

Photographic Technologies

Sections

12.1 Cameras

12.2 Recording the Image

12.3 Processing the Image

What You'll Learn

- **Name** the main parts of a camera.
- **Compare** film and digital cameras.
- **Describe** how images are captured on film.
- **Explain** how images are captured with a digital camera.
- **Summarize** how film negatives are processed.
- **Discuss** how digital images are processed.

Explore the Photo



Making a Splash You have to open this camera's waterproof battery compartment to find its rechargeable battery and SD flash memory card. *Do you think this is a film or digital camera? Why?*





Launch the TECHNOLOGY LAB

Process Photographs

At the end of this chapter, you will be asked to process and edit film and/or digital pictures. Get a head start by using this checklist to prepare for the Technology Lab.

PROJECT CHECKLIST

- ✓ Pass your classroom's safety test for film processing.
- ✓ Select an old photo you want to edit or repair.
- ✓ Practice repairing photos with your classroom's photo editing software.

Reading Guide

Before You Read

Predict What are the main parts of a camera?

Content Vocabulary

- lens
- shutter
- focus
- aperture
- CCD
- CMOS

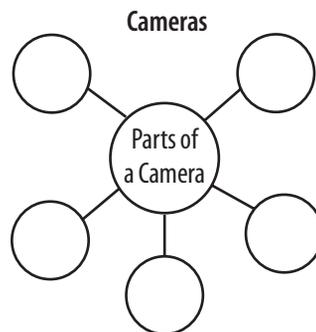
Academic Vocabulary

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

- compensate
- demonstrate

Graphic Organizer

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



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

TECHNOLOGY STANDARDS

- STL 5** Environmental Effects
- STL 7** Influence on History
- STL 11** Design Process
- STL 13** Assessment

ACADEMIC STANDARDS

Science

NSES Content Standard B Interactions of energy and matter

Social Studies

NCSS 8 Science, technology, and society

- 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*

The Evolution of Photography

When was the first digital camera sold?

The first consumer film camera went on sale in 1888. The first consumer digital camera, the Apple QuickTake 100, went on sale in 1994. Once introduced, each of these photographic technologies went through a slow, methodical process to improve their performance, one product cycle at a time. Today photography is changing from a chemical technology into a digital technology.

As You Read

Contrast What makes film and digital cameras different?

Parts of a Camera

What is the purpose of a camera lens?

Digital cameras and film cameras have the same basic components: a lens, shutter, aperture, and viewfinder. See **Figure 12.1**. Film cameras record images on light-sensitive film. Digital cameras record images electronically. Otherwise, they are basically the same.

Lens

Photography uses reflected light from a scene to record images. The **lens** on your camera focuses this reflected light and magnifies the image. A moderately priced camera might have a zoom lens that can be adjusted from wide angle to telephoto. A wide-angle lens makes close objects appear further away, and a telephoto lens makes far away objects appear closer.

To learn about new lenses, type “Octopus Camera Lens” or “Ceramic Lens” into your favorite Internet search engine.

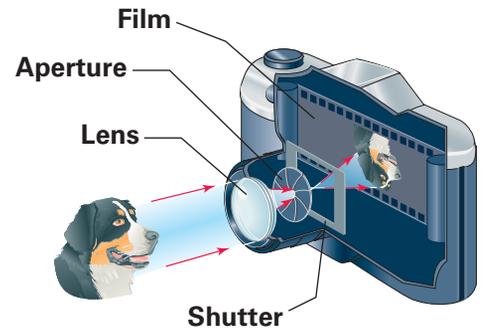
Shutter

The **shutter** lets the reflected light from the scene enter the camera. It blinks open for a very short time. On more expensive cameras, shutter speed is adjustable. A slow shutter speed can help **compensate** for low-light conditions. The photo on this page **demonstrates** how a fast shutter setting keeps moving objects in **focus**, which is the sharpness of the image.

