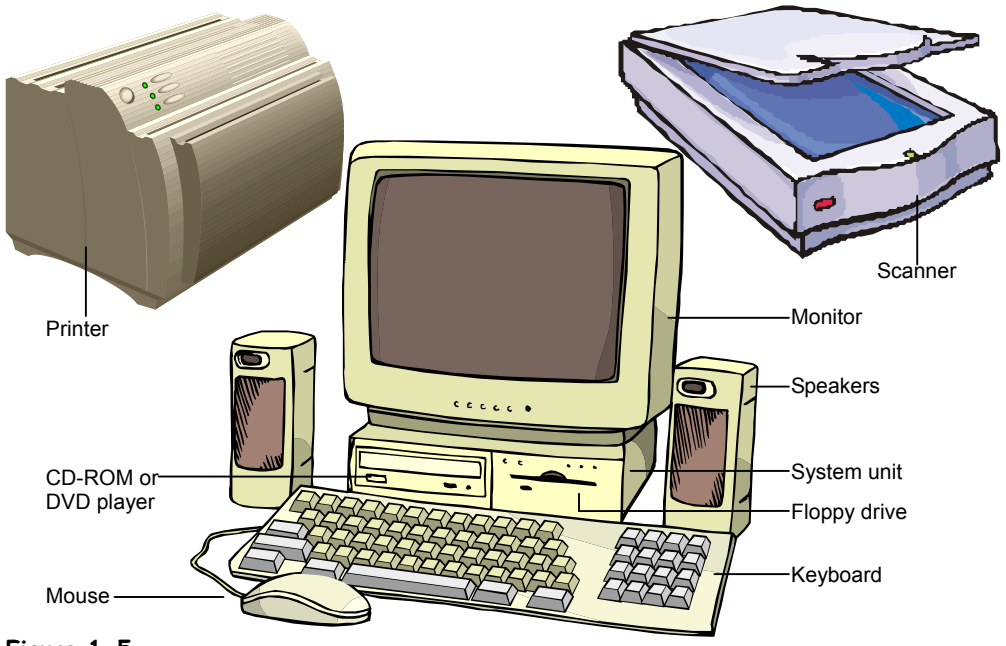


Figure 1-5

The system unit or computer case is that plastic box that sits under your monitor or desk and is covered with slots, buttons, and lights. Computer cases come in several shapes and sizes. Older computers often have the horizontal desktop case, which has gradually been replaced by the vertical tower case. Manufacturers are now phasing out the tallest towers because the compact size of the smallest tower, known as a *mini-tower,* is attractive to consumers.

Everything outside of and connected to the system unit is called *peripherals*. You can add dozens of peripherals and accessories to make it more useful and fun. Common peripherals include printers, scanners, external hard drives, CD-ROM drives, and digital cameras. Many peripherals are considered to be *input devices*, because they allow you to talk to your computer by inputting information. Other peripherals are *output devices*, because they let your computer talk back to you. One more thing: all peripherals are considered to be part of a computer's hardware.

Table 1-3: What's on the Front or Outside of a Computer Case?

Item	*Description*
System Unit or Computer Case	A plastic or metal case with slots, buttons, and lights in the front and holes in the back. This is the most important part of a computer because it contains the Central Processing Unit (CPU). The system unit directs the computer, performs calculations, and stores information.
Floppy Drive	Reads and writes to 3½-inch floppy disks. A floppy disk can store about 1.5 MB of information—about as much as a novel.

Item		Description
Hard Drive (Not shown)		The computer's main, long-term storing device. Unlike floppy disks and CD-ROMs, you typically cannot remove a hard disk.
CD-ROM or DVD Drive		CD-ROMs and DVDs for your computer can store lots of information and look exactly like CDs for your stereo and DVDs for your home DVD player. In fact, you can listen to audio CDs on a CD-ROM drive and even watch DVD movies on a DVD drive. The only real difference between a CD-ROM and a DVD is how much information they can store. A CD-ROM can store approximately 650MB (megabytes) of information, while a DVD can store much more—up to 17 GB (gigabytes) or 17,000MB on a double-sided DVD. Most CD-ROMs and DVD are *read-only*, meaning you can't write information to them. You can buy special CD-ROM and DVD drives that *can* write or burn information to special CD-R, CD-RW, DVD-R, and DVD-RW discs.
Zip Drive (Not shown)		A special type of disk drive that can read and write to Zip disks. A Zip disk is a lot like a floppy disk, although they are faster and can store more information—from 100 to 250MB (megabytes).
Tape Backup (Not shown)		A device that you can use to store backups, or copies, of the information on a computer's hard drive.
Input Devices	**Keyboard**	The keyboard is the thing you type on to tell your computer what to do.
	Mouse	Like the keyboard, the mouse is another *input device* that you use to communicate with your computer.
	Scanner	Scanners work like photocopiers, except the image is translated into a digital image in your computer rather than copied onto paper.
Output Devices	**Monitor**	The monitor resembles a television set, and is where the computer displays information.
	Speakers	If visible, your computer speakers are similar to those on a stereo system (or at least a cheap stereo system). They allow your computer to play sounds.
	Printer	A printer is where a computer writes down information or *output*, onto paper, or a *hardcopy*.

Quick Reference

Components Visible from the Outside of the System Unit May Include:

- Floppy drive
- CD-ROM or DVD drive
- Zip drive or tape backup
- Keyboard
- Mouse
- Scanner
- Monitor
- Speakers
- Printer

Lesson 1-4: The Inside of a Computer

Figure 1-6

The side view of the guts of a tower case.

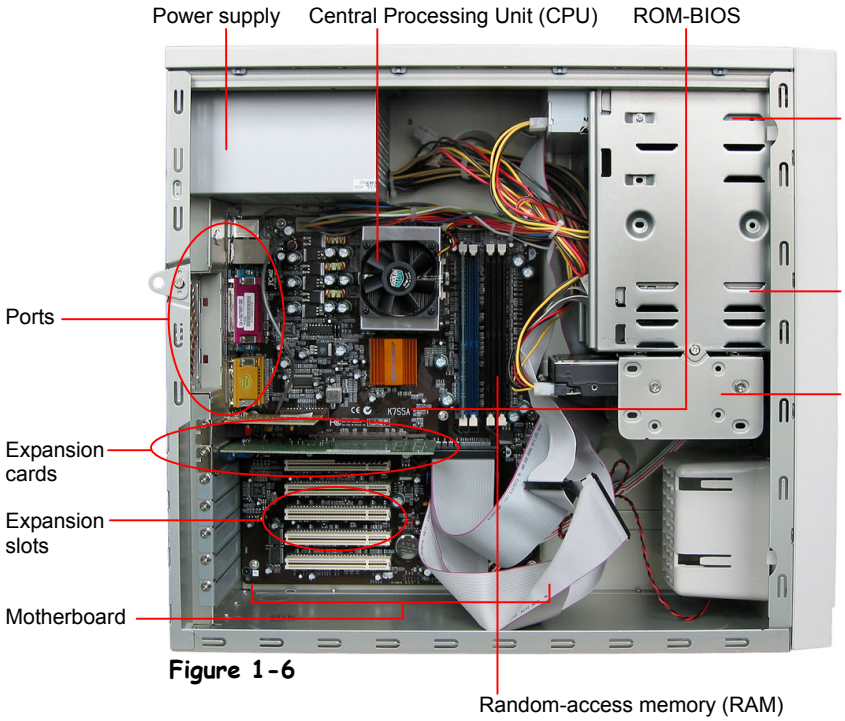
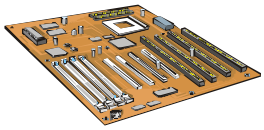


Figure 1-6



Everything plugs into a computer's motherboard.

Now that you know what's on the outside, let's crank open that mysterious computer case and look inside. But no tools required—we've done all the work for you. Just compare Figure 1-6 with Table 1-4: *What's Inside a Computer Case?* to see what's important.

Table 1-4: What's Inside a Computer Case?

Item	*Description*
Motherboard	The main piece of circuitry in a computer. Everything connects to or is wired to the motherboard.
Central Processing Unit (CPU)	The computer's brain or heart, the CPU is a computer's main chip. The CPU is really nothing more than an incredibly fast and powerful calculator.
Random Access Memory (RAM)	A computer's temporary storage place, where it gets its work done. For example, when you use a word processor to type a letter, the letter is stored in the computer's memory.
ROM-BIOS	A computer's ROM-BIOS (stands for Read Only Memory – Basic Input/Output System) is a special chip with instructions for the computer to communicate with other hardware parts.
Expansion Slot	An expansion slot lets you add more features and capabilities to a computer by plugging in expansion cards.

Item	*Description*
Expansion Card	A card that allows you to expand your computer's capabilities, such as a modem card, a network card, a video card, or a sound card.
PCMCIA Cards	Notebook computers are too small to use expansion cards, so they use special credit-card sized PCMCIA cards instead. You plug in a PCMCIA card, or PC Card, into a notebook computer to give it more features and capabilities. Nobody's getting tested on this, but PCMCIA stands for Personal Computer Memory Card International Association.

🕮 Quick Reference

Components Inside the System Unit May Include:

- Motherboard
- CPU (Central Processing Unit)
- RAM (Random Access Memory)
- ROM-BIOS
- Expansion slots and cards
- PCMCIA cards (laptops only)

Lesson 1-5: The Back of a Computer (Ports)

Figure 1-7

The back of a computer case.

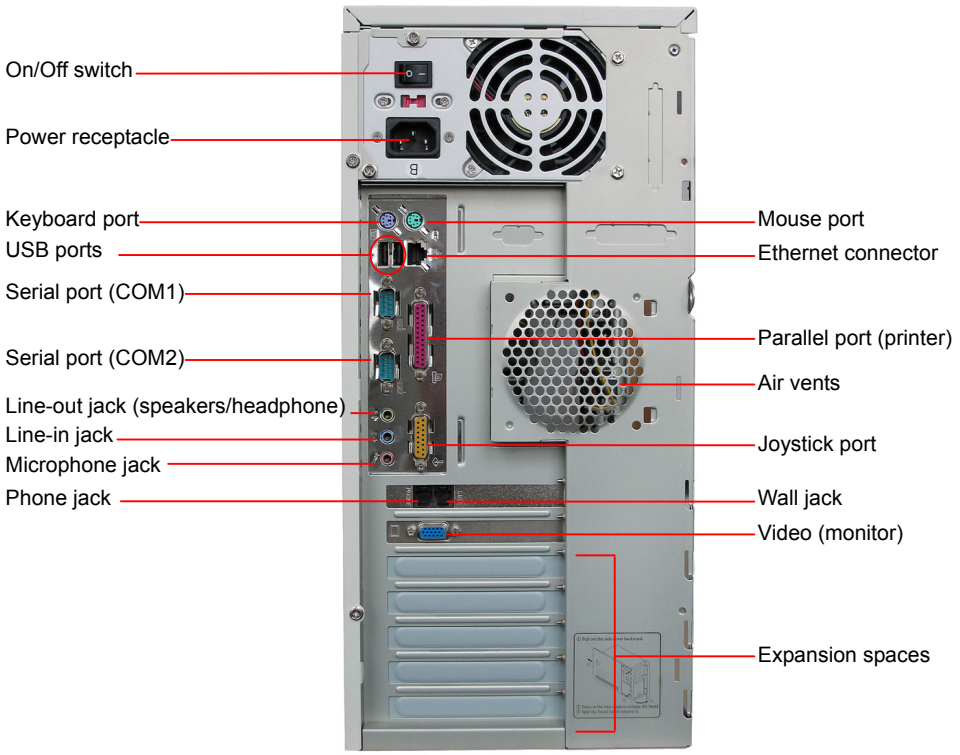
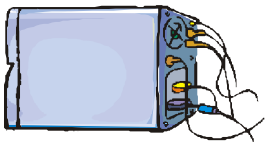


Figure 1-7



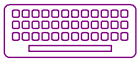
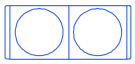
You may feel a bit overwhelmed the first time you look at the back of a computer.

When you look at the back of a computer, you may feel a bit overwhelmed by all the slots and holes. Fortunately, manufacturers have added some fairly standard icons and color coding to help you identify what should be plugged into your computer and where. Before long, you'll recognize those icons and colors, and the configuration won't seem so mysterious. It's rather like hooking up cable and a DVD player to the back of your television—unless you're one of those people who just wait for the cable guy to take care of that heinous task. In any case, this lesson will review each item piece by piece so you won't get completely lost.

Before we begin, let's define a couple of terms. The first thing you'll notice is that the back of your computer has lots of holes. Those holes are called (depending on who you ask) *jacks*, *ports*, or *connectors*. You may notice that some of the connectors have holes, but some have what look like stickpins (which are aptly named *pins*). The ones that have holes are called *female* connectors; the ones that have pins are called *male* connectors. Let's leave it at that.

Now let's begin. Compare Figure 1-7 to Table 1-5: *What's on the Back of a Computer Case?* The back of your computer may be arranged differently but should include the same elements.

Table 1-5: What's on the Back of a Computer Case?

Port	Icon	Description
 Keyboard & Mouse	 	The keyboard and mouse jacks look identical on most PCs, so look for colors and icons to help you with plugging in these devices. Some mice and keyboards use USB ports. Older mice may use a serial port.
 Serial or COM		Serial (or COM) ports are a very versatile type of port. Some of the things you can plug into a serial port include: a mouse, modem, scanner, or digital camera. Most computers have two serial ports: COM1 and COM2.
 Parallel or Printer		You plug your printer into the parallel, or printer, port. Many newer printers may use a USB port.
 USB		Designed to replace older Serial and Parallel ports, the USB (Universal Serial Bus) can connect computers with a number of devices, such as printers, keyboards, mice, scanners, digital cameras, PDAs, and more. Better yet, the USB port supports *plug-and-play*, so you can simply plug in a USB device and start using it. USB 1 ports can transfer information at a speed up to 12 Mbps (Megabytes per Second). Newer USB 2 ports can transfer information at a speed up to 480 Mbps. Most computers come with two USB ports.
 Video or Monitor		You plug your monitor into the video port.
 Line Out		Plug in your speakers or headphone into the Line Out jack.
 Line In		The Line In jack allows you to listen to your computer using a stereo system.
 Microphone		You can plug a microphone into this jack to record sounds on your computer.
 Joystick or Game		If you have a joystick, musical (MIDI) keyboard, or other gaming device, this is where you plug it in.
 Phone or Modem		The phone or modem jack is where you plug your computer into a phone line.
 Network or Ethernet	< • • • >	You can connect your computer to a network by plugging in an Ethernet cable in this port.
 SCSI		An SCSI port is one of the fastest ways to connect a hard drive, CD-ROM drive, or other device to a computer.
Firewire		A FireWire (IEEE 1394 or i.LINK) port lets you connect such devices as hard disks and digital camcorders to a computer. A FireWire port can transfer information at a speed up to 400 Mbps (Megabytes per Second).

Quick Reference

Ports on the Back of a Computer Include:

- Keyboard and Mouse
- Serial or COM
- Parallel or Printer
- USB
- Video or monitor
- Line in, line out, microphone
- Joystick or game
- Phone or modem
- Ethernet or network
- SCSI
- Firewire

Lesson 1-6: System Bus and Expansion Cards

Figure 1-8

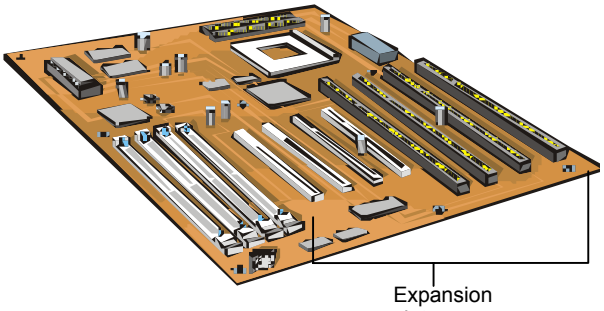
Expansion cards plug directly into a computer's motherboard.

Figure 1-9

Most computers have around six expansion slots.

Highway

- The **number of lanes** determines how many cars can use the highway at once
- The **speed limit** determines how fast cars can **drive** on the highway



System Bus

- The **bus width** determines how much **information** can flow along the bus at a time
- The **bus speed** determines how fast information can travel

You're furious! You just bought an expensive digital camcorder only to find out that it can't connect to your computer because your computer apparently doesn't have a Firewire port. Don't worry—you can easily add a Firewire port to the computer by buying an *expansion card*.

Expansion cards plug directly into the motherboard.

