

Multimedia Technologies

Sections

13.1 Audio and Video Technologies

13.2 Multimedia Applications

What You'll Learn

- **Explain** how radio and TV signals are transmitted.
- **Describe** how discs are recorded.
- **Discuss** the use of computers for animation.
- **Explain** how film, video, and video games are produced.
- **Discuss** features of the World Wide Web.

Explore the Photo



Movie Magic The crew for a film includes camera operators as well as makeup artists, directors, and many others. Once film or video has been shot, a post-production team will edit it and add music. *What else might be added during post-production?*





Launch the TECHNOLOGY LAB

Create a Multimedia Web Page

At the end of this chapter, you will be asked to gather a variety of media and use software to develop a multimedia Web page. Get a head start by using this checklist to prepare for the Technology Lab.

PROJECT CHECKLIST

- ✓ Visit technology Web sites and study their designs.
- ✓ Think of some ideas for your own Web page.
- ✓ Make a list of the multimedia tools and applications you will use.

Audio and Video Technologies

Reading Guide

Before You Read

Preview What is the difference between audio and video technologies?

Content Vocabulary

- multimedia
- video
- audio
- pixel
- animation
- digital compression

Academic Vocabulary

You will see these words in your reading and on your tests. Find their meanings at the back of this book.

- formula
- enable

Graphic Organizer

Draw the section diagram. Use it to organize and write down information as you read.

Requirements for Audio and Video Recording Systems

1. _____
2. _____
3. _____



Go to glencoe.com to this book's OLC for a downloadable graphic organizer and more.

TECHNOLOGY STANDARDS

- STL 3** Relationships & Connections
- STL 4** Cultural, Social, Economic & Political Effects
- STL 17** Information & Communication Technologies

ACADEMIC STANDARDS

Science

NSES Content Standard E Understandings about science and technology

English Language Arts

NCTE 1 Read texts to acquire new information.

STL *National Standards for Technological Literacy*

NCTM *National Council of Teachers of Mathematics*

NCTE *National Council of Teachers of English*

NSES *National Science Education Standards*

NCSS *National Council for the Social Studies*

Multimedia Technologies

What kinds of multimedia do you use in your daily life?

Multimedia combines different media for text, sound, and images into one presentation to create a more enriched and entertaining message. Multimedia technologies include the machines and systems used to create and transmit these messages. You experience multimedia when you go to the movies, watch television, play video games, or explore Web sites on the Internet.

As You Read

Predict How are sounds and images recorded to DVDs?

Radio

How does a remote control transmit a signal to your TV?

All wireless over-the-airwaves communication is based on radio transmission technology. Cell phones and TV remote controls are examples of devices that communicate by wireless radio.

The radio transmitter at a radio station or the one built into a wireless telephone converts sound into electrical signals. These signals are then carried by a radio carrier wave through the atmosphere to a receiving device. The radio on the receiving end converts the transmission back into its original form.

You can compare the joining of these two signals to a trip on a bus. The sound signals are like the passengers, and the radio carrier wave is like the bus. The bus carries passengers to their destination; the carrier wave carries the radio signal to your cell phone or wireless gaming device.

Television

How does a television work?

In your television, the **video** transmission and **audio** transmission are separate. The video signal contains the moving electronic images, and the audio signal contains the synchronized sound.

If your TV uses an antenna, audio and video signals reach it via radio carrier waves. If you have cable, your cable provider sends signals to your home through wire or fiber optic cables.

TV images consist of tiny dots of light called **pixels**. The full motion images you see are a series of quick-changing still images. These images are replaced 30 times each second, which is so fast your eyes are fooled into seeing a moving image.

High-Definition Television

In digital HDTV (high-definition television), the studio camera's image is converted into a compressed digital signal. This signal is then transmitted to your TV receiver. The computer in your HDTV converts this signal into moving images. The United States switched entirely to digital broadcasting in 2009. All new TVs manufactured after March 1, 2007 have digital tuners.



Reading Check

Summarize How are radio signals transmitted?



No Strings Attached

Wireless and motion-sensitive game controllers have changed the way players experience video games. The wireless components in these game controllers are based on radio technology. *What are some other wireless devices?*



Audio and Video Recording

How are audio and video recorded?

All audio and video recording systems need to convert sound or images into a recordable signal. These signals must be stored on some type of material. The recording system must also have a way of converting the stored information back into sound and/or images in a playback unit.

