

Read to your supervisor.

My Goals

To learn about light

- I. What Is Light?
- II. What Causes Light Rays?
- III. What Are the Kinds of Light?
- IV. What Is Light Like?
- V. How Does Light Behave?
- VI. What Does Light Do?
- VII. How Is Light Measured?
- VIII. How Fast Does Light Travel?

To learn to use all I have for God's glory—
to be generous

Read these words and tell what they mean.

bullets	eternal	loss	shot	torch
camp	gun	set	sign	trillion



Generous

"Give and it shall be given
unto you."

Giving shows we are believing.
Luke six, thirty-eight is a
promise to elate,
But giving comes before
receiving.



Learn this Scripture Verse

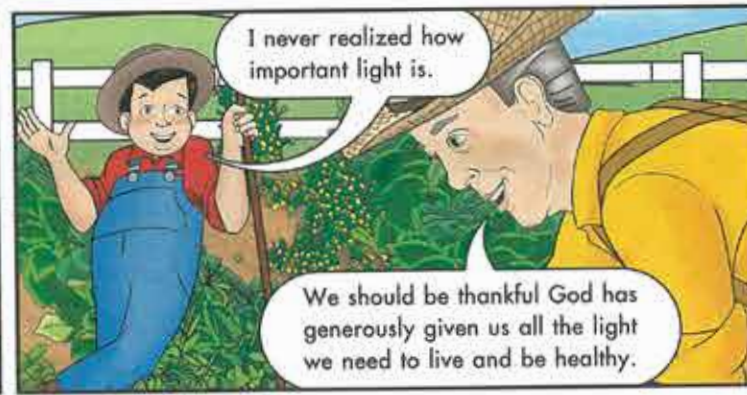
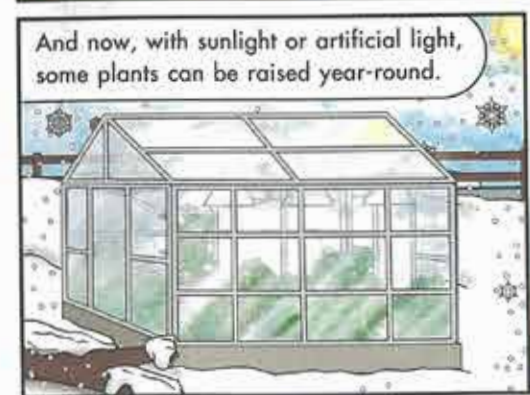
... remember the words of the Lord Jesus, how he said, It is
more blessed to give than to receive.

Acts 20:35

Symbol and Sound Chart

<u>ā</u> glad	<u>ī</u> sit	<u>ōō</u> tool	<u>oi</u> coin	<u>zh</u> Asia
<u>ā</u> save	<u>ī</u> kind	<u>ū</u> cup	<u>ou</u> out	<u>ə</u> a in above
<u>ā</u> fair	<u>ō</u> box	<u>ū</u> use	<u>sh</u> she	<u>ə</u> e in the
<u>ā</u> barn	<u>ō</u> go	<u>ch</u> much	<u>th</u> this, thin	<u>ə</u> i in easily
<u>ē</u> best	<u>ō</u> soft, order	<u>kw</u> queen	<u>ūr</u> burn	<u>ə</u> o in lemon
<u>ē</u> bee	<u>ōō</u> look	<u>ng</u> song	<u>z</u> has	<u>ə</u> u in Jesus

Generous



B. Artificial Light

Artificial light has changed the way people live. At night, buildings and outdoor areas can now be as bright as day. Work and play are no longer limited to daylight hours. There are several kinds of artificial light.

1. Incandescent Lights

After Mr. Thomas Edison developed the light bulb in 1879, many changes in living and working conditions took place. The incandescent light bulb allowed people to do things at night that they had only been able to do during the day. Industries found many uses for the electric light. Manufacturers were able to light their manufacturing plants at night to provide work 24 hours a day. A person could work either during the day or at night.

After World War I, the use of automobiles caused highway construction to increase. Because electric lights made night travel safer, buses and trains carried passengers day and night. Industry grew faster and bigger because of the incandescent light bulb, and the world moved into a new age.

2. Fluorescent Lights

Mr. Edison invented a fluorescent light bulb in 1896, but it produced dangerous rays. Many years later a safer fluorescent light bulb was developed that uses less energy but produces more light than an incandescent light bulb. The fluorescent bulb is a glass tube filled with a special gas. When electricity flows to the light bulb, the gas inside is heated, producing light. The light strikes a coating on the inside of the glass, and the coating glows.