Aperture

The **aperture** is an adjustable opening that controls how much light will enter the camera when the shutter opens. Most inexpensive cameras have an aperture that cannot be adjusted. The aperture setting effects how much of a picture is in focus.

Figure 12.1 Parts of a Camera



Similarities Film cameras like this one and digital cameras have the same components. *How do digital cameras record images?*



Shutter Speed Shutter speed helps determine what is in focus. For the photo on the left, the shutter speed was slow. For the photo on the right, the shutter speed was fast. *How did the photographer keep the cyclists in focus in the second picture?*



Range of Focus

The photo on the left was taken using a large aperture. Only one car is in sharp focus. The photo on the right was taken using a small aperture. *What aperture setting would you use to shoot in low light?*

The size of the aperture is indicated by units called “f-stops.” A larger f-stop number indicates a smaller aperture opening. A smaller aperture opening allows a larger area of focus. (See Figure 12.2.)

Viewfinder

The viewfinder on a camera allows you to view your picture before you take the shot. Film and digital single lens reflex cameras (SLRs) let you view your subject directly through the camera lens. Most digital cameras, including SLRs, have a small video screen that displays the picture and functions as a viewfinder and stored-picture viewer.

Reading Check

Recall What is a camera’s aperture?

Figure 12.2 Aperture Settings



Field of Focus The relationship between the f-stop and the size of the opening is shown here. *What aperture setting would keep a viewer’s attention on a single element of a photograph? Why?*

Film and Camera Memory

What is used to record an image?

Do you and your friends take photographs using film or digital cameras? Do you have a digital camera or one in a cell phone?

Film

In a film camera, photographic film records the image. This film is made with different levels of sensitivity to light. This light sensitivity is known as *film speed*. The International Standards Organization (ISO) uses a number system to rate the speed of film. If the number is higher, the film speed is “faster.” If you know you will be taking photos where the light levels are low, you should use faster (higher number) films.

Digital

A digital camera does not use film. Light from the image falls on the **CCD** or **CMOS** microchips that convert light into an electrical signal. At one time, CCD sensors produced higher-quality images than CMOS sensors, but CMOS sensors consumed less energy than the more expensive CCDs. Today both sensors are equal in picture-taking quality and energy consumption. Digital cameras store their images in the camera’s memory or on separate flash memory cards. Unlike film, a digital camera’s memory can be erased and reused many times.

Academic Connections Science

Looking at Lenses

Lenses are curved on one or both sides. The curvature determines the lens’s effect on light waves. Concave lenses spread the light waves. Convex lenses bring them together.

Apply Obtain a series of photo lenses. Use them to observe the same object to determine their effect. Write two paragraphs about the strengths and weaknesses of different types of lenses.



section 12.1 assessment

After You Read Self-Check

1. Name at least three camera components.
2. Describe the purpose of a camera aperture and shutter.
3. Explain what creates the electrical signal in a digital camera.

Think

4. Forecast how trends in photography, such as combining cameras and telephones will evolve.

Practice Academic Skills

English Language Arts/Writing

5. The first camera was the *camera obscura*. Research the *camera obscura* and answer the following questions in a short report: How did they work? What does *camera obscura* mean? Who used them, and how are they similar to modern cameras?

STEM Mathematics

6. The shutter speed on Anna’s digital SLR camera is set at $\frac{1}{125}$. She wants to photograph a friend running in a race at a shutter speed that is four times faster. What shutter speed should Anna choose?

Math Concept Understanding Operations When thinking through this problem, do not be confused by the word *faster*. In this case, the *smaller* the fraction of a second, the *faster* the shutter speed.

1. Think about the question asked in the problem.
2. Divide the starting shutter speed by four.



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

Recording the Image

Reading Guide

Before You Read

Connect How do cameras capture images?