Digital Video Recorders (DVRs) first convert sound and images into a digital electrical signal. This signal is then compressed (squeezed) so it will take up less space. The “write” head on the DVR’s hard drive then converts this compressed signal into a magnetic pattern that it can record. Before digital technology, engineers recorded sounds and images onto magnetized tapes.

CD and DVD recorders use lasers instead of magnetism to record the same compressed digital file. During playback, the hard drive’s magnetic head, or the CD or DVD’s laser, “reads” the signal and sends it to the speakers and video screen.



Explain How is audio recorded to CD and DVD?

Animation

How are individual drawings used to create animation?

Animation creates the illusion of movement of images. Each separate image or drawing is slightly changed to show movement. See Figure 13.1. The images move at 24 frames per second when played. This is too fast for your eyes to see one image at a time.



Define What is animation?

Ethics in Action

Facing the Music

When retailers first started selling music online, they protected it with DRM software. DRMs are like locks—they prevent people from illegally copying music files.

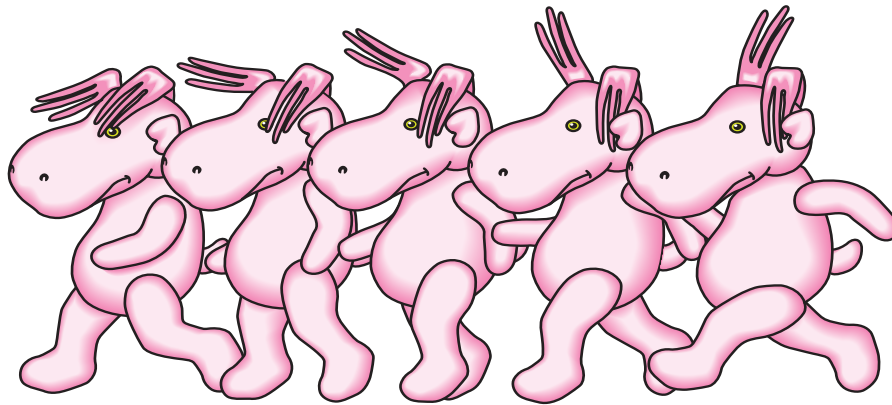
Changing Their Tune Now, retailers like iTunes are selling music without DRMs. Instead, when you purchase music, they record some of your personal data in the file. If you distribute one of these files illegally, the file can be traced back to you.


English Language Arts/Writing

Fighting Fire with Fire? Piracy has seriously hurt the music industry. However, many people do not like the idea of using personal data to combat piracy. They are concerned that hackers and thieves could access and abuse this information.

1. Do some research on anti-piracy in the music industry.
2. Hold a panel discussion to debate the pros and cons of this issue.

Figure 13.1 Animation



 **Illusion of Movement** For animation, still drawings pass rapidly in front of your eyes and give the sensation of motion. *What happens if the drawings are shown at less than 24 frames per second?*

Computer-Drawn Animation

For computer-drawn animation, the beginning and ending images in a sequence are drawn first. The artist then saves the images to the animation program's memory. The computer fills in the images in between the beginning and the ending images. Feature-length animated films contain hundreds of thousands of separate digital images. Without the aid of computers, these films would take years to draw.

3D Animation

Animation that appears three-dimensional (3D) is created by using complex mathematical **formulas**. The process starts with a simple drawing that combines various shapes, lines, and arcs to create solid surfaces. This drawing is then *rendered*, which gives it depth and produces reflections. 3D animation makes video and computer games more realistic.

Video and Computer Games

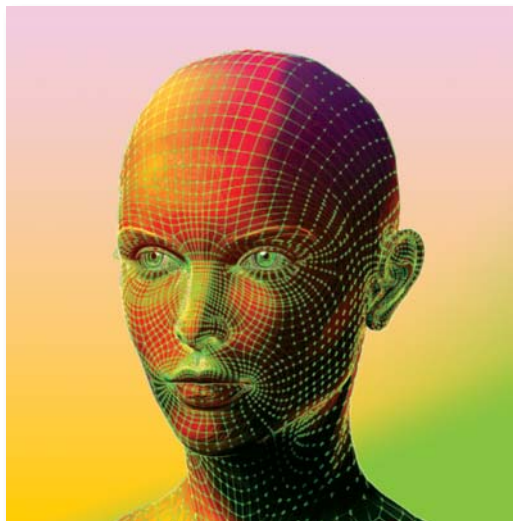
In video and computer games, the graphics on the screen are always changing. Game software has many animation sequences and sounds stored in its memory. Each move you make with the controller tells the computer which sequence to run. As you play, you create a story.