The sun produces a full spectrum of pleasant light. Incandescent light bulbs produce a visible spectrum of light like the sun, but they also produce a great deal of heat and use a large amount of energy. On the other hand, most

fluorescent light bulbs do not produce a full-spectrum of light. You will learn more about the light spectrum later in this PACE.

3. LED Lights

A kind of lighting called LED (light-emitting diode) lighting is used in many lighted signs, flashlights, digital clocks, calculators, signal lights, and car and boat lights. Since a single LED is tiny, LEDs are often grouped in clusters and produce a much safer light than an incandescent or fluorescent light.

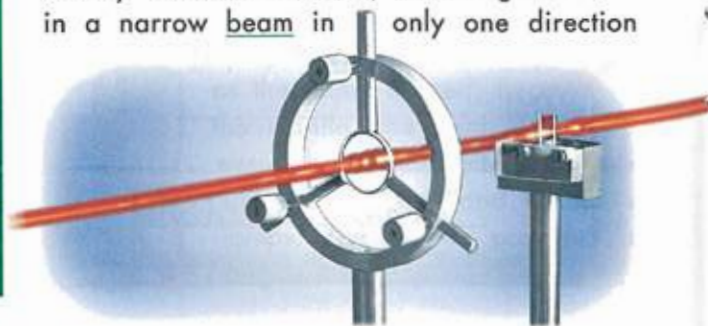
LEDs use a fraction of the power of incandescent light bulbs, do not contain mercury found in fluorescent light bulbs, produce less heat, and last longer. LEDs can produce the full visible spectrum of light and are available in various colors.

4. Vapor Lights

Streets and highways use very bright, long-lasting vapor light bulbs. These light bulbs contain either mercury or sodium vapors. As electricity heats the vapors, they begin to glow. This type of light bulb requires several minutes to heat the vapors to their greatest brilliance. Watch a street light as it begins to glow at sundown. How long does it take to reach its greatest brilliance?

5. Laser Lights

Scientists have learned to make a special kind of light called laser light. Laser light does not radiate from its source like light usually radiates. Instead, laser light travels in a narrow beam in only one direction

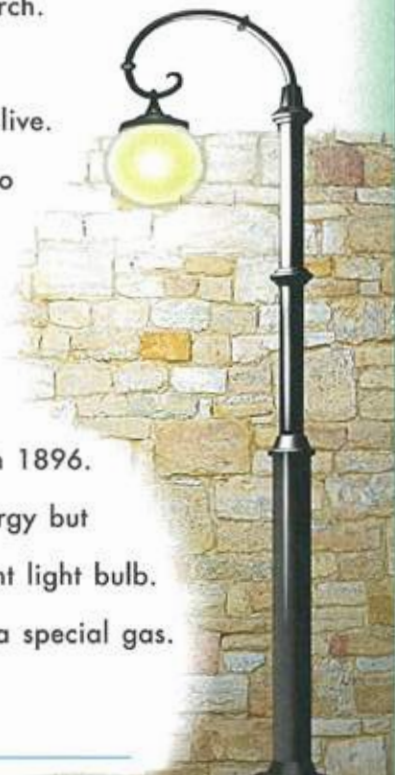


from its source. Laser light can deliver millions of telephone messages and video pictures in a second over great distances. One beam can deliver many messages at the same time. Some industries use lasers that generate intense

heat. One laser beam generates such intense heat it can burn a hole through a diamond. Lasers are also being used in the field of medicine, as defense weapons by the military, and in scientific research.

Fill in the blanks with the correct answers.

- (1) _____ light has changed the way people live.
- (2) The _____ light bulb allowed people to do things at night that they had only been able to do during the day.
- (3) Manufacturers were able to light their manufacturing plants at night and provide work _____ a day.
- (4) Electric lights made night travel _____.
- (5) Mr. Edison invented a _____ light bulb in 1896.
- (6) The fluorescent light bulb uses _____ energy but produces _____ light than an incandescent light bulb.
- (7) The fluorescent bulb is a _____ filled with a special gas.
- (8) The sun produces a full _____ of light.
- (9) Incandescent light bulbs produce a great deal of _____ and use a large amount of _____.
- (10) LED is the abbreviation for _____ diode.
- (11) LEDs are used in lighted signs, flashlights, _____, calculators, signal lights, and _____ and boat lights.
- (12) Streets and highways use bright, long-lasting _____ light bulbs.
- (13) Laser light travels in a narrow beam in only _____ direction.
- (14) Laser light beams can deliver millions of _____ messages and _____ in a second over great distances.
- (15) Lasers are also being used in the field of _____, as defense _____ by the military, and in _____ research.