Expansion cards allow you to add more gizmos and capabilities to a computer. You can also use expansion cards to replace a component of a computer that breaks, like a modem. Expansion cards plug into expansion slots on a computer's motherboard.

A computer talks to its expansion cards—and everything else on the motherboard—through its *bus*. A computer's bus is an electronic pathway that carries information between devices in a computer. Two factors determine how information flows through the bus: the *bus width* and the *bus speed*.

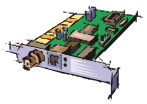
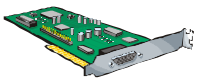
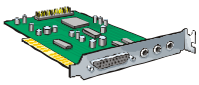
- **Bus Width**
  The bus width determines how many "lanes" there are on a computer's electronic highway. Actually, the bus width isn't measured in lanes, but in *bits*. The wider the bus, the more information can travel across it at the same time.
- **Bus Speed**
  The bus speed determines how fast information can travel through the bus. The higher the bus speed, the faster information can travel through it. Bus speed is measured in MHz.

As if this weren't confusing enough there are several bus types out there. They include:

- **ISA**
  The *Industry Standard Architecture (ISA)* is the original, slowest, and oldest type of bus. The ISA bus has a width of 16 bits and a speed of 8 MHz. The ISA bus is going the way of dinosaurs and is no longer found on new computers.
- **PCI**
  The *Peripheral Component Interconnect (PCI)* bus is the main bus found in newer computers. The PCI bus can have a width of 32 or 64 bits. The PCI bus supports *Plug and Play*, which lets you add new devices to a computer without a complicated installation process.
- **AGP**
  An *Accelerated Graphics Port (AGP)* is a blazingly fast bus that is currently only used for video cards. The AGP port has a width of 64 bits and supports Plug and Play.

So what kind of expansion cards are out there? Here are some of the more common expansion cards that you may come across…

Table 1-6: Common Types of Expansion Cards

Expansion Card	Description
 Modem	A modem allows computers to exchange information through ordinary telephone lines. Almost all computers already come with built-in modems, so you would probably only want to add a modem expansion card if the original modem in a computer breaks.
 Network	A network interface card (NIC) is an expansion card that connects a computer to other computers on a network.
 Video or Graphics	A video card or adapter is what generates the images and text displayed on a monitor. Computers come with a built-in video card, but some people like to upgrade their original video card with faster, more powerful video cards.
 Sound	A sound card lets a computer play and record sounds, just like a home stereo system.
 Additional Port(s)	You can use expansion cards to add additional ports to a computer, such as the newer Firewire or USB 2 ports.

Quick Reference

- An **expansion card** plugs into a computer's motherboard to give it additional capabilities.
- A computer communicates with its expansion cards and devices through the system bus.
- How much information flows through the system bus depends on the bus width and bus speed.

There are several bus types:

1. ISA

2. PCI

3. AGP

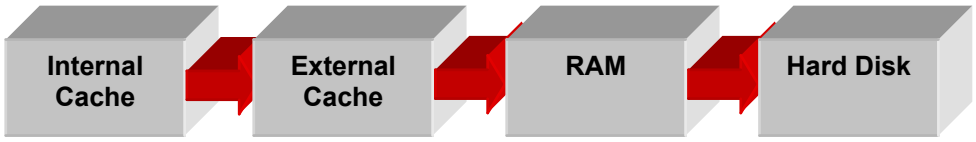
Lesson 1-7: Memory Cache

Figure 1-10

An illustration of how a computer searches for information in a memory cache.

Figure 1-11

An illustration of how a police officer looks for a gun in a "weapons cache."



1. The computer looks for data in the internal cache first. This is the fastest way the computer can get information.

2. When the computer does not find what it's looking for in the internal cache, it next looks in the external cache.

3. If the computer can't find what it needs in the internal or external cache, it looks in the slower main memory (RAM).

4. If the computer *still* can't find what it needs, it looks at the slow as molasses hard disk cache.

Figure 1-10

1. Hopefully the officer has his revolver in his hand, ready for action.

2. If the officer can't find his revolver in his hand, he next reaches down to his holster for the gun.

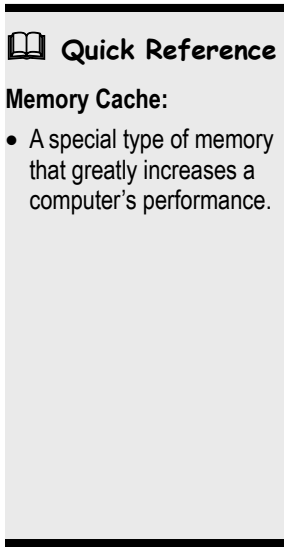
3. If the officer can't find his revolver in its holster, he next runs back to see if he left it in the squad car.

4. If the officer *still* can't find his revolver, his last stop is a gun store.

Figure 1-11

A *memory cache* increases a computer's performance by storing the most recently used data. There are two types of cache:

- **Internal Cache** (*also called primary or L1 cache*)
  When the computer needs data it first looks in the internal cache. The internal cache is inside the CPU and is the fastest possible way for the computer to get information. The internal cache can normally only contain a very small amount of information.
- **External Cache** (*also called secondary or L2 cache*)
  If the computer doesn't find the data in the internal cache, it then looks in the external cache. The external cache is slower than the internal cache, but much faster than the normal RAM memory. The external cache normally holds much more information than the internal cache, but still not as much as the main memory (RAM).


Quick Reference
Memory Cache:
• A special type of memory that greatly increases a computer's performance.

Lesson 1-8: Computer Performance

Figure 1-12

There are lots of factors that determine a computer's speed. Most of them are listed in Table 1-7: *Factors that Affect Computer Performance*.

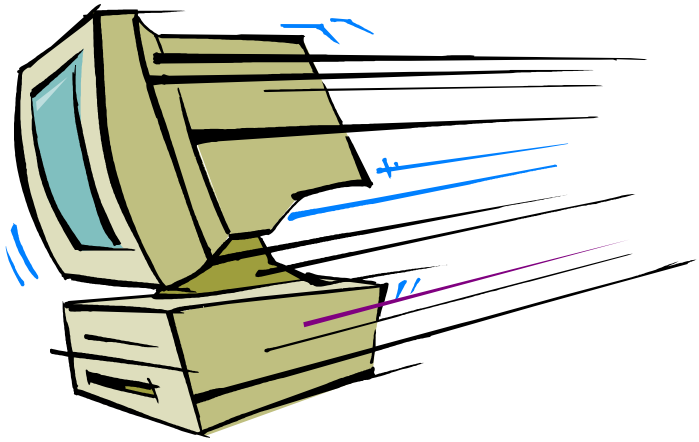
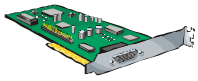


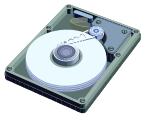
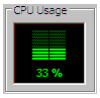
Figure 1-12

Wondering why your neighbor's computer is so much faster than your computer? There are a number of reasons why a computer may run faster or slower. You learn about each of them by reading Table 1-7: *Factors that Affect Computer Performance*.

A much simpler reason that your neighbor's computer is faster than your computer is probably because it's newer.

Table 1-7: Factors that Affect Computer Performance

Factor	*Description*
 CPU Speed	Arguably the single most important factor that determines a computer's performance is the speed of its CPU. The speed of the CPU is measured in megahertz (MHz) and gigahertz (GHz). The faster the CPU, the faster the computer. The first PC in 1981 ran at 4.77 MHz, while today's computers can run at speeds exceeding 3,000 MHz, or 3 GHz.
 Amount of RAM	The amount of RAM, or memory, is another very important factor in a computer's performance. Generally, the more RAM a computer has the better its performance. However, you usually won't see much of an improvement after 1 GB of RAM.
 Type of Video Card	Video cards have their own processor and memory, just like the computer does. The faster the processor and the more memory a video card has, the faster it can draw images on the monitor. Video card performance is especially important if you're interested in playing newer, 3D computer games.

Factor	*Description*
 **Hard Drive Speed**	A hard drive's average access time is how fast it can find information. Average access time is measured in milliseconds (ms), or 1/1000 of a second. The lower the access speed, the faster the hard drive. Most newer computers have an average access time of 8 to 15 ms. Another factor that determines hard drive performance is how fast it spins, in revolutions per minute (rpms). Faster IDE hard drives may have speeds as fast as 7,200 rpm, while high-end SCSI hard drives have speeds of 15,000 rpm.
 **Free Hard Disk Space**	Not only do you need a fast hard drive, you have to make sure that is has plenty of free storage space. Microsoft Windows uses this hard disk space to create a cache on the hard drive where it stores temporary information.
 **Hard Disk Fragmentation**	Normally a computer stores a file in the same location on a hard drive. Over time, a hard drive can become *fragmented*, and instead of storing a file in the same location it begins storing parts of it all over. When the computer needs to read a fragmented file, it must read several different parts of the hard drive instead of just one. Defragmenting a hard drive puts the fragmented files back together in one place. You should defragment your computer's hard drive about once a month.
 **Multitasking Considerations**	Microsoft Windows can *multitask*, or run more than one program or task at a time—probably no different than your job. And, just like your job, the more programs or tasks you throw at Windows, the longer it takes to complete each one, and hence a drop in computer performance.

Quick Reference

Computer Performance is Determined By:

- CPU speed
- Amount of memory or RAM
- The type and speed of the video card
- A hard disk's speed, free space, and fragmentation
- How many programs are running, or multitasking, at the same time

Lesson 1-9: Buying a Desktop Computer

Figure 1-13

What should you look for when you're buying a new computer? That depends on what you want it to do. Table 1-8: *Desktop Computer Buyer's Guide* lists some of the more important factors and features to be aware of when buying a new computer. Just make sure the information listed isn't too out of date!

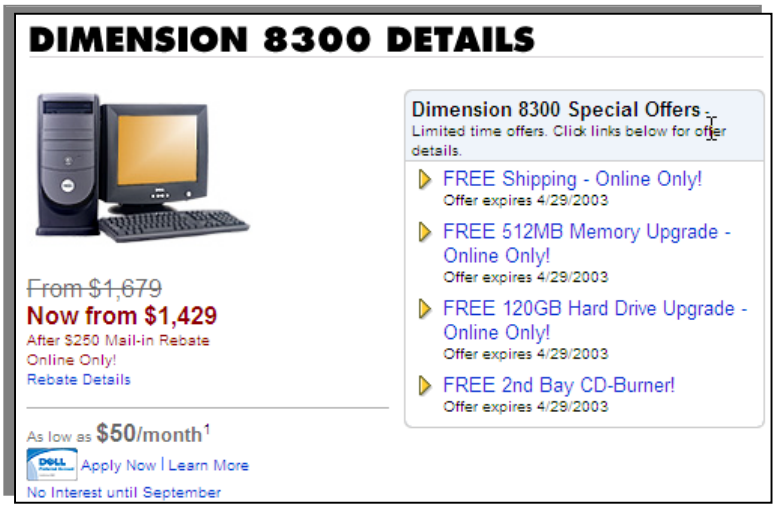


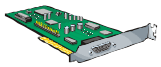
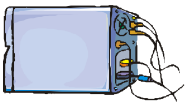
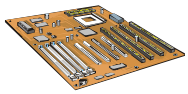
Figure 1-13

Nothing's worse than going to the computer store and listening to a know-it-all salesperson tell you to buy the most expensive computer in the store because the Radon graphics accelerator with 128 megabytes of RAM is something he thinks you're definitely going to need.

Instead of listening to a nerdy computer salesperson, who may be on commission or a sales quota, call one of your computer-geek friends or relatives, tell them how you're going to use your computer, and ask what they would recommend. If a computer-geek friend isn't readily available, Table 1-8: *Desktop Computer Buyer's Guide* will give you a good idea of what you should look for when you buy a new computer. Just remember that computer technology changes about as quickly as the latest fashions (every six months), so this information will probably be out of date shortly after you read it.

Table 1-8: Desktop Computer Buyer's Guide

Factor	*Budget*	*Middle of the Road*	*High End, Gaming*
 **CPU**	Duron or Celeron at 2GHz	Pentium 4 at 2GHz, Athlon at 1.7 GHz	Pentium 4 at 3GHz, Athlon at 2.1GHz
 **RAM**	256MB	512MB	1GB
 **Monitor**	15-inch or 17-inch CRT	17-inch CRT or 15-inch flat panel/LCD	19-inch CRT or 17-inch flat panel/LCD

Factor	*Budget*	*Middle of the Road*	*High End, Gaming*
 **Video Memory**	32MB	64MB to 128MB	128MB or more
 **Hard Drive**	40GB to 60GB	80GB	120GB or more
 **CD or DVD Drive**	CD-ROM Drive	CD-RW Drive	DVD+-R/RW & CD-R/RW Drive
 **Ports**	USB 1.0	USB 2.0	USB 2.0, Firewire
 **Included Devices**		Ethernet, 56K modem	Ethernet, 56K modem

* This information was updated May 2003.

Lesson 1-10: Buying a Notebook Computer

Figure 1-14

What should you look for when you're buying a new computer? That depends on what you want it to do. Table 1-9: *Notebook Buyer's Guide* lists some of the more important factors and features to be aware of when buying a new computer. Just make sure the information listed isn't too out of date!

Figure 1-14

Deciding on which notebook to buy is even more confusing than buying a desktop computer. That's because there is much more variance in features and prices between various notebooks. Notebook computers can't be upgraded as easily as desktop computers, so your decision is pretty much final.

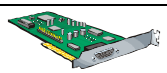
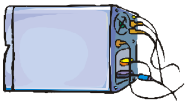
Table 1-9: *Notebook Buyer's Guide* will give you a good idea of what you should look for when you buy a new notebook computer. Just remember that notebook technology changes incredibly fast, so don't use Table 1-9: *Notebook Buyer's Guide* after December 2003.

Some other important factors to consider when buying a notebook include:

- **Size**
  Generally speaking, while convenient and cool looking, smaller notebooks aren't as powerful or fast as larger notebook computers. If you travel frequently and need to lug your notebook around with you, you might want to consider a smaller notebook. If your notebook doesn't move around much you're probably better off with a larger notebook.
- **Battery Life**
  A notebook's battery life can range any where from 2 to 7 hours. Some notebooks can even accept a second battery for extra long life. Battery life probably isn't much of an issue if you only use your notebook when it's plugged into the wall.
- **Warrantee**
  Notebook computers are notorious for breaking down. What's worse, they're not very easy to open and they have their own unique notebook parts, so they're much harder and more expensive to repair than their desktop counterparts. Most of us hate the old three-year extended warrantee sales pitch, but if you're buying a notebook computer the cost of the extra warranty is probably worth it.

- **Included Devices and Features**
  Notebook computers usually have several devices and gizmos built-in—often more than a desktop computer! A modem and Ethernet port are usually a standard part of most notebooks today. Some notebooks also have memory card readers (especially useful if you have a digital camera or PDA), Firewire ports, and even wireless networking, known as *WiFi*. If you're comparing various notebook models, make sure that you know what devices are or aren't included.

Table 1-9: Notebook Buyer's Guide

Factor	*Budget*	*Middle of the Road*	*High End*
 **CPU**	Duron, Celeron, Pentium 3 , or Athlon at 700MHz or better	Duron, Celeron, Pentium 3 or 4, or Athlon at 1GHz or better	Pentium 4 at 2GHz or better
 **RAM**	256MB	256MB	512MB
 **Video Memory**	16MB	32MB to 64MB	32MB to 64MB
 **Hard Drive**	20GB	30GB	60GB
 **CD or DVD Drive**	CD-ROM Drive	CD-RW Drive	DVD & CD-R/RW Drive
 **Ports**	USB 1.0	USB 2.0	USB 2.0, Firewire
 **Included Devices**	56K modem	Ethernet, possibly WiFi (wireless networking) 56K modem	Ethernet, WiFi (wireless networking), 56K modem, Bluetooth (a next-generation wireless port)

* This information was updated May 2003.

Lesson 1-11: Upgrading a Computer

Figure 1-15

Computer upgrades can get expensive! There's a fine line between when it's more cost effective to upgrade an older computer, or to simply buy a new computer altogether.

Figure 1-16

Most computer upgrades require that you, or better yet someone who actually knows about computers, opens up the computer case.