Content Vocabulary

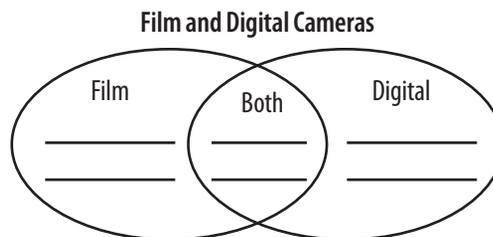
- latent image
- photosite

Academic Vocabulary

- undergo
- equip

Graphic Organizer

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



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TECHNOLOGY STANDARDS

- STL 1** Characteristics & Scope of Technology
- STL 2** Core Concepts of Technology
- STL 17** Information & Communication Technologies

ACADEMIC STANDARDS

Mathematics

NCTM Number and Operations Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

Science

NSES Content Standard G Science as a human endeavor

STL *National Standards for Technological Literacy*

NCTM *National Council of Teachers of Mathematics*

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Images on Film

How does photographic film record a color image?

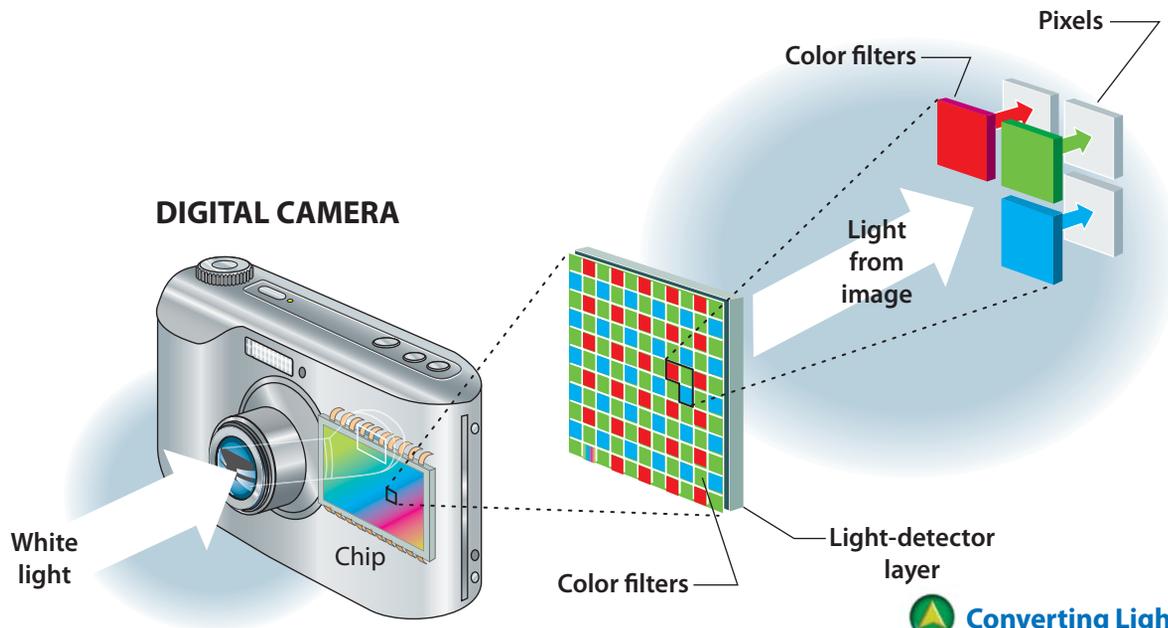
Photographic film consists of a sheet of thin plastic that is coated with chemicals that are very sensitive to light. Color film has three layers of chemicals. Each layer is sensitive to one of the three primary colors of light—red, green, or blue. When color film is exposed, the chemicals in each of these layers **undergo** changes that record the image.

The image stored on the film is invisible until after the film is developed. This invisible image is called a **latent image**.

As You Read

Predict How do movie cameras create the illusion of motion?

Figure 12.3 Digital Camera



Digital Images

How does a digital camera record a picture?