The first video and computer games had simple controls and 2D graphics. Today's games have 3D graphics, movie-like music and animation, and wireless, motion-sensitive controllers. The computers and consoles that games are designed for are always being made faster and more powerful.

Academic Connections Language Arts

Movie Talk Movies and TV shows seem more believable when the actors sound like real people. Their speech must be natural, not artificial.

Apply Write a conversation between two people who are trying to decide which of two TV shows is more interesting. Make their conversation realistic.



Keeping It Real
 Rendering and animation are used to make people and objects appear more realistic. *Why do designers render and animate new designs early in the design process?*

Presentations

Presentation software, such as PowerPoint® and HyperStudio®, helps create better presentations. Facts presented with graphics and sound are easier to remember. The programs **enable** you to add and organize text, graphics, sound, and other media.

Digital Compression

What is digital compression?

The images in an animated film or 3D video game contain too much data to store conveniently.

Digital compression reduces the size of a digital file by removing bits of information that a computer can recreate when processed.

Digital compression is also used for ordinary audio and video files. The most common digital compression for video is called MPEG. The computer keeps the part of the video picture that remains the same and compresses only new data.

Audio compression drops out sound values that are beyond human hearing or that are drowned out by other sounds. The audio compression for music is commonly known as MP3. File compression reduces a digital file to $\frac{1}{200}$ the original size.

section 13.1 assessment

After You Read Self-Check

1. Identify the form of transmission used for radio signals.
2. Explain the principle of animation.
3. Compare HDTV to ordinary TV.

Think

4. Some people think that computers have reduced the need for skilled artists in making animated films. Explain why you think this is or is not true.

Practice Academic Skills

Social Studies

5. Many viewers say that HDTV is so clear that they can see the individual blades of grass on a field. Research and write a one-paragraph report on the effect you think the switch from TV to HDTV has on people, the environment, the economy, and your favorite shows. Examine both positive and negative impacts.

Mathematics

6. Marcus has \$200 and wants to use it to subscribe to satellite radio. The radio costs \$69.95, and the monthly subscription costs \$12.95. Use estimation and mental math to figure out how many months he can subscribe before his money runs out.

Math Concept Mental Math Rounding numbers makes them easier to work with mentally.

1. Round the two types of costs to the nearest dollar.
2. Subtract the cost of the radio from Marcus's total, and divide the result by the monthly cost.



For help, go to glencoe.com to this book's OLC and find the Math Handbook.

Multimedia Applications

Reading Guide

Before You Read

Connect In what ways can technology be used to make videos and Web pages?

Content Vocabulary

- producer
- script
- director
- editing
- motion capture
- HTML
- URL
- browser
- search engine

Academic Vocabulary

- indicate
- link

Graphic Organizer

Draw the section diagram. Use it to organize and write down information as you read.

Producing a Video

Pre-Production	Production	Post-Production



Go to glencoe.com to this book's OLC for a downloadable graphic organizer and more.

TECHNOLOGY STANDARDS

- STL 8** Attributes of Design
- STL 9** Engineering Design
- STL 11** Design Process

ACADEMIC STANDARDS

Science

NSES Content Standard F Science and technology in society

English Language Arts

NCTE 5 Use different writing process elements to communicate effectively.

- STL** *National Standards for Technological Literacy*
- NCTM** *National Council of Teachers of Mathematics*
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- NSES** *National Science Education Standards*
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Film, TV, and Video Production

What career skills must people have to be hired by a producer?

Feature films and TV programs cost a lot of money to create. These productions are run by a **producer**, who has financial and supervisory responsibility over every aspect of the project. This includes hiring the accountants, writers, the director, camera operators, performers, and the editor. In a small production, one person may do several jobs.

Producers and accountants use spreadsheets and other databases to track shooting schedules, props, costumes, and all financial aspects of a production.

As You Read

Predict Why are scripts important to film and television production?

Pre-Production

Every production, from a major motion picture to your classroom video assignment, can be divided into three phases: pre-production, production, and post-production. Pre-production includes all the jobs done before the cameras start rolling.