*"For THOU art my
LAMP, O LORD:
and the LORD
will lighten
my darkness."*

II Samuel 22:29

Score pages 16, 18, and 20.

Correct mistakes.

Rescore.

V. How Does Light Behave?

Optics is the study of how light behaves. Light can become more useful to us once we understand some things about optics.

A. Optics of Reflected Light

One subject in the study of optics is reflected light. When you look at yourself in a mirror, you are seeing a reflection. Light waves reflect from your face, bounce off the mirror into your eyes, and create a sharp image of your face. Smooth, shiny objects through which we cannot see are the best reflectors of light.

When God's people built the Tabernacle, the workers made the huge wash basin for the courtyard of the Tabernacle from shiny brass mirrors carried out of Egypt. These brass mirrors were smooth, highly polished surfaces. Most mirrors today are made of smooth glass. A reflective coating is placed on the back and is usually a thin layer of aluminum or silver.

When light strikes a smooth surface, such as a mirror, the light rays bounce off at the same angle and in the same direction. Reflected light is direct and bright and often causes a glare.



An object with a rough surface reflects light differently than an object with a smooth surface. When light strikes a rough surface, the light rays bounce off at the same angle but in many different directions. The reflected light is diffused. Diffuse means to go in all directions. Diffused light is soft and does not cause a glare.

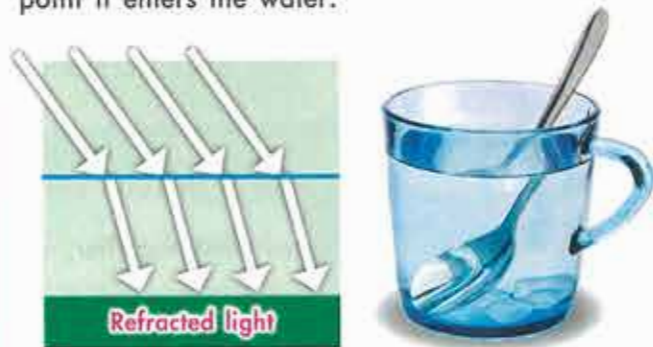
The moon is a reflector of light. It has no light of its own, but its surface reflects the rays

of the sun. The surface of the moon, being rough, reflects the sun's rays in many different directions. Thus moonlight is diffused light.

B. Optics of Refracted Light

When light waves pass through clear substances, such as glass or water, the light changes speed. This change in speed causes the light waves to change direction or bend. The bending of light as it passes through a substance is called refraction.

You can perform a refraction experiment by placing a spoon in a clear glass of water. The spoon looks bent, or refracted, at the point it enters the water.



Telescope lenses, microscope lenses, and eyeglasses all refract light. A lens has at least one curved surface that refracts, or bends, light. Eyeglasses correct weak vision by refracting light through the lenses. Telescopes can help us see far away, and microscopes can help us see things closer because of the way lenses refract, or bend, light.

C. Optics of Absorbed Light

When light strikes objects, the objects will absorb and reflect colors of light. Objects that allow most of the light to pass through them are called transparent because we can see through them. Objects that absorb some light but also let some light pass through them are called translucent. We cannot see clearly through translucent objects.

Solid objects, like a blue ball, absorb almost all light. A blue ball absorbs all colors of light except the color blue. Blue light is the light that is reflected.

White and black objects, on the other hand, are only reflecting or absorbing. A

white object reflects all colors, and a black object absorbs all colors. When we see color anywhere in the world, except for white or black, what we are seeing is an object that reflects a color to our eyes and absorbs the rest of the color spectrum.

Fill in the blanks with the correct answers.

- (1) The study of how light behaves is called _____.
- (2) When you look at yourself in a mirror, you are seeing a _____.
- (3) Smooth, shiny objects through which we cannot see are the best reflectors of _____.
- (4) Most mirrors today are made of _____, coated on the back with a thin layer of _____ or silver.
- (5) When light bounces off a rough surface, the light goes in all directions, or is _____.
- (6) Diffuse means to go in all _____.
- (7) The bending of light as it passes through a substance is called _____.
- (8) _____, _____, and _____ all refract light.
- (9) Objects that allow most of the light to pass through them are called _____.
- (10) Objects that allow some light to pass through but are not clear enough to see through are called _____.
- (11) _____ objects absorb almost all light.
- (12) A blue ball reflects _____ light.
- (13) White objects _____ all colors.
- (14) Black objects _____ all colors.

