

## Reviewing Content

Choose the letter that best answers the question or completes the statement.

- Electromagnetic waves
  - all have the same wavelength.
  - do not carry energy.
  - can travel through empty space.
  - all have the same frequency.
- The particle model describes light as
  - a stream of photons.
  - an interference pattern.
  - a wave.
  - an electric field.
- The electromagnetic waves with the highest frequency are
 

a. infrared rays.	b. gamma rays.
c. ultraviolet rays.	d. radio waves.
- Microwaves and radar are
 

a. infrared rays.	b. X-rays.
c. radio waves.	d. ultraviolet rays.
- Light that vibrates in only one direction is
 

a. scattered.	b. reflected.
c. refracted.	d. polarized.
- Objects appear fuzzy through a material that is
 

a. polarized.	b. translucent.
c. transparent.	d. opaque.
- Combining equal intensities of red light, green light, and blue light makes
  - a secondary color.
  - a complementary color.
  - black light.
  - white light.
- A green object
  - absorbs green light.
  - reflects green light.
  - absorbs yellow and blue light.
  - reflects red and blue light.
- An object that produces its own light is
 

a. luminous.	b. coherent.
c. opaque.	d. translucent.
- Which type of light bulb uses phosphors?
 

a. neon	b. incandescent
c. tungsten-halogen	d. fluorescent

## Understanding Concepts

- How do electric and magnetic fields interact in an electromagnetic wave?
- What behavior of light is evidence for a wave model of light?
- Why are infrared rays useful in search-and-rescue operations?
- How are ultraviolet rays harmful? How can they be helpful?
- X-rays can take pictures of your bones but visible light cannot. Explain why.
- Explain why you can see through the glass walls of the terrarium below.



- How do polarized sunglasses work?
- What does a prism do to white light?
- How are the secondary colors of light related to the primary colors?
- What are complementary colors of pigments?
- When mixing colors of light, why does combining a secondary color with its complementary color give white light?
- Explain why fluorescent lights are more efficient than incandescent lights.
- Explain how laser light is different from ordinary visible light.
- What is the purpose of halogen gas in a tungsten-halogen lamp?



## Critical Thinking

25. **Comparing and Contrasting** How are microwaves and infrared rays similar? How are they different?
26. **Applying Concepts** How does the frequency of a car's returning radar signal change if the car moves away from the radar source?
27. **Applying Concepts** What color would the sunset be if you observed it on the moon? (*Hint: the moon has no atmosphere.*)
28. **Comparing and Contrasting** List the three primary colors of light and the three primary colors of pigments. What is the result if the three primary colors of light are mixed? What is the result if the three primary colors of pigments are mixed?

Use the illustration below to answer Questions 29–31.



29. **Interpreting Photos** Describe each combination of colors in A, B, and C.
30. **Applying Concepts** If you had green paint, such as produced in mixture A in the illustration, what is the fewest number of colors you could mix with it to get black? What would the color or colors be?
31. **Predicting** What color would you expect to make if you combined cyan and yellow from A, magenta and yellow from B, and only the magenta from C? Explain why.
32. **Inferring** Why might it be unsafe to look directly at laser light?

## Math Skills

33. **Calculating** An FM radio station broadcasts on a frequency of 91 MHz. What is the wavelength of the wave that carries the coded information?
34. **Calculating** What is the frequency of a microwave that has a wavelength of 0.050 m?
35. **Converting Units** Convert the speed of light to miles per second and miles per hour. (*Hint: 1 mile = 1610 meters*)

## Concepts in Action

36. **Problem Solving** What can you do to ensure even heating of microwaved food? Why does that work?
37. **Predicting** Are you more likely to see a mirage in the desert when the temperature is 32°C or 23°C? Explain why.
38. **Relating Cause and Effect** You are working the lights for a school play. The red jacket on the main character looks red, but her green pants look black. What is happening? How can you make both her jacket and her pants look their true color?
39. **Writing in Science** Write an advertisement for a sunscreen product. Make sure to explain to consumers why ultraviolet rays are dangerous.