Figure 1-15

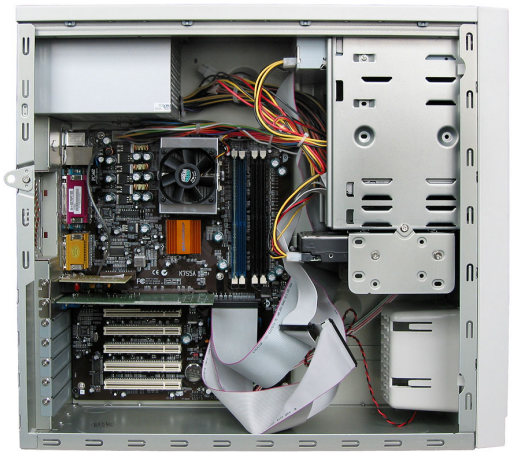


Figure 1-16

When you *upgrade* a computer, you usually replace older components with newer components to improve the computer's performance. You can also upgrade a computer by adding additional components, such as more memory or a second hard drive. Upgrading a computer to improve its performance is often cheaper than buying a new computer. For most upgrades you will need someone with a lot of computer experience to do the upgrade for you.

It's often difficult to determine which is better—upgrading an old computer or simply buying a new computer. If you're an average computer user, plan on buying a new computer every four or five years (sorry—someone has to break this news to you). By then, the cost of a new computer will be less expensive than any effective upgrades you do.

So what can you do to upgrade a computer? The following table lists some of the more common upgrades.

Table 1-10: Typical Things to Upgrade on a Computer

Upgrade	*Description*
 Memory (RAM)	Increasing the amount of memory in a computer is probably the most effective and inexpensive upgrades you can make. More memory can significantly increase the performance of your computer. 512MB to 1GB of memory is all you should ever need—for the next year or so anyway.
 Hard Disk	The hard drives in newer computers have become so huge that you may never need to buy another one. If you do somehow run out of room on your hard drive, you can buy a second one, since most computer can handle two internal hard drives.
 CPU and Motherboard	It's often better to buy a whole new computer than to upgrade the CPU and motherboard. That way you get *all* new components all once—which is a lot cheaper than buying them all individually.
 Add Devices and Peripherals	There are an endless variety of devices that you can add to a computer. You can add CD-ROM, DVD, and Zip drives, graphics cards, tape backups, and more.

Quick Reference

Make sure any upgrades you make to a computer are worth the cost—sometimes it's simply better to buy a new computer.

Upgrades to Improve Performance Include:

- Adding more memory or RAM
- Adding a bigger hard drive
- Adding a new CPU and motherboard (usually not recommended)
- Adding new devices, such as a DVD drive

Chapter One Review

Lesson Summary

Hardware, Software, and Information Technology (IT)

- A typical computer includes the system unit, monitor, keyboard, mouse, speakers, and printer.
- **Hardware:** A computer item you can physically see or touch.
- **Software:** A computer program that tells computer hardware how to operate.
- **Information Technology (IT):** The broad subject related to computers and managing and processing information.

Computer Overview

- The basic computer processes are input, processing, and output.
- Different types of computers include mainframes, PCs, Macs, servers, laptops, and PDAs.

The Front of a Computer and Peripheral Devices

- Components visible from the outside of the system unit may include the floppy drive, CD-ROM or DVD drive, Zip drive or tape backup, keyboard, mouse, scanner, monitor, speakers, and printer.

The Inside of a Computer

- Components inside the system unit may include the motherboard, CPU (Central Processing Unit), RAM (Random Access Memory), ROM-BIOS, expansion slots and cards, and PCMCIA cards in laptops.

The Back of a Computer (Ports)

- Ports on the back of a computer include: keyboard, mouse, serial or COM, printer or parallel, USB, video or monitor, line in, line out, microphone, joystick or game, phone or modem, Ethernet or network, SCSI, and/or Firewire.

System Bus and Expansion Cards

- An **expansion card** plugs into a computer's motherboard to give it additional capabilities.
- A computer communicates with its expansion cards and devices through the system bus.
- How much information flows through the system bus depends on the bus width and bus speed.
- There are several bus types, including ISA, PCI, and AGP.

Memory Cache

- **Memory Cache:** A special type of memory that greatly increases a computer's performance.

Computer Performance

- Computer performance is determined by CPU speed, amount of memory or RAM, the type and speed of the video card, the hard disk speed, free space, and fragmentation, and the number of programs running at the same time.

Upgrading a Computer

- Make sure any upgrades you make to a computer are worth the cost—sometimes it's simply better to buy a new computer.
- Upgrades to improve performance include adding more memory or RAM, adding a bigger hard drive, adding a new CPU and motherboard (usually not recommended), and adding new devices, such as a DVD drive.

Quiz

1. Hardware is any software that is installed on a computer's hard disk. (True or False?)

2. Laptops are faster than desktop PCs, generally speaking. (True or False?)

3. Which of the following moves the pointer to another location on-screen?

A. Pressing the arrow keys on the keyboard.
B. Moving the mouse until the pointer points to that spot.
C. Moving the mouse until the pointer points to that spot and clicking the left mouse button.
D. Moving the mouse until the pointer points to that spot and clicking the right mouse button.

4. Which of the following is NOT a type of computer port?

A. USB
B. Parallel or printer
C. Backup
D. Network or Ethernet

5. When you type a document on a computer, every letter you type is saved to the computer's _____ or temporary storage area.

A. Hard drive
B. RAM
C. ROM
D. CPU

6. What is the 'brain' or main chip of a computer called?

A. The RAM
B. The ROM-BIOS
C. The motherboard
D. The CPU

7. ROM stands for 'Read-Only Memory' (True or False?)

8. Which of the following does NOT affect a computer' s performance?

A. The amount of memory or RAM.
B. The speed of the CPU.
C. The type and speed of the video or graphics card.
D. The number of keys on the keyboard.

Quiz Answers

1. False. Hardware is any physical part of the computer you can see and touch.
2. False. Laptops are generally slower than desktop PCs.
3. B. Move the pointer by moving the mouse until the pointer points to that spot.
4. C. There isn't such as thing as a backup port.
5. B. RAM or Random Access Memory.
6. D. The CPU, or Central Processing Unit, is the main chip in a computer.
7. True. ROM stands for Read-Only Memory.
8. D. The number of keys on the keyboard does not affect a computer's performance.

Chapter Two: Understanding Hardware

Chapter Objectives:

- **Understand what a CPU does**
- **Learn how memory is measured**
- **Learn about input devices: mouse, keyboard, and digital cameras**
- **Learn about output devices: monitor, graphics, and printers**
- **Learn about storage devices: hard drives, CD-ROMs, and DVDs**

☑ Prerequisites

- A desire to learn about computers.

Hardware is any physical part of a computer that you can see or touch. A computer's monitor, CD-ROM or DVD drive, mouse, keyboard, and printer are all different types of hardware. This chapter takes a closer look at the physical parts that constitute a computer.

This chapter is broken up into several sections, since there are several different categories of hardware devices. First we'll examine *processing devices*, such as computer's CPU and memory. You'll finally understand what those technical sounding words megahertz and gigabyte mean. From there we'll move on to *input devices*, such as the keyboard and mouse and *output devices*, such as the monitor and printer. The last part of this chapter discusses *storage devices*, such as hard drives and CD-ROM drives.

That's a lot of material to cover, so let's get started!

Lesson 2-1: Central Processing Unit (CPU)

Figure 2-1

The Intel Pentium 4 is the fastest and most recent CPU available.

Figure 2-2

The CPU can get hot! Most CPUs have a built-in fan to keep them from burning out.

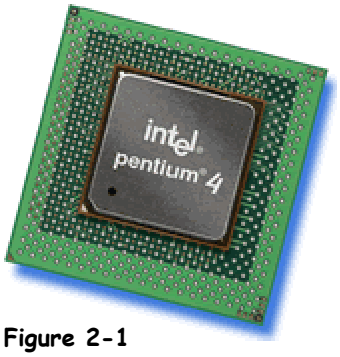


Figure 2-1

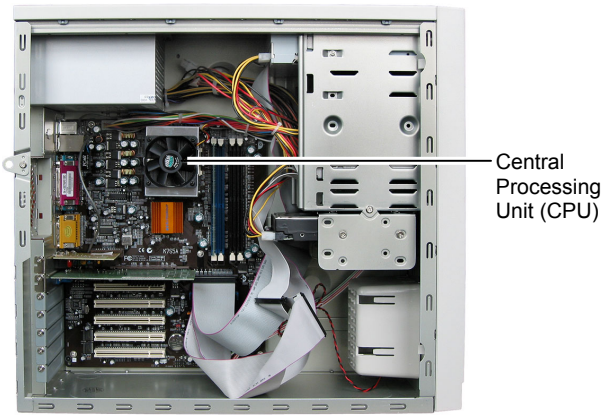
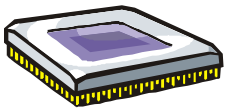


Figure 2-2

Inside the computer case, hidden amongst all the wiring and gizmos, is a particularly important part of the computer known as the *central processing unit* (or *CPU*, for short). The CPU is also known as the *computer chip* (because that's what it is) or the *microprocessor* (or *processor*, for short).



A CPU's speed is measured in megahertz (MHz) or gigahertz (GHz).

Some say the CPU is the brain of the computer while others describe it as the heart. In any case, it's the thing that makes your computer a computer. The CPU does all the work: It calculates, it processes, it keeps things running smoothly. You might think of it as a talented stage manager. When it does its behind-the-scenes job well, you don't notice it; you simply enjoy the performance.

Originally, CPUs were given wildly inventive names like *Chip*. Okay, maybe not. The names were actually based on numbers like *8088*. The next few names in the series—the *286*, the *386*, and the *486*—were actually just shortened names for 80286, 80386, and 80486. Then, what would have been the 586 was dubbed the *Pentium*. After that, the names became rather mysterious: Pentium Pro and Pentium MMX. Finally, the names returned to a semi-ordered numbering system (albeit a mix of Roman and Arabic numerals): Pentium 2, Pentium 3, and Pentium 4. And that's where we are at the moment. Both the Pentium 3 and the Pentium 4 are still quite common.

Intel makes most CPUs. In fact, Intel is the company that came up with the name *Pentium*. However, AMD and VIA Technologies are two other well-known CPU manufacturers. Their CPUs are less expensive and use a different naming system (such as the AMD Athlon and the AMD Duron). Intel actually makes a less expensive version of the Pentium as well, which it calls the *Celeron*. The Celeron does what the Pentium does, but not as quickly.

Speaking of which, speed is what the CPU is all about, and each successive version of the CPU gets progressively faster. A CPU's speed is measured in megahertz (MHz) or, for newer models, in gigahertz (GHz). A megahertz equals millions of cycles per second; a gigahertz equals billions of cycles per second. Higher numbers equate to higher speeds. You might see an Intel Pentium 4 at 3.06 GHz, a Pentium III at 1.40 GHz, and a Celeron at 2.20 GHz.

Another common measure of a CPU is how many bits it can handle at a time. A bit is the tiniest piece of information processed by a computer. Eight bits make up one byte, and one byte equals one character. Computers used to handle 8 or 16 bits; now they're up to 32 and 64 at a time. Don't worry if all of this seems a bit confusing—we'll cover bits and bytes in greater detail in a later lesson.

Table 2-1: Types of CPUs

CPU	Speed	Description
	1 GHz to 3 GHz	**Intel Pentium 4 Processor** The Pentium 4 is Intel's more recent and fastest generation of CPUs, with processing speeds over 3 GHz.
	450 MHz to 1 GHz	**Intel Pentium III Processor** Launched in 1999, Pentium 3 CPUs are still found in some new computers.
	1.06 to 2 GHz	**Intel Celeron Processor** Intel's Celeron CPU is an inexpensive processor designed for people on budget. Celeron processors are very similar to Pentium processors, but they have less built-in memory.
	500 MHz to 3 GHz	**Intel Xeon Processor** Don't expect to see any Xeon-based computers at your local computer store—it's designed for high-end servers.
	850 MHz to 1.67 GHz	**AMD Athon Processor** The Athlon processor is equivalent to Pentium processors—only it's less expensive.
	700 MHz to 800 MHz	**AMD Duron Processor** The Duron CPU is AMD's is similar to Intel's Celeron processor. It has less built-in memory and is designed for people on a budget.
Older Processors		Here's a summary of the other most common—and obsolete—processors out there:

Processor	Release Date	Average Speed
Pentium II	1997	266 MHz
Pentium	1993	133 MHz
486	1989	66 MHz
386	1985	25 MHz
286	1982	12.5 MHz
8088	1979	8 MHz

Quick Reference

- The CPU, or Central Processing Unit, is the computer's main chip. It calculates and processes information.

CPU Speed is Measured In:

- Megahertz (MHz).
- Gigahertz (GHz).

Common CPUs Include:

- Intel Pentium III
- Intel Pentium 4
- Intel Celeron
- AMD Athlon
- AMD Duron

Lesson 2-2: Memory

Figure 2-3

A hard drive might have 60GB of memory.

Figure 2-4

A recordable CD (CD-R) can have up to 700MB of memory.

Figure 2-5

A memory chip might have 512MB of memory.

Figure 2-6

A zip disk can have between 100MB and 250MB of memory.

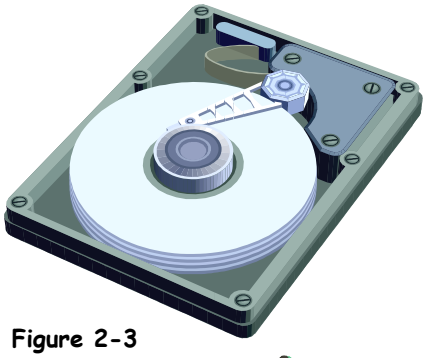


Figure 2-3

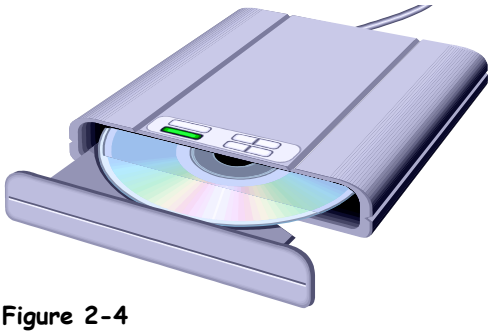


Figure 2-4

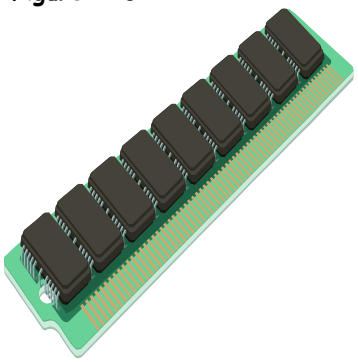


Figure 2-5

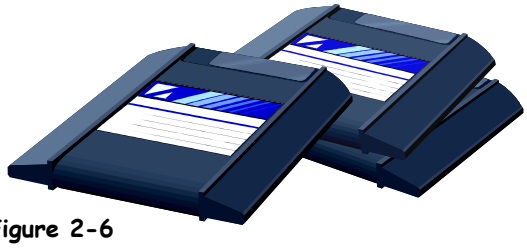


Figure 2-6

Everything that a computer does is based on a combination of ones and zeros, which is known as the *binary system*.

Most people know that a computer has memory. But what does that really mean? You often hear techies toss around numbers like "60GB hard drive." Okay, that sounds impressive, but what does it tell you? This lesson breaks memory into measurable units.

The first thing you need to know is that, at its most basic level, a computer only understands the concept of "on and off." *On* is represented by the number one (1); *off* is represented by the number zero (0). Everything that a computer does is based on this combination of ones and zeros, which is known as the *binary system*. These ones and zeros are digits, known as *bits*, which are the smallest memory unit. The term *bit* is short for *binary digit*.

The second thing you need to know is that a computer saves information in *bytes*, not bits. So what is a byte? The term *byte* is short for *binary digits eight*. So one byte is made up of eight bits. And a byte is the equivalent of a character, which can be a letter, a number, or a symbol. So let's say that you're a self-involved poet whose latest creation is simply titled "I." That one-word title would equal one byte.

Of course, it would be fairly tedious if a computer stored everything in single bytes. The next largest unit is the *kilobyte*. A kilobyte (abbreviated *K* or *KB*) equals 1,024 bytes or characters. Now let's say you're a short-story writer. The one-page, double-spaced masterpiece you submit to your editor would be the equivalent of a kilobyte.

After the kilobyte, the next largest unit is the megabyte. A megabyte (abbreviated *M* or *MB*) equals 1,048,576 bytes or characters. If you were a novelist, your latest bestseller would equal a megabyte.