In digital photography, a CCD or CMOS microchip records pictures. See Figure 12.3. The microchip contains millions of **photosites**, which are tiny, light-sensitive cells that convert light into an electrical charge.

The brighter the light that strikes a single photosite sensor, the greater the electrical charge. These charges become a photo file stored in the camera's memory or removable flash memory card.

Converting Light In a digital camera, the light goes through filters and light sensors to create the tones and colors on the final photograph. *In what ways are color filters on a digital camera's microchip similar to four-color process printing? How are they different?*

Ethics in Action

Protecting an Image

Digital technology is so advanced that almost anything is possible. For example, the famous actor Fred Astaire died in 1987. Nine years later, he appeared in a new television commercial, dancing with a vacuum cleaner.

Happily Ever After? Fred Astaire's widow authorized use of his image for the commercial. But the relatives of other deceased celebrities want to stop people from cashing in on their fame. They feel that a person's likeness and image should be protected.

English Language Arts/Writing

Now Showing Advertisers have already used deceased actors to promote soft drinks, clothing lines, and personal computers. Thanks to digital technology, you could see them starring in new movies.

1. Henry David Thoreau, the great American writer, once said, "Men have become the tools of their tools." What did he mean by this?
2. Do you agree or disagree? Write a one-paragraph response.

Tech Stars

Steven Sasson

Inventor of the Digital Camera

Fresh out of college, Steven Sasson was working as an electrical engineer at Eastman Kodak Company. His supervisor, Gareth Lloyd, gave him an assignment. Lloyd asked him if he could build a camera with solid-state electronics and imagers, and an electronic sensor that gathers optical information. Using components available at the time, he assembled the first prototype of a digital camera. It was 1975. About the size of a toaster, the camera's first images were blurred. But Sasson fixed that problem.

Digital World By 1978, Sasson and Lloyd's invention was finely tuned, and they were issued a U.S. patent. At Eastman Kodak Company, Sasson has been involved in many other innovative ideas in the world of digital photography.

English Language Arts/Writing Write a short essay about the first digital camera.



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



Color Filters

To record the colors in the scene, color filters are placed in front of the photosites. The filters separate the light into red, green, or blue—the three primary colors of light. Each photosite records only one color, and each color produces a different electrical signal. These varying signals create the range of tones and colors that appear in the final photograph. (See again Figure 12.3.)

Pixels

The image from each photosite appears as a tiny dot called a “pixel.” Pictures shot with a digital camera are collections of pixels. Cameras **equipped** with a CMOS use filters to record colors.



Reading Check

Describe How are digital images recorded?

Motion Pictures

How are motion pictures recorded?

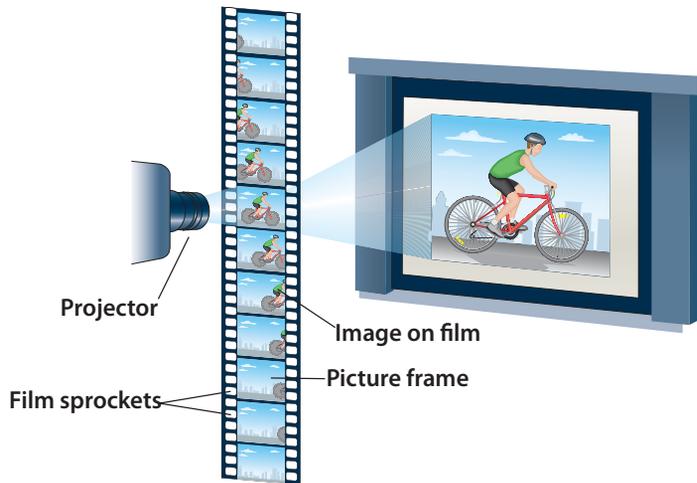
The invention of the film camera led to the invention of the movie camera. Film and digital movie cameras produce movies using the same components in a still camera. They are designed to rapidly photograph many still pictures per second.



Reading Check

Compare In what way are movie and still cameras similar?