## Performance-Based Assessment

**Comparing and Contrasting** Visit a store that sells a variety of light bulbs including incandescent bulbs, tungsten-halogen bulbs, and fluorescent bulbs. Gather information from the packages on price and expected hours of service and display the data in a table. Conclude from your data which kind of bulb provides the most economical lighting for a particular purpose. Write your conclusions in a paragraph and share it with your family and classmates.

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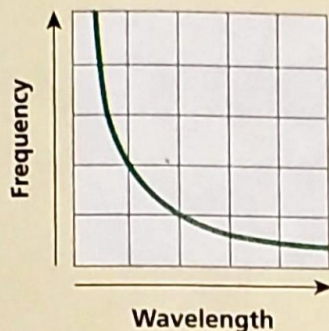


# Standardized Test Prep

## Test-Taking Tip

### Analyzing Data

Some test questions are based on graphs. Take about 20 seconds to scan the graph. Read the labels. Describe the graph to yourself. *The graph gives information on wavelength, from shorter to longer, and frequency, from lower to higher. Use the information to select which choice best answers the question.*



What relationship is represented by the graph?

- (A) Frequency is directly proportional to wavelength.
- (B) Frequency is inversely proportional to wavelength.
- (C) Comparing wavelength and frequency shows photon energy.
- (D) Waves with lower frequencies and longer wavelengths exhibit the photoelectric effect.
- (E) Wavelength is greater than frequency.

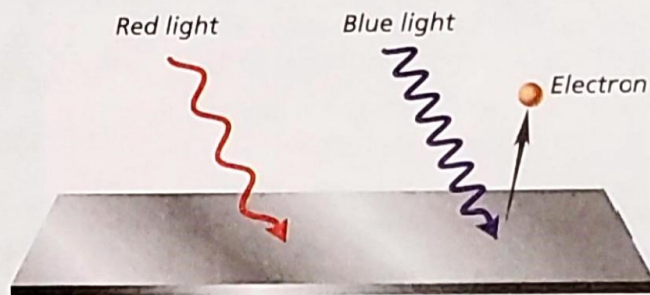
(Answer: B)

Choose the letter that best answers the question or completes the statement.

1. In order of increasing frequency, the electromagnetic waves are radio waves, infrared rays,
- (A) microwaves, visible light, X-rays, and gamma rays.
  - (B) visible light, ultraviolet rays, X-rays, and gamma rays.
  - (C) ultraviolet rays, X-rays, visible light, and radar.
  - (D) gamma rays, X-rays, ultraviolet rays, and visible light.
  - (E) gamma rays, X-rays, visible light, and ultraviolet rays.

2. A light source that emits light partly because of its phosphor coating is
- (A) an incandescent bulb.
  - (B) a tungsten-halogen lamp.
  - (C) a neon tube.
  - (D) a fluorescent tube.
  - (E) a laser.
3. A material that reflects or absorbs all of the light that strikes it is
- (A) translucent.
  - (B) opaque.
  - (C) black.
  - (D) transparent.
  - (E) incandescent.
4. An electromagnetic wave in space has a frequency of  $0.5 \times 10^8$  Hz. Its wavelength is
- (A) 0.6 m.
  - (B) 6 m.
  - (C) 60 m.
  - (D) 600 m.
  - (E) 6000 m.

Both a source of red light and a source of blue light shine on a metal, as shown in the diagram below.



5. What scientific concept does the diagram represent?
- (A) interference
  - (B) the photoelectric effect
  - (C) polarization
  - (D) diffuse reflection
  - (E) refraction
6. Why was no electron emitted when the red light hit the metal?
- (A) Photons of red light have too little energy.
  - (B) There were not enough photons available.
  - (C) All electrons had already been emitted when the blue light hit the metal.
  - (D) Red light is absorbed by metal.
  - (E) Red light is reflected by metal.