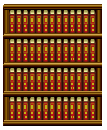
The next unit after the megabyte is the gigabyte. A gigabyte (abbreviated *G* or *GB*) equals 1,073,741,824 bytes or characters. Let's pretend you are a researcher. A whole shelf of books devoted to your favorite subject would be the equivalent of a gigabyte.

Finally, after the gigabyte comes the terabyte. A terabyte (abbreviated *T* or *TB*) equals 1,099,511,627,776 bytes or characters. Let's imagine that you're an egomaniac who owns an entire bookstore filled only with books by authors you like. Such a single-minded store would be the equivalent of a terabyte.

Okay, let's review. The following table summarizes all the units of memory.

MB is an abbreviation for *megabyte*. *GB* is an abbreviation for *gigabyte*.

Table 2-2: Bits and Bytes

Unit	*Abbreviation*	*Size*	*Symbol*	*Equivalent*
Bit	—	—	—	An atom or speck, the smallest unit of memory.
Byte	—	8 bits		A single letter, a number, or a symbol.
Kilobyte	**K or KB**	1,024 bytes		A one-page, double-spaced letter.
Megabyte	**M or MB**	1,048,576 bytes		A best-selling novel.
Gigabyte	**G or GB**	1,073,741,824 bytes		An encyclopedia set.
Terabyte	**T or TB**	1,099, 511,627,776 bytes		A bookstore.

Quick Reference

Computers function based on the binary system:

- *On* is represented by a one (1).
- *Off* is represented by a zero (0).
- Ones and zeros are digits, known as *bits*.

Bit:

- Short for *binary digit*
- Smallest memory unit
- Eight bits equal one byte

Byte:

- Short for *binary digits eight*.
- One byte equals one character (letter, number, or symbol)

Kilobyte (K or KB):

- 1,024 bytes

Megabyte (M or MB):

- 1,048,576 bytes

Gigabyte (G or GB):

- 1,073,741,824 bytes

Terabyte:

- 1,099, 511,627,776 bytes

Lesson 2-3: RAM and ROM

Figure 2-7

RAM, or Random Access Memory, works like a notepad; you can read from it and write to it.

Figure 2-8

ROM, or Read Only Memory, works like a novel, you can read from it but not write to it.

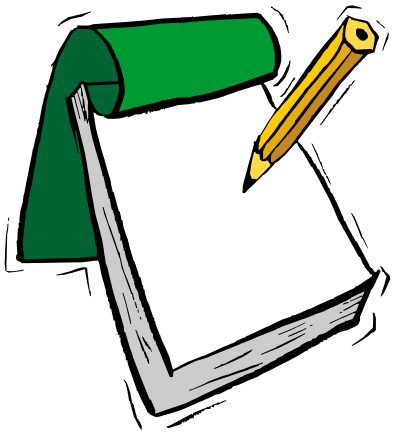


Figure 2-7

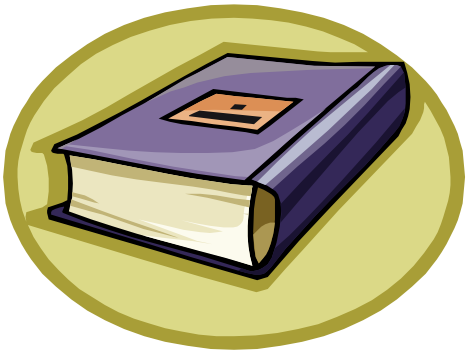


Figure 2-8

So now you know that computer memory is measured in various byte-sized units: kilobytes, megabytes, gigabytes, petrabytes, and philobytes. Okay, those last two were just made up to see if you were paying attention.

Next you need to know that computers have two major types of memory: *random-access memory* (or *RAM*) and *read-only memory* (or *ROM*). Let's discuss these two types of memory in greater detail.

When you work with a file on your computer, you're using RAM.

- **RAM (random-access memory)**
  When someone at a computer superstore tells you how much memory a new computer has, they're really talking about RAM. RAM is the computer's main memory, which it uses to process information. Whenever you work with a file on your computer, you're using RAM. And the data in that file is temporarily stored in RAM. However, RAM is *volatile*, which means that the data is stored only as long as the computer has power. Once you shut off your computer, the data is gone. However, you can and should save your data (read: your file). That's where storage comes in, but more on that later. For now, think of RAM like a notebook: You can read from it and write to it. Technically, it could be called "read and write memory." And, as with a notebook, you can overwrite it many, many times—provided you have an eraser!
- **ROM (read-only memory)**
  ROM is the computer's low-level memory, which it uses to perform its most basic functions. This memory is permanent; the data remains even if you shut off the computer. This only makes sense because ROM is required to restart your computer. You never hear people discuss how much ROM you have because the manufacturer usually installs it, and you never touch it. It does all the behind-the-scenes work and then disappears once you're underway, much like a party planner. You can also think of ROM like a novel: You can read from it, but you can't write to it (and thus, its name).

Table 2-3: Comparing RAM and ROM

RAM	*ROM*
Random-access memory	Read-only memory
Main memory.	Low-level memory.
Necessary to process information (example: work with a file).	Necessary to perform the most basic functions (example: start the computer).
Volatile: If not saved, data disappears when you shut off the computer's power. It's temporary.	Nonvolatile: Data remains even when you shut off the computer's power. It's permanent.
Often discussed when buying a computer.	Seldom mentioned when buying a computer.
You can read from and write to it. Comparable to a notepad.	You can read from it, but you can't write to it. Comparable to a novel.

🕮 Quick Reference

Computers have two types of memory:

- Random-access memory (RAM).
- Read-only memory (ROM).

RAM:

- Computer's main memory, which is used to process information (example: work with a file).
- Volatile: Unless saved, data disappears when you shut off the computer.
- You can read from it and write to it. Comparable to a notebook; you can read and write to it.

ROM:

- Computer's low-level memory, which is used to perform its most basic functions (example: start the computer).
- Nonvolatile: Data remains even when you shut off the computer. It's permanent.
- You can read from it, but you can't write to it. Comparable to a novel; you can only read it.

Lesson 2-4: Mouse

Figure 2-9

Clicking with the mouse.

Figure 2-10

Double-clicking with the mouse.

Figure 2-11

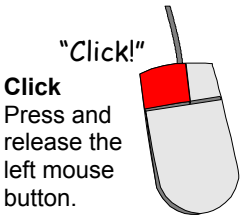
Right-clicking with the mouse.

Figure 2-12

Dragging and dropping with the mouse.

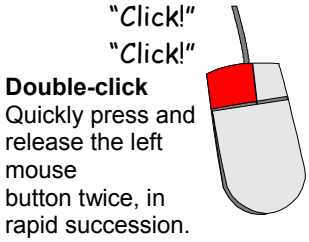
Figure 2-13

Using the scroll wheel.



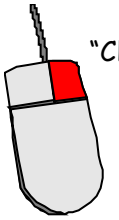
Click
Press and release the left mouse button.

Figure 2-9



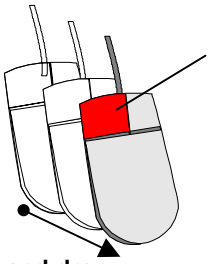
Double-click
Quickly press and release the left mouse button twice, in rapid succession.

Figure 2-10



Right-click
Press and release the right mouse button.

Figure 2-11



Hold down the mouse button while you drag the mouse across your desk.

Drag and drop
Place the pointer over an object and press and hold down the left mouse button. While still holding down the button, move the mouse (and thus the cursor) to where you want to place the object and then release the mouse button.

Figure 2-12

Use the center wheel to scroll through screens of information.

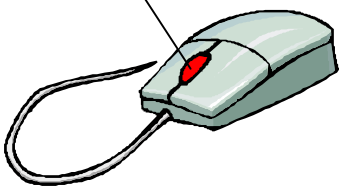
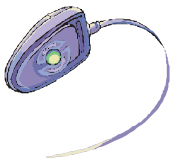


Figure 2-13

A computer would be useless if you had no way to communicate with it. That's why you need an *input device*. Essentially, an input device lets you talk to your computer. Two examples of input devices are the keyboard and the mouse. We'll discuss keyboards later; for now let's concentrate on the mouse.

That funny-looking object that, frankly, looks like a mouse (with its oval body and long tail-like cord connecting it to the computer) *is* the mouse. Originally, computers only came with a keyboard. But in 1968 Doug Engelbart invented the mouse. In 1984, Apple Computers introduced the mouse with its Macintosh computers. Shortly thereafter, the mouse was standard equipment on all computers.



The underside of a roller ball mouse.

The mouse acts as a handheld pointing device that allows you to control the actions of that blinking item on your screen known as a *cursor*. Depending on the software you are using and the task you are doing, the cursor may resemble such symbols as a slanted arrow (↖), an "I" (I), or a vertical line (|). A cursor is essentially a place-marker that appears on your computer screen. You move the mouse to place the cursor over an object on your screen and click the mouse buttons to *select* that object. Once an object has been selected, you can move it or manipulate it. We'll cover mouse buttons in greater detail in a later lesson.

Some mouse pads have a wrist rest to help users keep their hands and wrists in better alignment.

The standard mouse has two buttons and a *rollerball* on the underside, which moves the cursor on the screen when you move the mouse. A rollerball mouse works best when used

on a mouse pad, especially one that has a rough texture on its surface. Some mouse pads now come with a wrist rest to help users keep their hands and wrists in better alignment.

Like other computer components, mice come in several shapes and sizes. Some mice have three (or more) buttons, which are programmable, and some include a trackball on the top (instead of a rollerball on the underside). Most new mice include a center scroll wheel between the two buttons. Not surprisingly, this scroll wheel lets you scroll through screens of information in a fluid motion. Many new mice are also ergonomically designed to fit the user's hand. And some new mice have Forward and Back buttons off to the side of the mouse, which help you navigate the Internet.

One of the latest innovations is the *optical mouse*, which is becoming quite common. An optical mouse operates by using an infrared sensor, which means it uses neither a rollerball nor a mouse pad. You can identify an optical mouse by the telltale red glow emanating from its underside.

One other hot innovation is the *wireless mouse* (and keyboard). A wireless mouse and keyboard run on batteries and communicate with the computer the same way a remote control communicates with a television.

A wireless mouse works just like a remote control.

Quick Reference

Input devices on a standard computer:

- Keyboard.
- Mouse.

What a mouse does:

- It acts as a handheld pointing device and controls the actions of that blinking item on your computer screen known as a *cursor*.

Lesson 2-5: Keyboard

Figure 2-14

The 101-key enhanced keyboard

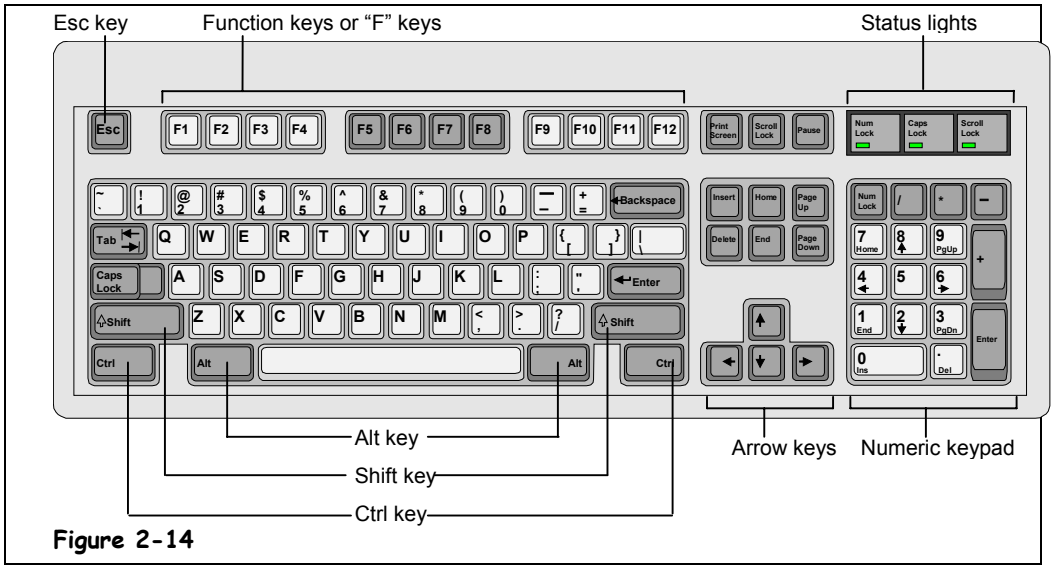


Figure 2-14

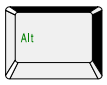
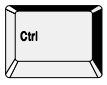
An ergonomic keyboard is designed to relieve the stress of typing for long periods of time.

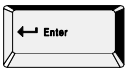
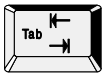
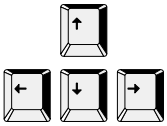
Like the mouse, the keyboard is an input device that allows you to talk to the computer. The keyboard is easily recognizable because it resembles a typewriter keypad. If the typewriter predates you, then look for the component that's covered with buttons that have letters, numbers, and symbols on them.

If you've ever used a typewriter, you probably recognize many of the keys on a keyboard. In any case, the alphanumeric, symbol, and punctuation keys are self-explanatory. And we'll review the rest of the keys that are unique to a (101-key and 104-key) keyboard. However, we will ignore the three keys found above the numeric keypad (<Print Screen/Sys Req>, <Scroll Lock>, and <Pause/Break>) because they are all fairly useless on most computers today.

NOTE: If your keyboard includes multimedia and Internet buttons above the keys, consult the manual that comes with your keyboard to learn their functions.

Table 2-4: Special Keys and Their Functions

Key(s)	*Description*
	The <Alt> key doesn't do anything by itself—it needs another key to make things happen. For example, pressing the <Tab> key while holding down the <Alt> key switches between any programs that are currently running.
	Just like the <Alt> key, the <Ctrl> key doesn't do anything by itself—you need to press another key with it to make things happen. For example, pressing the <X> key while holding down the <Ctrl> key cuts whatever is selected.
	The <F1> key is the help key, and pressing it displays helpful information about what you're doing.

Key(s)	Description
	The <Esc> (Escape) key is the "Wait, I've changed my mind" key and is the same as clicking Cancel in a dialog box. For example, if you click something and an unfamiliar dialog box appears, you can close it by pressing the <Esc> key.
	The <Enter> key is the "Carry out my orders" key and is the same as clicking the OK button in a dialog box. For example, after you've typed the name of a program you want to run in a dialog box, press <Enter> to run the program. The <Enter> key also adds new lines and starts new paragraphs if you're entering text.
	When you're in a dialog box, pressing the <Tab> key moves to the next field. When you're using a word processor, the <Tab> key works just like you'd think it would and jumps to the nearest tab stop whenever you press it.
	The arrow keys move your computer's cursor across the screen.
	Nothing surprising here. The <Delete> key deletes or erases whatever you select—files, text, or graphical objects. If you're working with text, the <Delete> key erases characters to the right of the insertion point.
	Use the <Backspace> key to fix your typing mistakes—it erases characters to the left of the insertion point.
	The <Home> key jumps to the beginning of the current line when you're working with text.
	The <End> key jumps to the end of the current line when you're working with text.
	The <Page Up> key moves up one screen.
	The <Page Down> key moves down one screen.

Quick Reference

- A keyboard lets you enter information and commands into a computer.

Lesson 2-6: Digital Cameras and Web Cams

Figure 2-15

A digital camera.

Figure 2-16

A Web cam usually sits on top of a computer's monitor.

Figure 2-17

Cameras with more megapixels can take sharper and more detailed pictures.

Figure 2-15

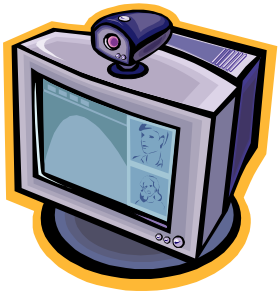


Figure 2-16

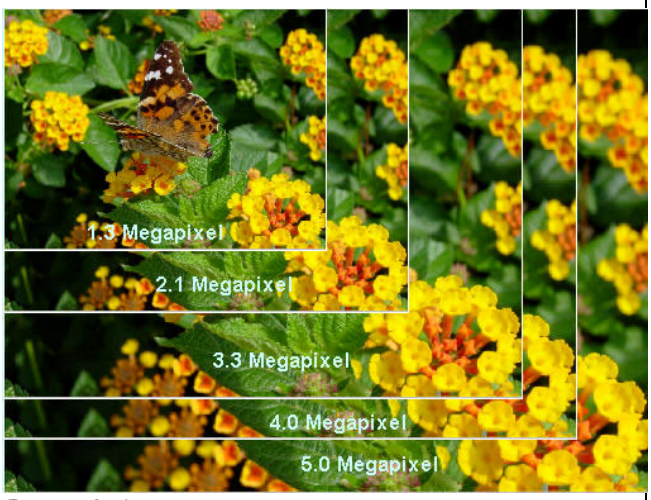


Figure 2-17

A megapixel contains one million pixels.