Figure 12.4 Film Playback



Action! A film movie camera shoots 24 still pictures per second. When the movie is played back, your brain thinks you are seeing motion. *Why does video shoot at 30 frames per second instead of 24 frames per second?*

Multi-Use Cameras

Camera makers realized they could combine the still camera and the movie camera. At first these dual digital cameras were superior in one type of photo shooting and inferior in the other. Newer digital cameras are true multi-use machines.

Frame Speed

Film cameras capture 24 frames per second, and video cameras capture 30 frames per second. The faster recording speed of video relates to the way video is refreshed on video screens. When played back, the images create an illusion of motion. Our eyes cannot see the quick change from image to image. See Figure 12.4.

section 12.2 assessment

After You Read Self-Check

1. Describe the effect that exposure to light has on film.
2. Summarize how a digital camera records a picture.
3. Compare a CCD to a personal computer's CPU.

Think

4. Discuss the meaning of the word *photography*.

Practice Academic Skills

English Language Arts/Writing

5. Cameras can show us places and things we cannot usually see, such as very small things, things that are very far away, and things that are under the ocean. Write a short report about this.

STEM Mathematics

6. The fastest camera can shoot 20,000,000 frames per second. How many frames can it shoot in one minute?

Math Concept Large Numbers Working with large numbers is often easier if you eliminate as many zeroes as possible.

1. Think of 20,000,000 as 20 million. Multiply 20 by 60 seconds. $20 \times 60 = 1,200$.
2. Think of a simpler way to express 1,200 million.



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

Processing the Image

Reading Guide

Before You Read **Preview** Do all photographs require processing?

Content Vocabulary

- developer
- negative

Academic Vocabulary

- determine
- feature

Graphic Organizer

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

Processing the Image

1. _____
2. _____ ↓
3. _____ ↓

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

TECHNOLOGY STANDARDS

- STL 2** Core Concepts of Technology
- STL 4** Cultural, Social, Economic & Political Effects
- STL 11** Design Process

ACADEMIC STANDARDS

Science

NSES Content Standard E Abilities of Technological Design

English Language Arts

NCTE 12 Use language to accomplish individual purposes.

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*

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Film Processing

How is film developed?

Commercial film processing centers develop your film by using a wet chemical process. This process is performed in a machine that looks very similar to a very large photo copier.

Negatives

Film processing must take place in total darkness since film is sensitive to all light. Your film is first bathed in a **developer** solution that turns the latent images into negatives. A **negative** is exposed film in which normally light-colored areas appear dark, and dark-colored areas appear light. Other chemical solutions in a “stop bath” are then used to end the film’s sensitivity to light.

As You Read

Predict Why is digital photography less damaging to the environment?

Making Prints

To print your photographs, light is projected through your negatives onto photographic paper. The distance between the negative and the paper **determines** the print size. Most automated equipment is pre-set to print all pictures to a single size.

Color Prints

Color print photographic paper has three layers that are sensitive to the three primary colors of light. Light passing through the negative causes a chemical reaction in the paper. The proper colors are produced after the paper travels through a number of chemical baths.

Darkrooms

Professional photographers and hobbyists develop and print their own film by hand in a photo darkroom. Film must still be developed into negatives in total darkness, but this process can be performed in a light-tight developing tank. Special color safelights can be used during the printing process.



Reading Check

Summarize How are film negatives processed?

Digital Processing

What do you need to process digital pictures?

Chemicals are not needed to process digital pictures. This makes digital photography much friendlier to the environment. Computer software is used to transform digital photographs into prints. You need to download the pictures from the digital camera into your computer or take or upload your memory card's information for processing.



Imagine This...

Snapshots of the Future

You have probably seen holograms on credit cards or in science fiction movies. Holograms are 3D images created using mirrors and lasers. Until recently, the images did not look very real. But French holographer Yves Genet developed a film coating that produces holographic images so true to life you have to touch them to know the difference. In the future, your HDTV and computer monitor will have images that seem to float off the screen.