Scripts

If you think about the many movies you have seen, you will probably recognize that big-name actors and special effects cannot save a boring story. The **script** is the written version of the production. It lists the different characters and their dialogue. It also describes each set and **indicates** the action that takes place during each scene.

Some scripts are done in storyboard form. A storyboard contains sketches of what the scenes will look like from the camera's point of view. The sketches show the camera operators how to shoot each scene.

Other Pre-Production Tasks

The **director** controls and guides the camera work and helps the actors achieve their best performances. During pre-production, the director is in charge of rehearsals, which give the performers a chance to practice and learn their lines.

Many other tasks are also accomplished during pre-production. Set designers may create stage sets and backgrounds. Costume designers may make, rent, or purchase costumes and props. Cameras, lights, and microphones have to be set up. When everything is ready, production can begin.

Green Screen

These actors are performing in front of a green screen. The audience will only see the final composite that will show them performing in a different location.

What type of shooting situations require a green screen?



Production

Not all the scenes in a video or movie are shot in the same order in which you see them. Some scenes are shot in a studio. Other scenes are shot on location, off the studio lot. Scenes that require the same setting are all done together.

Green Screens

Directors can also shoot actors in front of a green screen. Later the editor can *composite* this footage, which means combining it with backgrounds or special effects to look real.

The Control Room

During live TV broadcasts, the director sits in a control room along with audio and video engineers. The director decides which camera feeds to send out to the public. The director can see what each camera sees by watching the different camera monitors.



Post-Production

When shooting is finished, post-production begins. This is the final phase. The most important post-production task is editing.

Editing is the cutting and arranging of the taped material to decide its final order and content. Careful editing can make the difference between a successful production and a confusing one.

The editor copies scenes in the proper order onto a master file. He or she might add special graphics, music, and other elements at the same time, including the title and credits. When the editor is finished and the director is satisfied, the project is complete.

Producing a Video

Have you ever created your own video? All you need is a video camera and a computer. The right hardware and software can turn a computer into a desktop video studio, allowing you to do all of your editing directly on it. When the project is complete, you can burn it to DVD or upload it to your favorite Web site.



Reading Check

Explain How are TV programs, films, videos, and commercials produced?



Compositing Post-production editors composite footage shot in front of a green screen with computer-generated landscapes and other special effects. By doing this, filmmakers can make scenes that are literally out of this world. *What other elements are added during post-production?*

Game Design

How do live actors help to produce video games?

Like TV or film production, computer and video game design usually requires many people. Game developers work with programmers, character and background artists, musicians, sound designers, and other technical experts.

A producer manages all of these people. If the game has a complicated storyline or scripted scenes, the producer might need to hire a writer. If the game will be sold in another country, translators will be essential.



Motion Capture The sensors attached to this actor's body record his (or her) movements and send the information to a computer. Designers or special effects artists use this information to create computer-generated characters. *What else can actors contribute to video games?*



Compare What do game design and film and TV production have in common?

Web Design

What is the Internet?

The Internet is a research tool, meeting hall, shopping mall, and video game arcade all rolled into one. When you explore the Internet by clicking on a [link](#) or typing in an address, you move from computer to computer until you reach the site you want to find.

You will find many examples of multimedia technology on the Internet. Audio, video, text, graphics, photography, and animation all come together in an interactive format. (*Interactive* means that you can participate in the activity on a site.) Some people are concerned that this format can be addictive.

The World Wide Web

The World Wide Web is only one part of the Internet. It is a huge set of files linked in such a way as to make information easy to locate. That is why so many people and organizations use it.

Coding

The code language used for the Web is called **HTML**, which stands for HyperText Markup Language. HTML uses markers called “tags” to turn text, images, and video into a Web page.

Each site on the Web may have many “pages” and links to take you to other locations on the Web. Each Web page has its own address, called a **URL** (Uniform Resource Locator).

Browsers and Search Engines

Internet service providers (ISP) give you access to the Internet. Web **browsers**, such as Mozilla[®] Firefox[®] or Internet Explorer[®], are software that allow you to view HTML documents.

Search engines such as Google™ help you search the Web. Web sites such as YouTube let you share videos. Social networking sites like Facebook provide a place for friends to communicate.

Web Designers

The Web sites of large companies or organizations are usually created by professional Web-page designers. These designers are skilled in combining different media to produce an exciting result. They may even write special software for pages with complex features. However, you do not have to be a professional designer to create your own Web page.