A digital camera lets you take pictures that you can transfer to a computer. Once you've transferred your pictures you can print them, insert them in word processing document, or send them in an e-mail message. You can also edit digital photos, to remove such undesirable objects as redeye or an ex-boyfriend.

The quality of the pictures a digital camera takes depends on its resolution, which is measured in *megapixels*. One megapixel is equal to one million, or 1000 × 1000 pixels. The higher the number of megapixels, the clearer and more detailed the picture.

Digital cameras don't use film—they store their pictures on a type of removable memory called *flash cards*. Flash cards can store anywhere from a dozen to several hundred pictures, depending on how much memory they have. There are three different types or formats of flash cards out there:

- 

CompactFlash: Definitely the most common type of "digital film" out there, CompactFlash cards can typically store anywhere from 8MB to over 1GB.
- 
SmartMedia: SmartMedia is another a very popular type of memory card because of its small size. SmartMedia cards are also widely used in many PDAs. SmartMedia cards are available in capacities ranging from 2 MB to 128 MB.

-  **Memory Stick:** Sony makes this type of memory card for use in its own products: Sony digital cameras, Sony PDAs, etc. Memory sticks are available in capacities ranging from 4 MB to 128 MB.

Another popular toy you can add to your computer is a *Web cam*. A Web cam is a tiny digital video camera that usually sits on top of a computer's monitor. People use Web cams for videoconferencing and to send live images over the Internet.

Table 2-5: Comparison of Megapixels

Megapixels	*Image Size*	*Description*
Under 1	640×480	Entry level and obsolete digital cameras have a measly resolution of 640x480 pixels. These cameras are fine if you want to e-mail someone a picture or send someone a photo on a computer, but the quality of a printed image is terrible when printed as 4x6in photo.
1	1024×768	Supposedly 1024×768 resolution is this is enough to make sharp 4x6 inch prints. The truth is, at this point it depends more on the quality of the digital camera than the resolution. Many printed photos can still look "digital" or blurry at this resolution.
2	1600×1200	Two-megapixel cameras can take fine 4x6 inch prints and even respectable 8x10s, about what you'd expect from a low-end film camera.
3	2048×1536	Once you reach the three-megapixel bracket the quality of print is normally excellent up to 8x11 prints. If you're looking for a really good digital camera with strong features and good image quality, three megapixels is a good range to search in.
4	2272×1740	Four-megapixel cameras are starting to get into the "enthusiast" territory. They take exceptionally sharp photos and can print even larger prints than 8x11.
5	2560×1920	We're definitely in enthusiast professional territory now. Five-megapixel cameras are even used by professional photographers to take really big prints.

Quick Reference

- A **digital camera** lets you take pictures and transfer them to a computer.
- The quality, or resolution of the pictures a digital camera can take are measured in **megapixels**, or millions of pixels (dots). The more pixels, the better the resolution.

Lesson 2-7: Other Input Devices

Figure 2-18

There's usually not enough room to use a mouse on an airplane or on the beach. It's for this reason that most laptops have built-in touch pads and AccuPoint® Pointing Devices.

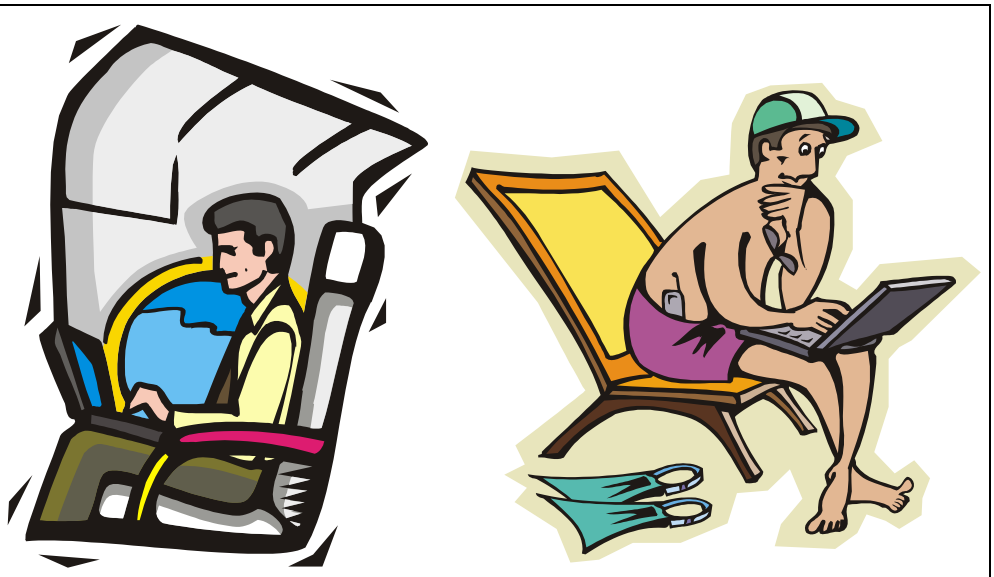
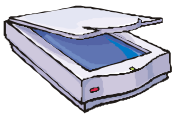


Figure 2-18

The keyboard and mouse are the two most common input devices for a computer, but there are many more. Most respectable laptops have a built-in touch pad or AccuPoint® Pointing Device or pointing stick that works like a mouse. Other mouse alternatives include track balls and light pens.

Other common computer input devices include scanners for copying images to a computer, joysticks for playing games, and microphones for recording sound. You can learn about these input devices by taking a look at the table on the next page.

Table 2-6: Other Input Devices

Input Device	Description
 Touch Pad	A touch pad is a small, touch-sensitive pad used as a pointing device on some portable computers. By moving a finger or other object along the pad, you can move the pointer on the display screen.
 AccuPoint® Pointing Device	An Accupoint® Pointing Device, or pointing stick, is another mouse substitute that is found on many laptop computers. An Accupoint® Pointing Device usually sits in the middle of the keyboard and resembles an eraser at the end of a pencil.
 Track Ball	A track ball is essentially a mouse lying on its back. To move the pointer, you rotate the ball with your thumb, your fingers, or the palm of your hand.
 Light Pen	A light pen is input device that utilizes a light-sensitive detector to select objects on a display screen. A light pen is similar to a mouse, except that with a light pen you can move the pointer and select objects on the display screen by directly pointing to the objects with the pen.
 Scanner	A scanner is a lot like a photocopier. Instead of producing copies, a scanner converts images into digital information and stores it in a computer.
 Joystick	Mostly used for computer games, a joystick is a lever that moves in all directions and usually controls some type of movement on the computer.
 Microphone	If your computer has a sound card (and most computer have one) you can plug in a microphone to digitally record sounds to your computer.

Quick Reference

Other Input Devices Include:

- Touch pads
- AccuPoint® Pointing Devices
- Track balls
- Light pens
- Scanners
- Joysticks
- Microphones

Lesson 2-8: Monitor

Figure 2-19

Similar in appearance to a television screen, a monitor displays images and text on its screen.

Figure 2-20

Flat-panel monitors are more expensive than traditional monitors, but they take up less space and use less electricity.

Figure 2-21

Common controls found on the front of a monitor.

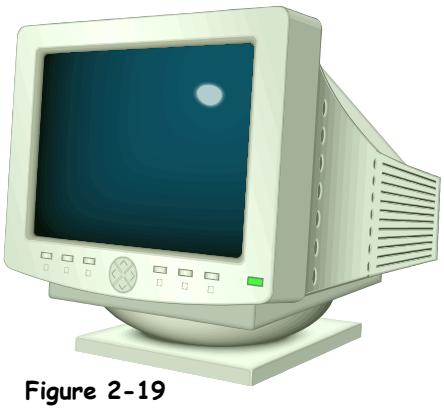


Figure 2-19

Figure 2-20

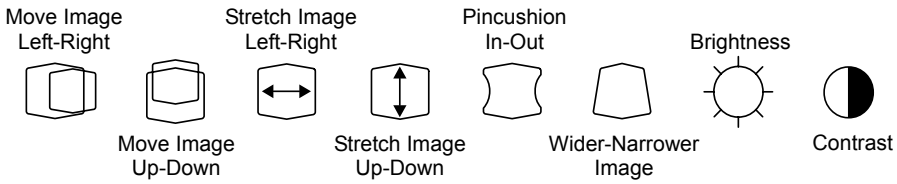
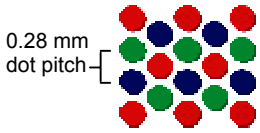


Figure 2-21

A computer's monitor looks and works a lot like a TV screen. The monitor is really only half of what makes text and images appear on the screen. The other half is the graphic card, or video/display adapter. The monitor plugs into the graphics card in the back of the computer.

Flat panel or LCD (Liquid Crystal Display) monitors, like the one in Figure 2-20, will eventually replace older CRT monitors, like the one shown in Figure 2-19. A flat panel monitor is the same type of display that is found in laptop computers. Flat panel monitors are thin, lightweight, and use a lot less electricity than traditional monitors. Flat panel monitors are also considerably more expensive than traditional monitors, although the price is dropping. Flat panel monitors are wider than traditional monitors are; in fact a 15-inch flat panel monitor has almost the same viewing area as a 17-inch traditional monitor!



Dot pitch is the distance between pixels or dots on a screen. Dot pitch is measured in millimeters (mm).

- **Size**
  The size of a monitor is measured diagonally across the screen, just like TVs. Common monitor sizes are 15, 17, 19, and 21 inches. The most popular monitor size is currently 17 inches.
- **Dot Pitch**
  Dot pitch refers to the distance between each pixel, or dot, on the screen, as measured in millimeters (mm). The smaller the dot pitch, the closer the dots, and the sharper the image is. If you're in the market for a monitor try to find one with a 0.28 mm or less.

- **Refresh Rate**
  The refresh rate determines how quickly the monitor redraws, or updates, the image on the screen. Higher refresh rates are better, since they flicker less and are easier on the eyes. The refresh rate is measured in herz (Hz), or the number of times per second the monitor redraws the entire screen. If you're buying a new monitor, make sure to get one with a refresh rate of 72 Hz or better.
- **Screen Savers and Energy Star Compliance**
  A screen saver is a moving picture that appears on your computer screen when you don't use your computer for a while. Screen savers originally prevented phosphor burn, which occurred when a static image became etched onto the screen after a long period of time. Today's monitors aren't susceptible to phosphor burn, but some people still use screen savers for fun.

  Most monitors are *Energy Star compliant*. This means they automatically turn themselves off after a period of time to save electricity. You turn the monitor back only by simply moving the mouse or pressing a key on the keyboard.

The Energy Star Logo

Quick Reference

CRT Monitors:

- Older type of monitor that looks like a television set.

Flat Panel LCD Monitors:

- Newer type of monitor that is thin, lightweight and somewhat more expensive.

Other Things to Know about Monitors:

- The **size** of a monitor is measured diagonally across the screen. Average monitor sizes range from 15-inches to 21-inches.
- The monitor **refresh rate** determines how quickly the monitor redraws, or updates, the image on the screen. Most monitors have a refresh rate of 72MHz or better.
- A **screen saver** is a moving picture that appears on your computer screen when you don't use your computer for a while.

Lesson 2-9: Graphics Card

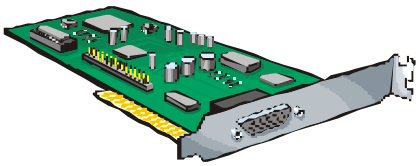


Figure 2-22

Figure 2-23

Figure 2-22

A computer's monitor plugs into the graphic card, an expansion slot that plugs into a computer's motherboard.

Figure 2-23

Newer computer games have fantastic graphics—but you'll need a 3D graphics accelerator card to see them.

The second part of a computer's video system is the graphic card or video adapter. A graphics card is an expansion card that plugs into a computer's motherboard and is responsible for all the text and pretty images that appear on your computer's monitor. Many computers don't have a graphics card at all—all the video capabilities are instead built into the computer's motherboard.

Graphics cards come in many models and prices. More expensive graphics cards are faster and can display more complex, 3D graphics—something especially useful if you're into computer games. Here are the basics about graphic cards:

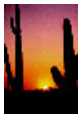
- **Screen Resolution**
  Resolution has to do with how much information can fit on the computer screen. Obviously you can't adjust how large or small your computer's monitor is (without buying a new one that is), but you can make all the images on your screen larger or smaller so you can see more information at once. You can adjust the screen resolution to suit your needs and preferences. For more information about screen resolution see Table 2-7: *Common Screen Resolutions*.
- **Color Depth**
  Color depth is the number of colors that are displayed on the screen at once. So why would you want to change the number of colors displayed on your screen? Perhaps you want to use higher color depth settings to make videos and photographs more realistic. Or some finicky games also require you to use a specific color depth. For more information about color depth see Table 2-8: *Common Color Depths*.
- **Graphics Card Memory**
  Graphics cards have their own memory, or RAM, just like a computer. You'll need more memory to display higher screen resolutions and color depths. Video cards can have anywhere from 1 MB all the way up to 128 MB of memory. If you're buying a new computer, make sure it has at least 64 MB of memory.
- **3D Graphics Accelerator**
  A 3D graphics accelerator card has its own CPU that is used to create 3D graphics. If you're even considering playing games on your computer, you should have a 3D graphics accelerator card, as most newer games require one.

Table 2-7: Common Screen Resolutions

Resolution	Description
 640 by 480	**No longer supported in most computers**, 640 by 480 used to be the lowest resolution setting. Larger and cheaper monitors have made 640 by 480 resolution effectively obsolete.
 800 by 600	This has been the standard resolution setting for most computers, and is the lowest setting on newer monitors. This is a good in-between resolution, allowing you to display quite a bit of information on the screen without having to use a magnifying glass to read it. Use this setting if you have a 15-inch or 17-inch monitor.
 1024 by 768	The new standard, 1024 by 768 puts a lot of information on your screen, but the images can start getting small and difficult to read at this point (unless you have a large monitor). Use this setting if you have a 17-inch or larger monitor or when you want to see a lot of information at the same time, for example if you're working on a large spreadsheet, graphic files, or multiple windows.
 Higher resolutions	Depending on how expensive the graphics card in your computer is, there may be several higher modes of resolution which continue to display more and more information and smaller and smaller images.

Higher Resolutions Require More Speed and Video Memory

Table 2-8: Common Color Depths

Color Depth	Description
 256 Colors	**No longer supported on many computers**, 256 colors was the standard color depth years ago, but most computers and video cards are fast enough to run with more colors without taking a performance hit, making this color depth almost obsolete.
 16-bit	16-bit color displays roughly 65,000 colors at once. This is the point where pictures become photo-realistic. This is a good color depth setting because it can display photo-realistic images without slowing your computer down. You have to really squint to see much difference between 16-bit color and higher levels of color depth.
 24-bit	24-bit color displays 16.7 million of colors at once. Depending on how expensive the graphics card in your computer is there may be several higher modes of color depth, which continue to display more and more colors on the screen.
 32-bit	32-bit color displays 16.7 million of colors at once. 32-bit color is faster and more efficient than 24-bit color.

More Colors Require More Speed and Video Memory

Quick Reference

Screen Resolution:

- Determines how much information can fit on the computer screen at once. Common screen resolutions include 800 by 600 and 1,024 by 768.

Color Depth:

- Color depth is the number of colors that are displayed on the screen at once. Common color depths include 16-bit and 24-bit color.

Video Cards:

- Have their own memory and processor. Generally speaking, the more memory a video card has, the higher the resolution and color depth it can display.

Lesson 2-10: Printer Basics

Figure 2-24

InkJet printers are the most inexpensive and popular type of printer sold today.

Figure 2-25

A printer's resolution determines the quality of the images it can produce.