How would holograms change TV, movies, and the Internet?



Go to glencoe.com to this book's OLC for answers and to learn more about holograms.



Darkroom In a darkroom, an enlarger is used to make the photo the desired size. *Does a darkroom have to be totally dark all of the time? Why?*



Digital and Green

Digital photography eliminates the use of highly toxic darkroom chemicals. However, there are more ways to lessen the effect on the environment. You can also use solvent inks and recycled paper for prints.

Try This Make a list of ten everyday activities in which you can choose to use nontoxic alternatives.

Downloading Digital Images

The download process usually involves placing the camera or a removable flash memory card in a cradle attached to a USB port on your computer. The software copies the digital files into computer memory.

You can then use the software that comes with your camera. Photoshop®, Google's Picasa®, and Hyperstudio® are programs used to crop, enlarge, improve color, and improve contrast. If the **feature** is available with your software, you can even change your photo into a work of art.



Reading Check

Explain How can you process digital images?

Printing Digital Images

New home and commercial printers have also been designed to print your pictures without using a computer. To use this type of printer, you plug in the memory card, view the pictures on a screen, and pick the pictures you want to print on special paper. Digital pictures can be printed at home, at a local store, or uploaded to an online photo printing company. These companies make it easy to electronically share your pictures with friends and family.

section

12.3

assessment



After You Read

Self-Check

1. Identify how the image on a negative differs from the original scene.
2. Explain why digital processing is easier on the environment than film processing.
3. Recall what causes a chemical reaction in photographic paper when you develop a color print.

Think

4. Describe how you think digital cameras and processing have affected film-processing businesses.

Apply



English Language Arts/Writing

5. Using either a film or a digital camera, create a photo essay about technology and the future. As you work, keep in mind your audience, medium, purpose, and the nature of your message. Write an introduction to your photo essay and a caption for each photo.



Science

6. Draw a diagram showing how the eye works. Then draw another diagram showing how a camera lens works. Write a paragraph or two discussing the similarities and differences between the two.

Exploring Careers

in Technology

Ben Clark

FREELANCE PHOTOGRAPHER

Q: *What do you do?*

A: I am a freelance photographer. Assignments or projects come from clients such as lifestyle magazines, clothing companies, skateboard gear manufacturers, event coordinators, and stock film agencies. I also shoot photos for artistic purposes.

Q: *What kind of training and education did you need to get this job?*

A: I started taking photos when I was in high school and concentrated on fine art photography when I attended college. After graduating, I had to go out, gain experience, and learn the business side of my work. I now run my own business and create my own jobs.

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

A: It isn't repetitive, and I don't have to be at a desk from 9 to 5. Every assignment is different. When I arrive at a shoot, I have to figure out what kind of photos I can get out of my subject. I consider the person's appearance and mood, the environment, and the client's expectations. When I'm finished with a job, I move on to the next one.

Q: *How did you become interested in your field?*

A: I've always had an interest in cameras, and I really enjoy the process of photography. I still feel excitement when I snap a picture and anticipate how the image will look. Using digital photography, I can create the image that I need.



English Language Arts/Writing

Make a Brochure Write a description of photographic services offered by a photographer. It can be portraiture, event photography, product shots, or other jobs.

1. Using a word-processing document, describe your services as well as the technology you offer.
2. Using a spreadsheet program, create a table listing your services and their prices.
3. Combine the pieces to make a brochure. It can be factual or artistic, but should include information such as services, prices, and contact information.



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

Real-World Skills

Speaking, listening, interpersonal, problem-solving

Academics and Education

Mathematics, English language arts, marketing

Career Outlook

Growth as fast as average for the next ten years

Source: *Occupational Outlook Handbook*

Chapter Summary

Section 12.1 Photography is an important tool of communication technology. It is changing from a chemical to a digital technology. A camera has several main parts: the lens, shutter, aperture, and viewfinder. The lens focuses the light on the film and can magnify the size of the object. The shutter allows light to enter the camera.