Building Your Own Web Page

You can design a page to share information with relatives, friends, or even strangers who share your interests. You can use text, audio, animation, links to other sites, e-mail links, and even video clips to create a page other people will enjoy.

Web-Site Building Programs

Software programs allow you to automatically convert your work into HTML. Most programs have preview buttons so you can see what your page will look like once it is converted.

Adobe® Dreamweaver®, Microsoft's Expression® Web, and Netscape Composer® are just a few of the many Web-site building programs that you might use.

Web for the People

The Green Wi-Fi Project is installing solar-powered networks around the world in an effort to give children in developing countries access to the Internet. The first prototype was made in 2006 in San Francisco.

Try This Make a list of items in your household or school that could be solar powered. Make a public service advertisement poster with illustrations of these items. Post it in your classroom.

Tech Stars

Chad Hurley, Steve Chen, Jawed Karim Co-Founders of YouTube

In 2005, Chad Hurley, Steve Chen, and Jawed Karim introduced a video sharing Web site called YouTube. Using Adobe Flash technology, they created an Internet phenomenon. According to one survey, over 100 million video clips are viewed every day on YouTube.

Chen and Karim studied computer science at the University of Illinois. Hurley studied design at Indiana University. The three men worked out of a garage in northern California.

Easy Money In November of 2006, Hurley, Chen, and Karim closed a deal with Google to sell YouTube for \$1.65 billion, making them each multimillionaires. The sale came barely a year after the site was launched.

English Language Arts/Writing Have you ever posted or watched a video on YouTube? Write a few paragraphs explaining your experience with the Web site.




Go to glencoe.com to this book's OLC to learn about young innovators in technology.

Imagine This...

Non-Stop Internet

Researchers predict that by 2020, the Internet will be so common, we will not notice it anymore. You will even be able to turn on your dishwasher and other appliances over the Internet. Buildings and vehicles will be online. Enormous amounts of information will be available. *Will there be a downside? Can you think of some impacts?*

 Go to Glencoe.com to this book's OLC for answers and to learn more about the future of the Internet.

Publishing Your Web Page

You can practice creating a Web site on a computer that is not connected to the Internet. However, to actually publish your page on the World Wide Web, you need an Internet connection.

Your Web-site building program can determine how you upload your page. After you upload your page, it will receive a URL. Enter this URL into a browser on any computer that has Internet access, and your page will appear. Many schools now provide space for students to upload their own Web pages. Most Internet providers have Web-page space set aside for their customers.

Reading Check

Describe What are some features of the World Wide Web?

Copyright Law

The elements that you use for your Web site can be of your own design or copied from sites that make them freely available. However, be cautious before you copy material that was designed by someone else. Copyright laws protect the material on the Web, and you may need permission to use it. You must assume that anything you find there is copyrighted. Many sites do make their graphics, templates, and animations available for anyone's use. But it is important that you respect copyright laws.

section 13.2 assessment

After You Read **Self-Check**

1. Name the source of dialogue in written form for a video production.
2. Identify what HTML stands for and explain its use.
3. Explain why a Web site needs a URL.

Think

4. Discuss why it would be important to know and understand the intended audience for a multimedia presentation.

Practice Academic Skills

English Language Arts/Writing

5. Develop a script for a one-minute radio commercial that uses two performers, music, and at least two sound effects. Indicate on the script where the music and sound effects will be inserted.

Social Studies

6. Thanks to the World Wide Web, you can shop, bank, and work without ever leaving your home. Some people feel this shift in communication has made the world increasingly impersonal. Write a few paragraphs telling whether you think that communication technology makes people more or less isolated from each other.

Exploring Careers *in* Technology

John Vehey

VIDEO-GAME DESIGNER

Q: *What is a typical day like for you on this job?*

A: Checking e-mails, prepping for meetings, playing our games to give feedback, and contemplating how to integrate our game with our Web site!

Q: *How did you train for your job?*

A: In 1997, Brian Fierte (one of the other co-founders of PopCap) and I created a game while we were in college. We sold that game to what is now Pogo.com, and then we went to work for Sierra Online. We worked there in various non-game development capacities before we quit to start PopCap Games.

Q: *What do you like most about your job?*

A: The fact that I get to work on great games like Bejeweled and Book Worm, and that the goal of the company is to only make the best! Furthermore, the casual-games side of the video-game industry is still emerging, so that most of the firms in this field are small and relatively informal. It's still a "garage," or cottage, industry in many ways.