Figure 2-24

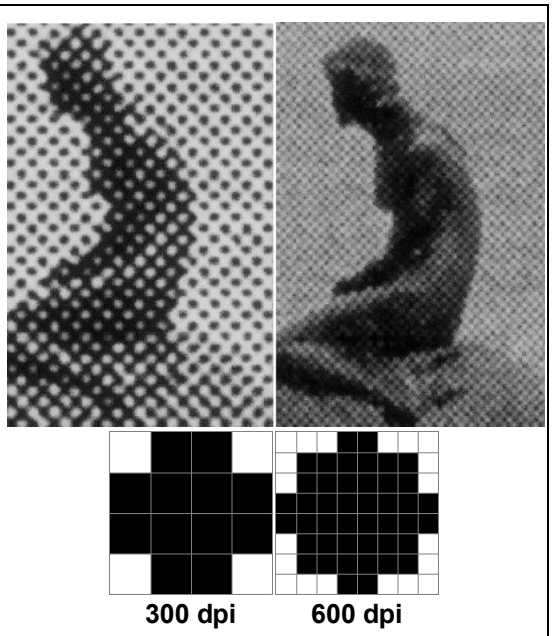


Figure 2-25

A printer is an output device that puts text and graphics on paper. Using the printer is often the last step in creating something on a computer, whether it's a letter, spreadsheet, or digital photograph.

Unfortunately, there's a lot to know about printers—especially if you're buying one. Here are the main printer concepts you should know:

- **Type of Printer**
  There are several different types of printers out there: InkJet and Laser printers are the most common. InkJet printers are the cheapest and most common type of printer and can be found in both homes and businesses. Laser printers are usually faster than InkJet printers, but they normally can only print in black and white. Laser printers are used mainly by businesses.
- **Color vs. Black and White**
  Color used to be an expensive option for printers, but not any more. Most InkJet printers can print in color and so can an increasing number of laser printers. Most laser printers still print in black in white—great for text but not for images and graphics.
- **Resolution**
  A printer's resolution helps determine the quality of the images it can produce. Higher resolution means higher quality images. Printer resolution is measured in dots per inch (dpi). Generally, 600-dpi resolution works great for text documents, while you will probably want 1200 dpi or better resolution for printing images. See Figure 2-25 for a good illustration of varying resolutions.

- **Speed**
  A printer's speed determines how quickly it can print pages. Speed is measured two ways: in characters per second (cps) or in pages per minute (ppm). Either way you want a higher number if you want to have a faster printer. Printers usually slow down quite a bit when printing pages with a lot of complicated graphics, or color images.
- **Ink Cartridges and Toner**
  Today many InkJet printers are cheap—about as much as dinner for two at a very fancy restaurant. Sound too good to be true? Here's the catch: the ink for most printers costs a *lot* of money. InkJet printers use ink cartridges that seem to run dry at an alarming speed. Laser printers user toner cartridges filled with the same messy black powder that is found in copy machines. Laser toner cartridges last a lot longer than InkJet cartridges, but they also cost significantly more.
- **Memory**
  Laser printers have their own memory, or RAM, just like a computer. This memory is used to store pages before they are printed. Memory is important for printing complex or high-resolution images. Most laser printers have anywhere from 2 MB to 8 MB of memory.
- **Print Buffer and Spooler**
  Computers are a lot faster than most printers are, so they can send information faster than the printer can accept it. A printer buffer or spooler fixes this problem. A print buffer works like a dam: it holds back the information and releases it at a rate that the printer can handle.

Quick Reference

- **InkJet** and **Laser** printers are the most common printer types.
- **Printer resolution** determines the quality of the images a printer can produce. Printer resolution is measured in dots per inch (dpi).
- A printer's speed determines how quickly it can print pages.
- Printers get their ink from expensive cartridges (InkJet printers) and toners (laser printers)
- Many printers have their own memory, which is required for printing more complex images.
- A **print spooler** or **buffer** temporarily stores large print jobs and releases them when the printer is able to print them.

Lesson 2-11: Types of Printers

Figure 2-26

There are many different types of printers available, with an enormous range of prices and features.

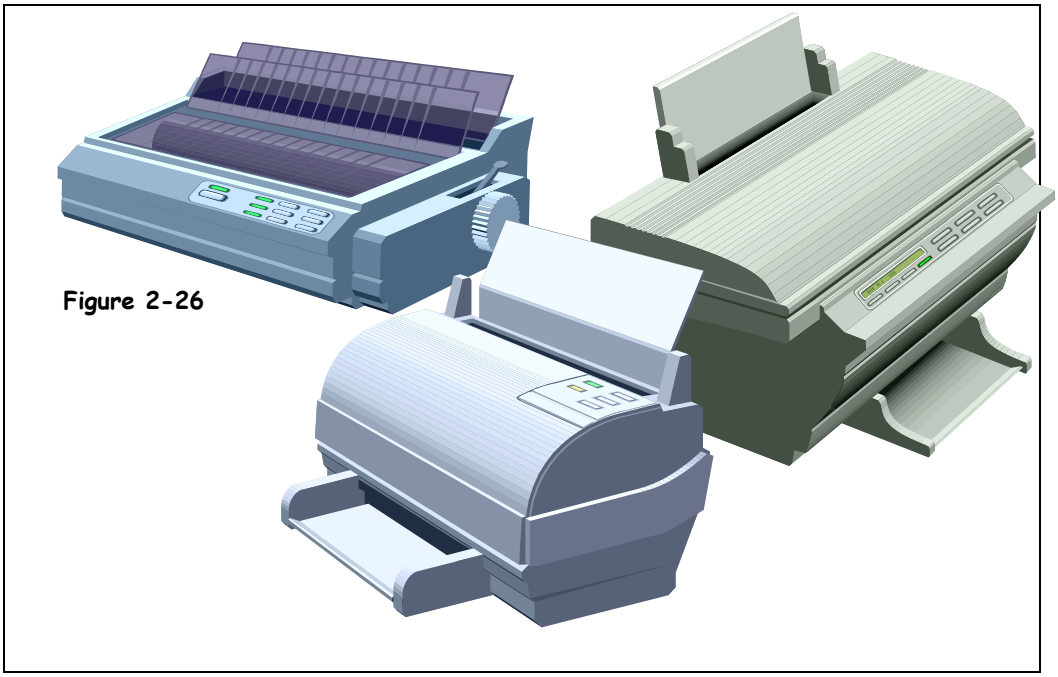


Figure 2-26

Leonardo da Vinci didn't limit himself by using only paint and brushes to create his masterpieces; he also used chalk to make sketches and a chisel and hammer to make sculptures. Maybe Leonardo would have used an airbrush or spray paint if they had been invented yet. Hmm… maybe not. Because there are different types of print jobs there are different types of printers. Are you a home user that prints an occasional letter or two? You'll probably want to buy a cheap *InkJet* printer. Are you a busy office that has lots of people who need to print lots of documents? You're probably looking at getting a *Laser* printer.

The following table describes the main types of printers out there and how or why you would use them, so you'll have no excuse for buying the wrong kind of printer when you get around to buying one.

Table 2-9: Types of Printers

Printer Type	*Description*
 Ink Jet	Inkjet printers are easily the most popular and inexpensive type of printer out there. If you have a printer for your home computer, chances are it's an InkJet printer. InkJet printers create images by spraying ink onto a page. The inexpensive InkJet printer gets its ink from very expensive InkJet cartridges. Most InkJet printers can print in color, and their speeds vary from 2 to 16 pages per minute (ppm).

Printer Type	Description
 Laser	Laser printers have blazing speed—anywhere from 4 to 20 pages per minute (ppm), great resolution—anywhere from 300 to 1,200 dots per inch (dpi), and recently have become relatively inexpensive. Laser printers are great for businesses and people who need to produce large amounts of text documents or correspondence. Laser printers use the same technology as photocopy machines to create black and white images on paper. Laser printers use powdered black ink, called toner, just like photocopy machines do. When the toner cartridge runs out, you have to replace it with a new toner cartridge. Toner cartridges cost a lot more than InkJet cartridges do, but they also last a lot longer.
 Color Laser	A color laser printer works just like an ordinary laser printer, except that it can print in color, of course. Color laser printers are quite expensive and the color toner cartridges for them are even costlier.
 Multifunction	As its name implies, a multifunction printer can perform more than one task. Multifunction printers can usually operate as a fax machine, copier, and scanner in addition to their traditional printing duties.
 Dot Matrix	Popular in the 1980's, noisy dot-matrix printers have gone the way of the dinosaurs, except in businesses that need to print on carbon copies. Dot matrix printers usually use a type of paper with holes punched along each side called continuous form paper, and loads it through something called a tractor feed. Dot-matrix printers range in speed from 25 to 450 characters per second (cps), or 1 to 18 pages per minute (ppm). Resolution is measured differently with dot-matrix printers. Instead of using dot per inch (dpi) dot matrix resolution is measured by how many little pins are on the dot-matrix print head. Dot-matrix printers are available with 9-pin (terrible quality) and 24-pin (higher quality) print heads.
 Plotter	Don't expect to find a plotter at your local computer store. Plotters are special, very expensive printers that are used to create posters and blueprints.

Quick Reference

Print Types Include:

- InkJet
- Laser and color laser
- Multifunction
- Dot matrix
- Plotter

Lesson 2-12: Sound and Speakers

Figure 2-27

Older computers had a sound card, which plugged into the motherboard of the computer. Newer computers have sound capabilities built into the motherboard.

Figure 2-28

You'll need to connect a pair of speakers or headphones to your computer if you want to hear sound.

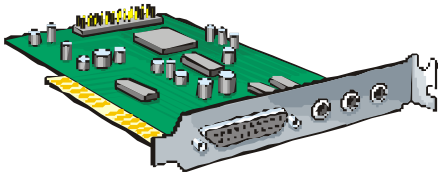


Figure 2-27

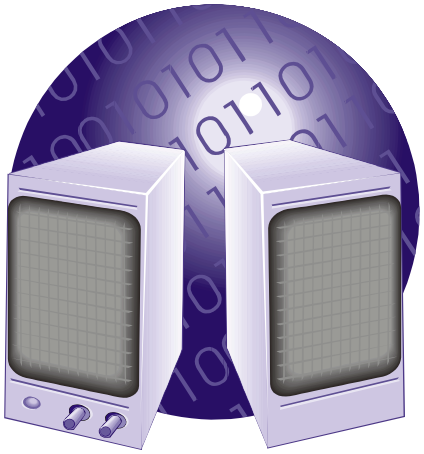


Figure 2-28

The term *sound card* is a little misleading; sound cards used to be expansion cards that plugged into a computer's motherboard. Although such sound cards still exist, today most computers have sound capabilities built-it to their motherboards. Either way, a sound card basically does two things: it plays and records digital sounds.

The types of sounds your computer can play range from the sounds you hear when you turn on your computer, to explosions in a computer game. A sound card can also play MP3 music files. An MP3 is a highly compressed sound file that lets you play CD-quality music on your computer.

While it's not nearly as important, sound cards also let you record sounds if you plug in a stereo or microphone. For example, you could use a sound card to record your aging cassette tape collection to MP3 files. Newer speech recognition software also requires that you have a microphone plugged into your computer.

Sound cards have the most confusing ports or jacks on the entire computer. Most of them look almost exactly the same—especially if you're crouched in the dark under a desk trying to plug in a pair of speakers to your computer. The table on the following page might make things a little easier by describing each of these ports.

Table 2-10: Sound Card Jacks and Ports

Jack	Picture	Description
Speaker		This is the main jack where you connect your speakers or headphones to hear the sounds produced by the sound card.
Microphone		This jack lets you connect a microphone to your computer so that you record sounds and use speech recognition software.
Line Out		You can listen to your computer through your home stereo system if you plug it into this jack. This is especially useful if you want to play MP3 files on your stereo.
Line In		You can record a cassette, audio CD, or the radio by plugging a stereo system into this jack.
Game Port		This port lets you connect a joystick, used for playing games, to your computer.

Quick Reference

Sound Cards:

- Allow computer to play and record digital sounds.

Lesson 2-13: Modem

Figure 2-29

An internal modem plugs into an expansion slot inside a computer.

Figure 2-30

An external modem plugs into a serial port and sits outside a computer.

Figure 2-31

Most laptops have a built-in modem.

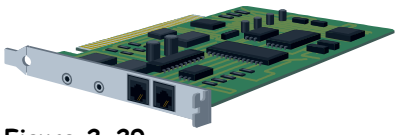


Figure 2-29

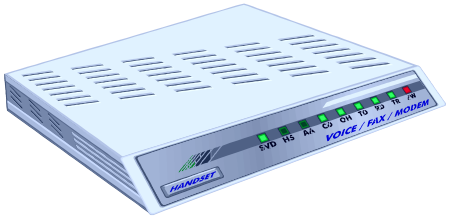


Figure 2-30

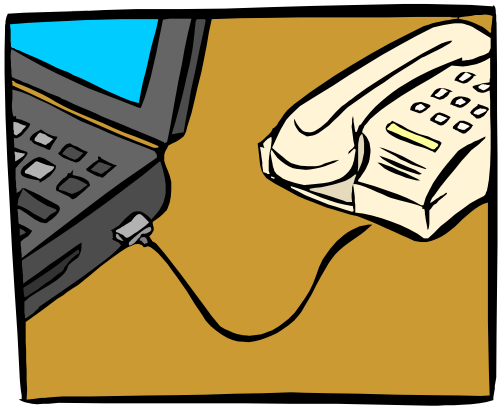


Figure 2-31

Just about every new computer comes with a built-in *modem*. A modem translates a computer's ones and zeros into audio tones, so that it can transmit information over the phone lines to other modems. The speed of a modem is measured by how fast it can transmit information in bits per second (bps).

- **Internal:** Most computers have an internal modem, like the one shown in Figure 2-29. Internal modems often plug into an expansion slot and are cheaper than external modems.
- **External:** An external modem, like the one shown in Figure 2-30, plugs in to a computer's serial port. Newer, *broadband* modem may plug into the USB or Ethernet port. A broadband modem transmits information directly over a connection, unlike older traditional modems that have to convert the information to tones or sounds first. Because of this, broadband modems are very, very fast—much faster than standard modems. DSL and Cable are the most common types of broadband connections.

Here's a quick overview of the major types of modems that are available:

Table 2-11: Modem Types and Speeds

Type		Speed (in bps)	Description
Standard		56K	Standard modems connect to a standard telephone line and are used for dial-up connections to the Internet.
Digital / Broadband	**ISDN**	56K to 128K	One of the older broadband connections. It's only twice as fast as a traditional modem and pretty much obsolete.
	DSL	256K to 6,000K	DSL modems take advantage of unused frequencies in the phone line, such as a pause in conversation. DSL modems are very fast; the problem is that you have to be close to a phone company in order to get DSL service.
	Cable	640K to 4,000K	A cable modem is the fastest modem you can buy for home use. The problem is your cable company has to offer cable Internet access in order to use it.

Quick Reference

Standard Modems:

- Transmit information over standard phone lines to other computers. Maximum speed is 56K bps.

Broadband and Digital Modems:

- Much faster than standard modems, with speeds up to 4,000K bps. Broadband modems include ISDN, DSL, and Cable.

Lesson 2-14: Input/Output Devices

Figure 2-32

Figure 2-33

Figure 2-32

A touch screen monitor is an example of an input/output device.

Figure 2-33

A multifunction printer is another example of an input (scanner)/output (printer) device.

Some computer devices can be categorized as *both* an input device and an output device. For example, a multifunction printer, like the one shown in Figure 2-33 has a scanner (input) and a printer (output). Touch screen monitors are another example of an input/output device; they display images (output) and also let users interact with the computer by pressing areas of the screen (input).

Quick Reference

- Some computer devices have both input and output functions. Examples include touch screen monitors and multifunction printers.