Section 12.2 Photographic film is coated with chemicals that are very sensitive to light. In a digital camera, tiny devices called “photosites” convert the light into an electrical charge. A movie camera uses the same components as a still camera. It photographs 24 pictures per second and creates an illusion of motion.

Section 12.3 Chemical developer is used to reveal the latent image in exposed film, creating a negative—areas that appeared light in the original scene appear dark, and dark areas appear clear. Information from a digital camera can be fed directly into a computer. The information does not have to be changed because it is encoded as electrical charges.

Review Content Vocabulary and Academic Vocabulary

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

Content Vocabulary

- lens
- shutter
- focus
- aperture
- CCD
- CMOS

- latent image
- photosite
- developer
- negative

Academic Vocabulary

- compensate
- demonstrate
- undergo
- equip
- determine
- feature

Review Key Concepts

- List** a camera’s main parts.
- Discuss** the similarities between film and digital cameras.
- Explain** how images are captured on film.
- Define** the term *latent image*.
- Describe** how digital cameras capture images.
- Summarize** how moving pictures are recorded.
- Describe** how photographic film is used to record a color image.
- Recall** the process of developing film negatives.
- Explain** how digital images are processed.



Real-World Skills

- 11. Evaluate Digital Cameras** You want to buy a digital camera. Make a list of ways in which you intend to use it. Research the various cameras available. List their costs and features. Write a paragraph about the camera you would choose to purchase and why.

STEM Technology Skill

- 12. Make a Pinhole Camera** You can make a simple camera using a discarded frozen orange juice can or an oatmeal box and some tape. Use the Internet to research how to build a pinhole camera.
- Use your pinhole camera to take some pictures in bright daylight.
 - Write a set of instructions someone could use to build a pinhole camera. Include photographs or illustrations of the one you built.

Academic Skills



Social Studies

- 13.** Write a two-page report about the earliest forms of image capturing and projection. When were the first images displayed on a screen? How were moving pictures first shown? Who are key inventors in photography?



Mathematics

- 14.** Lonnie's family stores their photos on a computer. They have 1,560 pictures stored. Lonnie's mother deletes $\frac{1}{3}$ of the pictures. Then his father deletes 45. Write and solve an equation to find how many pictures are left.



- Solving Equations** Do the math within the brackets first. Start with multiplication or division, and then perform addition or subtraction, left to right.



WINNING EVENTS

Photographer

Situation Develop a portfolio of digital photographs depicting the importance of family and friends.

Activity Use digital photography to capture moments that show the connections you have with your family and friends. Make a series of photographs. Select your best shots and edit them. Finally, arrange them in a portfolio.

Evaluation The portfolio and photographs will be evaluated by the following criteria:

- Originality
- Art—communicates the importance of family and friends
- Technical—effective use of the principles of photography



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

Standardized Test Practice

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

- Where are images recorded in a digital camera?
A on a negative
B on an aperture
C on a video screen
D on a microchip
- To record a moving image, video cameras capture 30 still frames per second.

T

F

Test-Taking Tip If each item on a test is worth the same number of points, do not spend too much time on questions that are confusing.

Processing Photographs

Film is developed in a darkroom using chemicals. Enlargers help you make big prints out of little negatives. Digital photos are processed by using the software that comes with your camera or by using graphics software such as *Photoshop*®, Google's *Picasa*® or *HyperStudio*®.

Tools and Materials

Film Processing

- ✓ A completed roll of black-and-white film
- ✓ Developing tank
- ✓ Photo enlarger
- ✓ Developing trays
- ✓ Photo paper
- ✓ Print dryer or hanging clips and wire
- ✓ Darkroom
- ✓ Developer
- ✓ Stop bath
- ✓ Fixer

Digital Processing

- ✓ Digital photos
- ✓ Computer and photo software
- ✓ Old damaged photo
- ✓ Scanner
- ✓ Printer

Set Your Goal

For this activity, you will develop and print a roll of black-and-white film. You will also use a computer either to process digital photographs or to repair a scanned image of an old, damaged photograph.