Q: *How did you get interested in producing video games?*

A: Playing lots of games! That's the only way to get interested in game development. If you're in it for money, you're in the wrong industry.



English Language Arts/Writing

Making Predictions Today you can play video games on a cell phone or handheld gaming device. You can even play games online with players from all over the world.

1. Use the library or Internet to do research on early video game systems. How were they different from today's video games?
2. Think of ways that video games have changed in your own lifetime. Have video game controllers changed?
3. Write a few paragraphs explaining how video games may change in 20 years. Use the correct tense when talking about the future.



Go to glencoe.com to this book's OLC to learn more about this career.

Real-World Skills

Creativity, problem-solving, organization

Academics and Education

English language arts, computer science, mathematics

Career Outlook

Growth faster than average for the next ten years

Source: *Occupational Outlook Handbook*

Chapter Summary

Section 13.1 Multimedia technologies use more than one medium in order to communicate. Audio devices include radios, CDs, and MP3 players. Video devices include TVs, VCRs, and DVD players. TV images consist of tiny dots of light called pixels. Animation creates the illusion of movement with a series of slightly different drawings or models.

Section 13.2 Pre-production, production, and post-production are all part of making feature films, TV programs, videos, and video games. The most important post-production task is editing, the cutting and arranging of material. The World Wide Web is one part of the Internet. The code language used for the Web is called HTML. Each page has its own URL, or Web address.

Review Content Vocabulary and Academic Vocabulary

- On a sheet of paper, use each of these terms and words in a written sentence.

Content Vocabulary

- multimedia
- video
- audio
- pixel
- animation
- digital compression
- producer
- script
- director
- editing
- motion capture
- HTML
- URL
- browser
- search engine

Academic Vocabulary

- formula
- enable
- indicate
- link

Review Key Concepts

- Explain** how radio and TV signals are transmitted.
- Describe** how discs are recorded.
- Discuss** the use of computers for animation.
- Describe** how sound and images are reproduced on CDs or DVDs.
- Explain** how animation is used in video games.
- Describe** digital compression.
- Explain** how videos are produced.
- Discuss** features of the World Wide Web.
- Explain** the difference between pre-production, production, and post-production.



Real-World Skills

- 11. Asking Permission** Before a company can use a photograph of someone, it must have the person's permission. With technology that allows people to take pictures or videos in public, receiving permission for those images is important. Create a document to be signed by someone who will give permission.

STEM Technology Skill

- 12. Film Production** Producing a film is a complex process with many steps.
- Write a script involving a conversation between two people. Include such information as where people should stand and how they should move.
 - Using a video camera, make a short film based on your script. Write a paragraph describing how well the film followed your script.



WINNING EVENTS

Electronic Game Designer

Situation Your design team must develop an E-rated electronic game. Your game must be exciting, intellectually challenging, and have educational and social value.

Activity Working as a team, brainstorm ideas for your game. Then determine the responsibilities of each team member. You are encouraged to use one of the free gaming engines available on the Internet.

Evaluation The game will be evaluated by the following criteria:

- Creativity and artanship
- Technical skill
- Social value
- Flow, story, and overall appearance



Go to glencoe.com to this book's OLC for information about TSA events.

Academic Skills



Social Studies

- 13.** Research ways that multimedia technologies have changed. Pick one technology and write a few paragraphs about how the technology was introduced, how it changed, and its future.



Mathematics

- 14.** Susan is producing an animated film for art school. She is drawing the individual frames by hand. She set the rate of the frames moving past your eyes at 25 frames per second. How many frames will she need to draw if her film is $5\frac{1}{2}$ minutes long?



Time Convert units of time by using multiplication or division. If you need to convert from a large unit to a smaller unit, such as from hours to minutes, you multiply.



Standardized Test Practice

Directions Choose the letter of the best answer. Write the letter on a separate piece of paper.

- What is the volume of a TV set that is 36 inches wide, 18 inches high, and 13 inches deep?
A 8,420 cubic inches
B 6,272 cubic inches
C 8,424 cubic inches
D 648 cubic inches
- Digital compression removes bits of data that can be recreated later.
T **F**

Test-Taking Tip Before you turn in your test, review your answers. Make changes you feel are important, but do not change an answer unless you have a good reason.