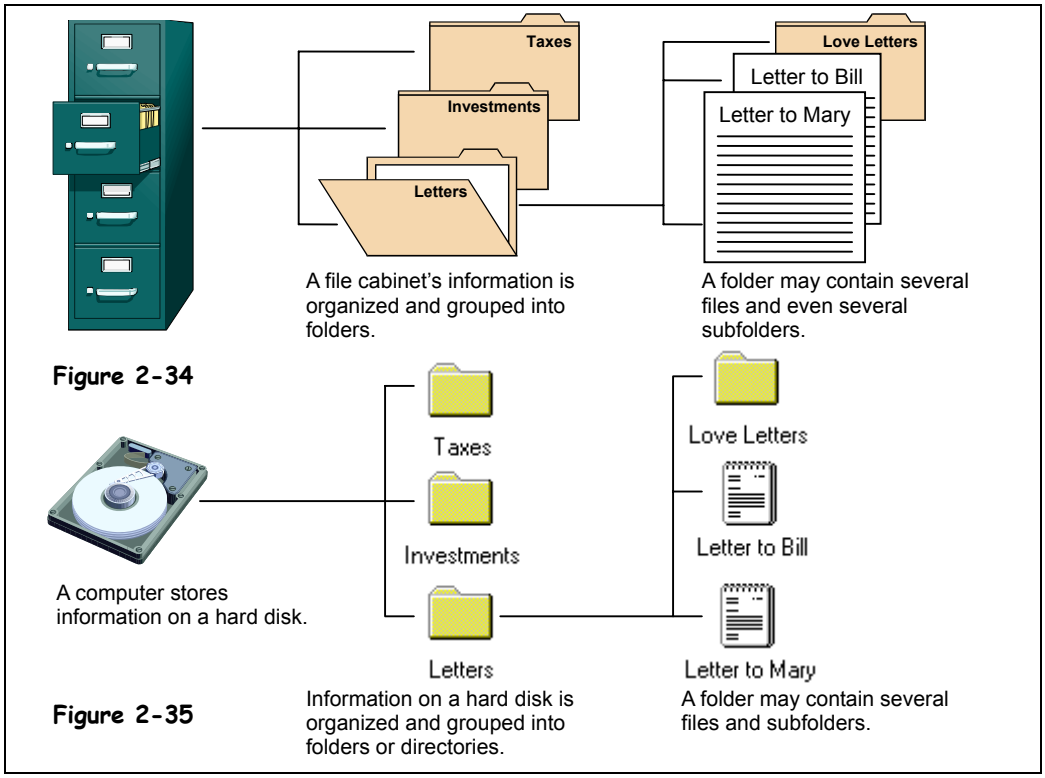
Lesson 2-15: Hard Drive

Figure 2-34

How information is stored in a file cabinet.

Figure 2-35

How information is stored on a hard disk.



Storage Notes: Internal Hard Disk

Speed: Very fast. Most hard disks have an average access speed of between 8 to 15 milliseconds (ms).

Capacity: Enormous. Many hard disks have more than 200 Gigabytes (GB) of storage.

Cost: Hard disks are becoming more and more inexpensive. Byte for byte they are the most inexpensive way to store data.

Unlike floppy disks and CD-ROMs, most hard disks reside inside of the computer or system unit and cannot be easily removed.

A hard drive or hard disk is a computer's main storage device. Most hard drives are tucked away in the system unit of a computer and hidden from view. Although you normally can't see a computer's *internal* hard drive you can usually hear it whirring inside when you start the computer or a program. An external hard drive sit outside the computer's system unit and plugs into a USB, Firewire, or SCSI port.

The hard drive is like the file-cabinet portion of your desk. And files really are saved in folders on a computer, so this really is the perfect analogy. Most computers have a single hard drive located inside of the computer case labeled C. When a computer has more than one hard drive they are labeled D, then E, and so on. Unlike RAM, a hard drive retains its information even when you turn the computer off.

So what's stored on a hard drive? Let's take a look…

- **Operating System Files**
  A computer's operating system, like Windows XP, is stored on the hard drive.
- **Program Files**
  Program files are the programs you work with, like your word processor, your Internet software, or your games. Programs usually come on floppy disks or CD-ROM's, to use it first install, or copy, it to your hard drive in order to use the program.
- **Data Files**
  Whenever you create a document or data file on your computer, like a word processing document, the computer stores it in its temporary memory (RAM.) You must save your documents to the hard drive or they will be lost when you turn off your computer.

Most hard drives are connected to a computer's motherboard through something called an *IDE* (Integrated Drive Electronics) connection. You can also connect CD-ROM and DVD drives to an IDE connection. A slight problem with IDE is that it only supports a total of four devices or drives. This isn't a big deal for most home users, but it is if you're a business and need a server with lots of hard drives. So there's another way to connect hard drives to a computer: through a SCSI (pronounced—get this—*scuzzy*) port. SCSI connections are often faster than IDE and they can connect up to seven devices instead of four.

OK, so what else do you need to need to know about hard drives?

- **Hard Disk Size (or Capacity)**
  How much information (how many programs and data) a hard drive can store is measured in bytes, just like RAM. Hard drive sizes in newer computers range from 20 Megabytes (MB) all the way up to 200 Gigabytes (GB)! How big a hard drive should you get when you buy a computer? Normally try to get at least 40 Gigabytes if you're a home or small business user. More is better in hard drives, because programs keep getting bigger.
- **Average Access Time**
  A hard drives average access time is how fast it can find information. Average access time is measured in milliseconds (ms), or 1/1000 of a second. The lower the access speed, the faster the hard drive. Most newer computers have an average access time of 8 to 15 ms.

Storage Notes: External Hard Disk

Speed: Very fast, though normally slower than internal hard disks.

Capacity: Enormous – same as internal hard disks.

Cost: Slightly more expensive than internal hard disks.

Quick Reference

Hard Drive:

- A computer's main storage device, sometimes called the C drive.
- Modern hard drives can store anywhere from 20GB to 250GB of information.
- **Average access time** is how fast a hard drive can find information.
- Hard drives are connected to a computer through either an **IDE** or **SCSI** interface.

Lesson 2-16: Hard Drive Maintenance

Figure 2-36

Routine hard drive maintenance keeps computers happy and running smoothly.

Figure 2-37

Most hard disk repair tools can be found in Microsoft Windows by right-clicking the hard drive, selecting Properties from the shortcut menu, and clicking the Tools tab.

Figure 2-38

Hard drives need to be defragmented periodically to make them more efficient.

Figure 2-36

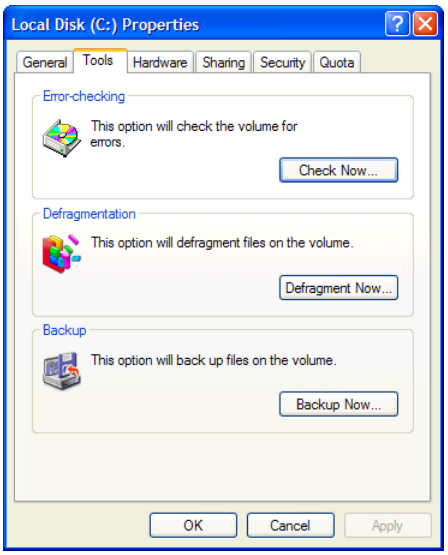


Figure 2-37

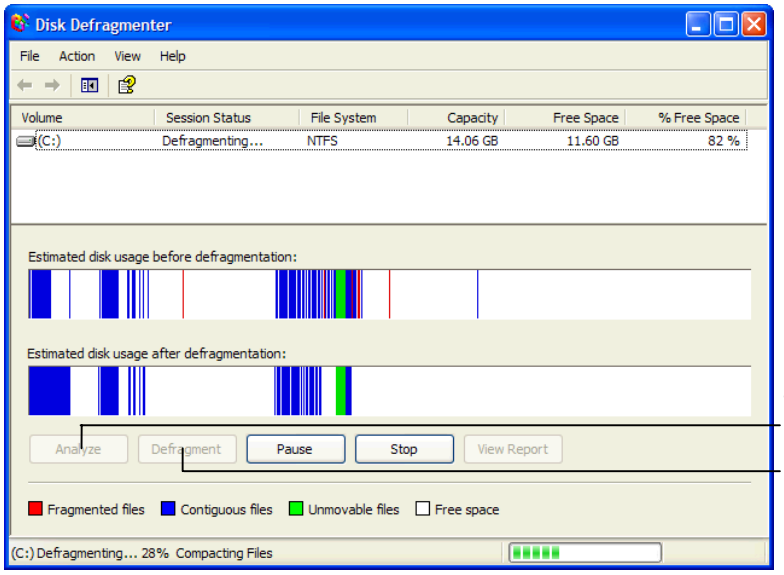
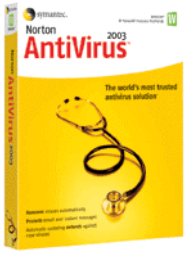


Figure 2-38

Cars require maintenance to keep them running at their peak performance. Some car maintenance tasks are simple and routine, such as changing the oil every 3,000 miles. Others are more complicated, such as installing a new radio. Hard drives are no different—they require routine maintenance to prevent and/or correct problems and to keep them running at their best performance.

By now you're probably wondering, "How does one maintain a hard drive?" There are quite a few ways:

- **Repair a Hard Drive**
  Over time, hard drives can become damaged, effecting their performance. Fortunately most of the hard drive damage is caused by normal wear and tear and is not serious. You can diagnose and correct most hard drive problems with a hard drive repair program. Microsoft Windows comes with a built-in hard drive repair program.
- **Defragmenting a Hard Drive**
  Normally a computer stores a file in the same location on a hard drive. Over time, a hard drive can become *fragmented*, and instead of storing a file in the same location it begins storing parts of it all over. When the computer needs to read a fragmented file, it must read several different parts of the hard drive instead of just one. Defragmenting a hard drive puts the fragmented files back together in one place. You should defragment your computer's hard drive about once a month.
- **Backing up a Hard Drive**
  A computer's hard drive stores information even when the computer is turn off, but you should still back up the documents you create to some type of removable storage, like a CD-RW or tape backup. This will give you an extra copy of your files in case your hard drive is damaged.
- **Virus Protection**
  A computer virus is actually a small computer program written by a malicious person with the purpose of vandalizing computers by erasing information on their hard drive and causing other problems. Anti-Virus programs that protect computers against viruses, like Norton AntiVirus or McAfee VirusScan, are available at most computer stores. If you're even thinking about connecting to the Internet, you need to have AntiVirus software installed on your computer.
- **Hard Drive Compression**
  A computer can increase space on a hard drive by using a special program to compress, or squeeze together, the files stored on a hard drive. Most data compression programs can effectively double the amount of information a hard drive can store. Sounds great, so why don't many people use disk compression? First, data compression slows your hard drive because the computer has to uncompress files before it can read them. Second, data compression often causes more problems in hard drives. Third, several programs won't run on the computer with compressed hard drives. Don't compress your hard drive unless you absolutely have to, and even then it might be better to start looking for a new, larger hard drive than to use data compression.



Make sure you install antivirus software on your computer to prevent malicious computer viruses.

Quick Reference

Hard Drive Repair and Fragmentation:

- Over time, small errors and fragmentation can degrade the performance of a hard drive. These problems can be corrected by a hard drive utility program.

Hard Drive Backups:

- Should be performed to give you an extra copy of your files if your hard drive becomes damaged.

Virus Protection:

- Software should be installed on every computer to protect against malicious computer viruses.

Compression:

- Increases the space on a hard drive by compressing, or squeezing together, its files.

Lesson 2-17: CD-ROM Drive

Figure 2-39

A CD-ROM drive.

Figure 2-40

A CD-ROM drive can also play the same, great audio CDs that a stereo system does.

Figure 2-41

Newer CD-ROM drives can transfer data faster than older drives, as this table shows.

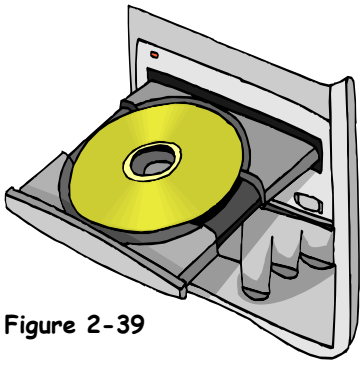


Figure 2-39

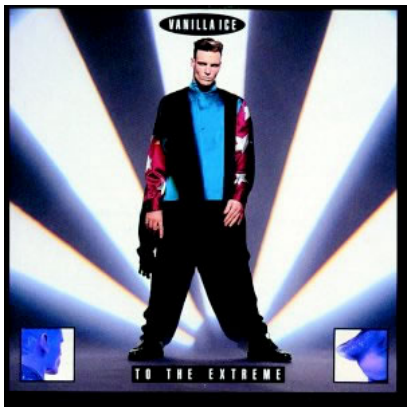


Figure 2-40

CD-ROM Speed	Transfer Rate
8x	1,000 KB/s
10x	1,600 KB/s
12x	1,800 KB/s
16x	2,400 KB/s
24x	3,600 KB/s
32x	4,800 KB/s
40x	6,000 KB/s
48x	7,200 KB/s
60x	9,000 KB/s

Figure 2-41

Storage Notes: CD-ROM

Speed: Much slower than a hard disk, but still faster than a floppy.

Capacity: About 650 Megabytes (MB).

Cost: Very inexpensive.

Another type of drive almost all computers have is a CD-ROM drive (CD-ROM stands for Compact Disc-Read Only Memory). CD-ROM drives play CD-ROM discs—the same kind of compact discs you can play in your stereo system. CD-ROMs can store lots of information: a single CD-ROM can hold more than 600 Megabytes (MB) of data—more than an encyclopedia set! Unlike a hard drive, most CD-ROMs can only read information—you can't save, or record anything on them (that's what the ROM in CD-ROM stands for: *Read Only Memory*!) On the other hand, CD-RW drives *can* read and write (or burn) to special CD-R and CD-RW discs (the RW in CD-RW stands for *ReWritable*.) The CD-ROM drive is usually labeled D on most computers.

The speed of a CD-ROM drive determines how quickly the computer can read information stored on the CD-ROM. Faster CD-ROM drives produce better sound and video quality. The original CD-ROM drive was no faster than an audio CD player, so the speed of all subsequent CD-ROM drives is measured by how many times faster they are than the original, 1x CD-ROM drive. Today's CD-ROM drives are up to *sixty times (60x)* faster than the original.

Here are some things you can do with CD-ROMs:

- **Install Programs**
  More programs are coming on CD-ROMs because of their large storage capacity. Instead of installing and copying 20 floppies to your hard drive, you only have to install a single CD-ROM.
- **Run CD-ROM Programs**
  CD-ROM-based programs are usually the coolest programs available for your computer. CD-ROM programs often have rich, exiting multimedia content: high quality sounds, music, videos, and animations. For example, a popular CD-ROM program is a complete, searchable encyclopedia set which contains high quality pictures, sounds, music, and videos.
- **Play Audio CDs**
  Most CD-ROM drives are capable of playing audio CDs—the same kind your stereo uses! So your computer can play music while you work.

Table 2-12: Types of CD's

CD Type	*Description*
CD-ROM	The original, standard CD, CD-ROM stands for Compact Disc, Read-Only Memory. What this means is that you can only read information from a CD-ROM; you can't add new information.
CD-R	If you have a CD-RW drive you can permanently store information on a CD-R (Compact Disc-Recordable) disc. The information you write or *burn* to a CD-R is permanent and can't be changed or erased. You can also use CD-R discs to create musical CDs that you can listen to in a stereo system.
CD-RW	Unlike CD-R discs, a CD-RW (Compact Disc-ReWritable) disc can be written to many times. You can also modify and erase information on a CD-RW disc—if you have a CD-RW drive, of course.

Quick Reference

CD-ROM:

- Stands for Compact Disc-Read Only Memory. A CD-ROM drive lets you install programs, run CD-ROM based programs, and play audio CDs. A CD-ROM holds about 650MB of information.

CD-R:

- Stands for Compact Disc-Recordable. Lets you permanently write or burn information.

CD-RW:

- Stands for Compact Disc-ReWritable. Can be written to and modified many times.

Lesson 2-18: DVD Drive

Figure 2-42

A DVD disc looks almost identical to a CD-ROM disc.

Figure 2-43

The DVD logo.

Figure 2-44

A single DVD can store as much information as several CD-ROMs.

Figure 2-45

A DVD drive can also play the same, great movies that you can watch on a DVD player.

Figure 2-42

Figure 2-43

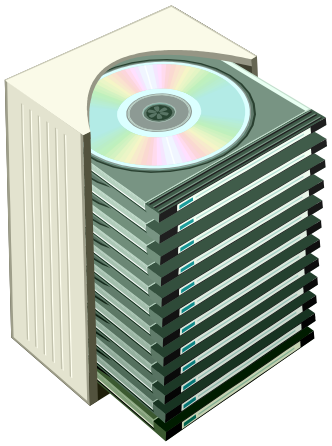


Figure 2-45

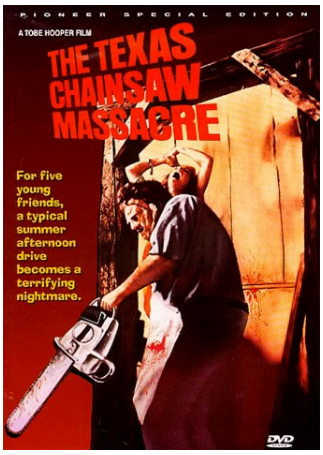


Figure 2-44

Storage Notes: DVD

Speed: Faster than a CD-ROM drive but not as fast as a hard disk.

Capacity: Usually about 4 Gigabytes (GB), although future DVD discs are rumored to hold up to 17 Gigabytes (GB).