Know the Criteria and Constraints

In this lab, you will:

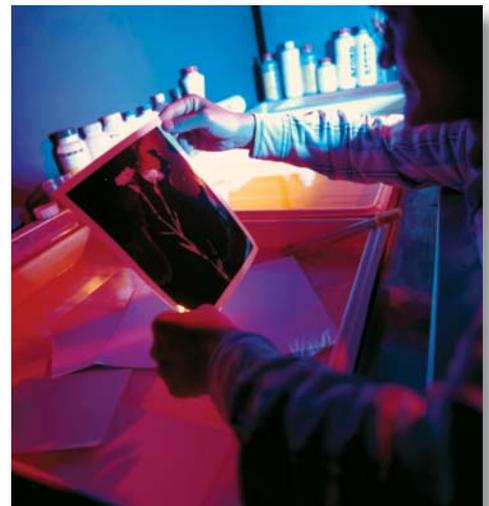
1. Select three of the best film photos to submit to the teacher. Indicate any changes you would make if you could alter the negative.
2. Select three of your best digital photos to submit and describe how you changed the picture on the computer to improve its appearance.
3. Turn in "before" and "after" prints that show how you removed scratches, cracks, and other defects from the damaged photograph.
4. Dispose of all chemicals properly when you have finished the lab.

Design Your Project

Follow these steps to complete this lab.

Film Processing

1. Set up the trays and other darkroom equipment following your teacher's instructions.
2. Load the film into a developing tank in darkness using only safe lights.
3. Develop your negatives according to the manufacturer's instructions.
4. Place the film in the stop bath for the proper time.
5. Place the film in the fixer for the proper time.
6. Wash the film and dry it.
7. Follow your teacher's instructions for making prints.



! SAFETY

Reminder

Pass a safety test before you work on the film processing part of this activity. Follow appropriate safety procedures and rules so you do not get hurt.

Digital Processing

Request teacher approval before starting this activity. Your teacher will determine if you know proper procedures for the computer, scanner, and software that you will be using.

1. Scan a photo needing repair and save it as two computer files, one as it is originally (“before”) and one with the changes you will make to it (“after”).
 - Make repairs on the “after” version of the photo.
 - Print copies of the original photo and the retouched photo.
2. Download new photos into the computer.
 - Select three for processing.
 - Use the software tools to improve the photos by removing red eye, cropping unwanted areas, and fixing backgrounds.
 - Print copies of before and after versions.
3. Select a series of photos that you can “morph” together. Place the photos in the desired order and use the morphing tools to make your changes.
4. Show the results to other students.



! SAFETY

Picturing Safety

Wear rubber gloves and OSHA-approved safety glasses, and use tongs when you work with photographic chemicals. Wash your hands with soap and water as soon as you leave the darkroom. Read labels before using chemicals. Follow your teacher’s directions and shop safety rules.

Evaluate Your Results

After you complete the lab, answer these questions on a separate piece of paper.

1. What part of this lab did you find most interesting?
2. Describe any hardware or software problems that you experienced and the way you solved them.
3. If you were to repeat this activity, what would you do differently?

Academic Skills Required to Complete Lab

| Tasks | English Language Arts | Math | Science | Social Studies |
|--|-----------------------|------|---------|----------------|
| Learn to process photo film in darkroom using chemicals. | ✓ | | ✓ | |
| Learn to use digital photography software. | ✓ | ✓ | ✓ | |
| Make a print in the darkroom. | | | ✓ | |
| Scan and retouch a photo on the computer. | | ✓ | ✓ | |
| Show the results to others. | ✓ | | ✓ | ✓ |