Cost: Slightly more than a CD-ROM but still very inexpensive.

Next generation DVD drives are quickly replacing CD-ROM drives in newer computers. A DVD (stands for Digital Versatile Disc) disc looks just like a CD-ROM, but it can store more than 4 Gigabytes (GB) of information—as much as seven CDs. There are even rumored to be future DVD discs that can hold up to 17 Gigabytes! Unfortunately there still really isn't a lot of software that is available on DVD discs. Most people simply use their DVD drive to watch DVD movies. The CD-ROM drive is usually labeled D or E on most computers.

New rewritable DVD drives, that can record or burn information to special type of DVD discs have recently become available the market. Unfortunately for the consumer, the greedy DVD manufacturers couldn't agree on a universal recordable DVD standard, so there are several different competing formats out there. Hopefully consumers will eventually make the decision for the DVD manufacturers, like they did between Betamax and VHS videotapes. Until then there isn't really any clear answer about which recordable and rewritable DVD format to go with, although both DVD+RW and DVD-RW discs work in most newer DVD drives and players. We can tell you that recordable DVD-RAM format is almost universally *not* compatible with most DVD players. Table 2-13: *DVD Formats* tries to make sense of all the available formats. For more information on recordable DVD standards, visit http://www.dvdrhelp.com/dvdplayers.php on the Web.

Table 2-13: DVD Formats

DVD Format	*Description*
DVD-ROM	The original, standard DVD. ROM stands for Read-Only Memory. This means you can only read information from a DVD; you can't add new information.
DVD-R	If you have a DVD-RW drive you can permanently store information on a DVD-R (DVD-Recordable) disc. The information you write or burn to a DVD-R is permanent and can't be changed or erased. DVD-RW drives can also write to DVD-RW discs

DVD Format	*Description*
DVD-RW	If you have a DVD-RW drive you can use DVD-RW (ReWritable) discs, which can be re-written up to 1,000 times. You can also modify and erase information on a DVD-RW disc. DVD-RW discs have some compatibility problems with older DVD Players and DVD ROM drives. DVD-RW drives can also write to DVD-R discs.
DVD+R	If you have a DVD+RW drive you can permanently store information on a DVD+R (DVD+Recordable) disc. The information you write or burn to a DVD+R is permanent and can't be changed or erased. DVD+RW drives can also write to DVD+RW discs.
DVD+RW	If you have a DVD+RW drive you can use DVD+RW (ReWritable) discs, which can be re-written to up to 1,000 times. You can also modify and erase information on a DVD+RW disc. DVD+RW discs have some compatibility problems with older DVD Players and DVD ROM drives. DVD+RW drives can also write to DVD+R discs.
DVD-RAM	DVD-RAM is a rewritable DVD format that can be re-written to many times. DVD-RAM discs are beginning to look like an orphan format, since they won't work in most DVD players.

🕮 Quick Reference

DVD:

- Stands for Digital Versatile Disc. A DVD disc looks like a CD-ROM, but can store much more information.

Recordable and Rewritable DVDs:

- There are several competing, non-compatible formats out there, including DVD-R /DVD-RW and DVD+R/ DVD+RW.

Lesson 2-19: Floppy Drive

Figure 2-46

A relic of the past, floppy disks don't have the speed or capacity to be very useful in the 21st century.

Figure 2-46

Storage Notes: Floppy Disk

Speed: Very slow.

Capacity: Very small – 1.44 Megabytes (MB).

Cost: Very cheap.

Quick Reference

Floppy Disks:

- Are slow and can only store 1.44MB. They are all but obsolete.

Most desktop computers still have a floppy drive, although most laptops have dropped the all-but-obsolete floppy drive. Floppy drives read flat, 3½-inch floppy disks. Floppy drives are as slow as a glacier when compared to hard drives and CD-ROM drives. Floppy disks can only store a scant 1.44 Megabytes (MB) – just a little more than your typical novel.

So why are these relics from the 1980's still around? Floppy disks can still be useful for transferring and backing up small documents. Some other uses for floppy disks include:

- A mini cutting board
- An eye patch (for one-eyed software pirates)
- A room divider for hamsters
- An accessory for aging computer nerds

Lesson 2-20: Zip and Jaz Drives

Figure 2-47

Figure 2-48

Figure 2-47

A Zip drive can store 100MB or 250MB on removable Zip disks.

Figure 2-48

A Jaz drive can store 1GB or 2GB on a removable Jaz disk.

Removable storage drives have features of both hard drives and floppy drives. Removable storage drives work like a floppy drive because they read and write information on small, removable cassettes that are about the size of a floppy disk. They are like hard drives because each cassette can usually hold more than 100 megabytes (MB) and is much faster than a floppy disk, but still not quite as fast as a hard drive. Two of the most popular removable storage drives are the Zip drive and Jaz drive, both made by Iomega.

Zip disks can store 100 to 250 Megabytes (MB) on a removable disk—about 70 to 170 times as much as an old floppy disk. Zip drives are available in both 100MB and 250MB versions. You'll need a 250MB version to read both 100MB and 250MB Zip disks. Zip disks are a great way to transfer and backup information—but they're not much of a value when compared to newer CD-RW and even newer DVD-RW discs.

Jaz disks can store 1 to 2 Gigabytes (GB) on a single removable disk—as much as an older hard drive! Jaz drives are also fast, though not as fast as a hard disk, so they're great for backing up information. Despite their huge storage capacities, Jaz drives really never caught on.

Storage Notes: Zip Drive

Speed: Significantly slower than most hard disks.

Capacity: 100 to 250 Megabytes (MB).

Cost: Expensive when compared to costs of equivalent CD-RW discs and other storage devices.

Storage Notes: Jaz Drive

Speed: Slower than most hard disks, but faster than a Zip disk.

Capacity: 2 Gigabytes (GB).

Cost: Fairly expensive when compared to costs of equivalent CD-RW discs and other storage devices.

Quick Reference

- **Zip** and **Jaz** drives are removable storage devices that have features of both floppy and hard disks.

Lesson 2-21: Other Storage Devices

Figure 2-49

Flash cards are most commonly used as the 'film' in digital cameras and can also be read by many PDAs and most computers.

Figure 2-50

A tape backup automatically makes a copy, or backup, of all the files on a computer's hard drive.

Figure 2-49

Figure 2-50

We've covered the main storage devices that are out there, but it seems as if one or two new storage devices are invented and released every year; some catch on, some don't. Here's a run-down on some of the less common storage devices that are out there:

Table 2-14: Other Storage Devices

Device	*Description*
 Tape Drive	A tape drive creates copies, or backups, of the files on a computer's hard drive onto a tape cartridge. The backed up files can be restored in case the original files are lost due to disaster or stupidity.
 LS-120 SuperDrive	The LS-120 drive was meant to be an alternative to Zip disks, because it could store 120 MB of data on a disk, and a replacement for floppy drives, because it could also read and write to traditional 1.44 MB floppy disks. Unfortunately LS-120 never really caught on with the general public.
 Flash Cards	Flash cards are commonly used as the 'film' for digital cameras. Flash cards can store anywhere from a dozen to several hundred pictures, depending on how much memory they have. There are three different types of flash cards: CompactFlash cards, SmartMedia cards, and Memory Sticks. Flash cards can store anywhere from 4 MB all the way up to 1 GB. Wow!
 USB Flash Drive	A USB flash drive is really another type of Flash Card that plugs into a USB port. USB flash drives range in sizes from 16 MB to 512 MB.

Quick Reference

Other Storage Devices Include:

- Tape drives
- LS-120 Super drives
- Flash cards
- USB flash drives

Lesson 2-22: Formatting a Disk

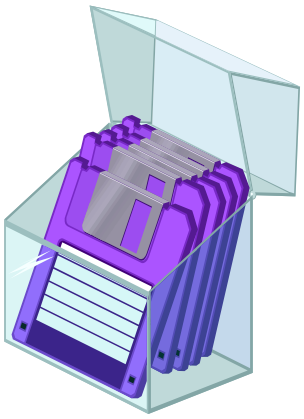
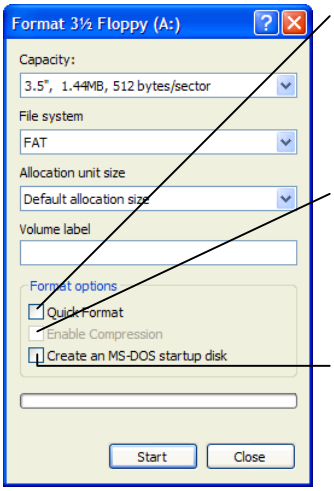


Figure 2-51



Quick (erase)
Erases all information from the disk, but doesn't scan the disk for damaged areas. Only works on disks that have previously been formatted.

Enable Compression
Formats the volume so that folders and files on it are compressed. Compression is supported only on NTFS drives.

Create an MS-DOS startup disk
If you're having problems with your computer, use a startup disk to help remedy your problems.

Figure 2-52

Figure 2-51

Most floppy disks and hard drives come pre-formatted

Figure 2-52

Formatting a floppy disk in Microsoft Windows XP.

Floppy disks must be formatted before you can use them. Fortunately, today most floppy disks you can buy come pre-formatted, so you don't have to do it yourself. When you *format* a disk, you erase *everything* on it and prepare it so that it can be read and used by the computer's operating system. Actually, you can format most storage devices, such as a hard disks and Zip disks, only you'll want to be extra careful about formatting these devices, as there's a lot more information that will be erased when you format them.

It's easy to format a floppy disk. Here's the procedure for formatting a floppy disk in Windows XP…

1. **Click the Start button and select My Computer.**

   The My Computer window will display your computer's various storage devices.

2. **Right-click the drive containing the floppy disk you want to format (usually A:), and select Format from the shortcut menu.**

   The Format dialog box appears. There are several options you can specify when formatting a floppy disk—see Figure 2-52 to see what they are.

3. **Click Start.**

   The floppy drive will whir as it formats the floppy disk. Formatting a floppy disk usually takes about a minute, formatting a hard disk takes a long time—over an hour if you have a slow computer and large hard disk.

Quick Reference

Formatting a Disk:

- Prepares it for use, so that it can be read and used by the computer's operating system.
- Formatting a disk erases *everything* on it.

Chapter Two Review

Lesson Summary

Central Processing Unit (CPU)

- The CPU, or Central Processing Unit, is the computer's main chip. It calculates and processes information.
- CPU speed is measured in megahertz (MHz) and gigahertz (GHz).
- Common CPUs include: Intel Pentium III, Intel Pentium 4, Intel Celeron, AMD Athlon, AMD Duron.

Memory

- Computers use the binary system, where *on* is represented by a one (1) and *off* is represented by a zero (0).
- A **Bit** is the smallest memory unit. Bit stands for *binary digit*.
- Eight bits make one **Byte**. A byte equals one character (letter, number, or symbol).
- 1,024 bytes make one **Kilobyte** (K or KB) which is equivalent to a one-page, double-spaced letter.
- 1,048,576 bytes make one **Megabyte** (M or MB) which is equivalent to a novel.
- 1,073,741,824 bytes make one **Gigabyte** (G or GB) which is equivalent to an encyclopedia set.
- 1,099, 511,627,776 bytes make one **Terabyte** (T or TB) which is equivalent to a small bookstore.

RAM and ROM

- **RAM:** Stands for Random Access Memory. This is the computer's main memory, which is used to process information. You can read from and write to RAM. RAM is volatile, and any data disappears when you shut off the computer.
- **ROM:** Stands for Read Only Memory. This is the computer's low-level memory, which is used to perform its most basic functions. You can read from ROM but you can't write to it.

Mouse

- A mouse acts as a handheld pointing device and controls the actions of that blinking item on your computer screen known as a *cursor*.

Keyboard

- A keyboard lets you enter information and commands into a computer.

Digital Cameras and Web Cams

- A **digital camera** lets you take pictures and transfer them to a computer.
- The quality, or resolution of the pictures a digital camera can take is measured in **megapixels**, or millions of pixels (dots). The more pixels, the crisper the image will appear when it is printed.

Other Input Devices

- Other input devices include touch pads, AccuPoint® pointing devices, track balls, light pens. scanners, joysticks, and microphones.

Monitors

- A **CRT Monitor** is an older type of monitor that looks like a television screen.
- A **Flat Panel LCD Monitor** is a newer type of monitor that is thin, lightweight and somewhat expensive.
- The **size** of a monitor is measured diagonally across the screen. Average monitor sizes range from 15-inches to 21-inches.
- The monitor **refresh rate** determines how quickly the monitor redraws, or updates, the image on the screen. Most monitors have a refresh rate of 72MHz or better.
- A **screen saver** is a moving picture that appears on your computer screen when you don't use your computer for a while.

Graphics Cards

- **Screen Resolution** determines how much information can fit on the computer screen at once. Common screen resolutions include 800 by 600 and 1,024 by 768.
- **Color Depth** is the number of colors that are displayed on the screen at once. Common color depths include 16-bit and 24-bit color.
- **Video Cards** have their own memory and processor. Generally speaking, the more memory a video card has the higher the resolution and color depth it can display.

Printer Basics

- **InkJet** and **Laser** printers are the most common printer types.
- **Printer resolution** determines the quality of the images a printer can produce. Printer resolution is measured in dots per inch (dpi).
- A printer's speed determines how quickly it can print pages.
- Printers get their ink from expensive cartridges (InkJet printers) and toners (laser printers).
- Many printers have their own memory, which is required for printing more complex images.
- A **print spooler** or **buffer** temporarily stores large print jobs and releases them when the printer is able to actually print them.

Types of Printers

- Print types include InkJet, laser and color laser, multifunction, dot matrix, and plotters.

Sound and Speakers

- A **sound card** lets a computer digitally play and record sounds.

Modems

- A **standard modem** transmits information over standard phone lines to other computers and has a maximum speed of 56K bps.
- A **broadband or digital modem** is much faster than a standard modem, with speeds up to 6,000 Kbps. Broadband modems include ISDN, DSL, and Cable.

Input/Output Devices

- Some computer devices have both input and output functions. Examples include touch screen monitors and multifunction printers.

Hard Drive

- A hard drive is a computer's main storage device, usually labeled C.
- Modern hard drives can store anywhere from 20GB to 250GB of information.
- **Average access time** is how fast a hard drive can find information.
- Hard drives are connected to a computer through either an **IDE** or **SCSI** interface.

Hard Drive Maintenance

- **Hard Drive Repair and Fragmentation:** Over time, small errors and fragmentation can degrade the performance of a hard drive. These problems can be corrected by a hard drive utility program.
- **Hard Drive Backups:** Should be performed to give you an extra copy of your files if your hard drive becomes damaged.
- **Virus Protection:** Software should be installed on every computer to protect against malicious computer viruses.
- **Compression:** Increases the space on a hard drive by compressing, or squeezing together, its files.

CD-ROM Drive

- **CD-ROM:** Stands for Compact Disc-Read Only Memory. A CD-ROM drive lets you install programs, run CD-ROM based programs, and play audio CDs. A CD-ROM holds about 650MB of information.
- **CD-R:** Stands for Compact Disc-Recordable. Lets you permanently write or burn information.
- **CD-RW:** Stands for Compact Disc-ReWritable. Can be written to and modified many times.

DVD Drive

- **DVD:** Stands for Digital Versatile Disc. A DVD disc looks like a CD-ROM, but can store much more information.
- **Recordable and ReWritable DVDs:** There are several competing, non-compatible formats out there, including DVD-R /DVD-RW and DVD+R/ DVD+RW.

Floppy Drive

- **Floppy disks** are slow and can only store 1.44MB. They are all but obsolete.

Zip and Jaz Drives

- **Zip** and **Jaz** drives are removable storage devices that have features of both floppy and hard disks.

Other Storage Devices

- Other storage devices include tape drives, LS-120 Super drives, flash cards, and USB flash drives.

Formatting a Disk

- Formatting a disk prepares it for use, so that it can be read by the computer's operating system. Formatting a disk erases *everything* on it.

Quiz

1. The speed of a CPU is measured in what?

A. Megahertz (MHz) and gigahertz (GHz)
B. Horsepower
C. Bits per second (Bps)
D. Lux

2. How much information can be stored in a kilobyte?

A. As much as a one page letter.
B. As much as a novel.
C. As much as an encyclopedia set.
D. As much as a bookstore.

3. Generally speaking, which of the following storage devices can hold the most information?

A. A hard disk
B. A Zip disk
C. A CD-ROM
D. A DVD

4. What is another name for a computer's main volatile memory?

A. RAM
B. ROM
C. RUM
D. Flash