

1. Light rays consist of _____.
 - (A) magnetic waves alone
 - (B) electrical waves alone
 - (C) magnetic and electrical waves
 - (D) microwaves
 - (E) an electron in motion

2. Electromagnetic rays that are not in the visible range include gamma rays, radio waves, ultraviolet rays, and infrared rays. Arrange these rays from lowest energy to highest energy.
 - (A) gamma rays, radio waves, ultraviolet rays, infrared rays
 - (B) radio waves , infrared rays, ultraviolet rays, gamma rays
 - (C) ultraviolet rays, infrared rays, radio rays, gamma rays
 - (D) gamma rays, ultraviolet rays, infrared rays, radio rays
 - (E) radio waves, ultraviolet rays, infrared rays, gamma rays

3. Arrange gamma rays, radio waves, ultraviolet rays, and infrared rays in order of speed through a vacuum.
 - (A) gamma rays, ultraviolet waves, infrared rays, radio rays
 - (B) gamma rays, infrared rays, ultraviolet rays, radio rays
 - (C) gamma rays, radio rays, ultraviolet rays, infrared rays
 - (D) ultraviolet rays, gamma rays, infrared rays, radio rays
 - (E) all of their speeds through a vacuum are equal

4. Radio waves at 90 Mhz (mega hertz) _____.
 - (A) cause air molecules to move back and forth at 90 Mhz
 - (B) cause electrons in the antennas to move back and forth at 90 Mhz
 - (C) cause the magnetic field inside an antenna to vibrate at 90 Mhz
 - (D) cause the bias current in the antenna to alternate at 90 Mhz
 - (E) cause electromagnetic waves in the antenna to alternate at 90 Mhz

5. Which statement about ultraviolet and infrared electromagnetic waves is true?
 - (A) They travel at different speeds through outer space.
 - (B) They are both invisible to the human eye.
 - (C) Ultraviolet rays have longer wavelengths than infrared light rays.
 - (D) Infrared light rays have a higher frequency than ultraviolet light rays.
 - (E) Infrared light rays are higher energy than ultraviolet light rays.

6. When white light strikes a green object _____.
 - (A) the green photons in the white light bounce off the object without being absorbed.
 - (B) all the photons in the white light are absorbed and the green photons are re-emitted.
 - (C) the green photons are absorbed and all the other photons are reflected away.
 - (D) green photons in the object are activated and released.

7. When light traveling through a vacuum enters a transparent medium, the light slows down. Why does it slow down?

- (A) The magnetic field within the medium opposes the movement of electromagnetic waves through the medium.
- (B) The electrical field around electrons in the transparent medium causes light rays to slow down.
- (C) A light ray strikes an atom and boosts the atoms' electron to a higher orbit. The re-emitted light ray continues on at a speed slower than the speed of light in a vacuum.
- (D) A light ray strikes an atom and boosts the atom's electron to a higher orbit. The re-emitted light ray continues on at the speed of light in a vacuum until it strikes another atom.

8. The index of refraction for a diamond is 2.42. The speed of light in a vacuum is 3 times ten to the 8 $\frac{m}{sec}$. What is the speed of light through a diamond?

- (A) $1.72 \times 10^7 \frac{m}{sec}$
- (B) $3.45 \times 10^7 \frac{m}{sec}$
- (C) $6.71 \times 10^7 \frac{m}{sec}$
- (D) $9.57 \times 10^7 \frac{m}{sec}$
- (E) $1.24 \times 10^8 \frac{m}{sec}$

9. Higher energy blue light is better able to boost electrons to a higher orbit than lower energy red light. Because of this, _____.

- (A) blue light passes through a transparent medium faster than red light
- (B) blue light passes through a transparent medium slower than red light
- (C) blue light and red light pass through a transparent medium at the same speed
- (D) the transparent medium has a higher index of refraction for blue light than for red light
- (E) B and D are both correct.

10. When a photon passes from the air into water, which property of the photon does not change?

- (A) speed
- (B) direction
- (C) wavelength
- (D) frequency
- (E) interference

11. Heating a substance like sodium causes it to emit orange-yellow light. What happens when that light is passed through a prism?

- (A) A single band of yellow light is seen.
- (B) More than one band of yellow-orange light is seen.
- (C) A single black band is seen in the yellow-orange end of the spectrum.
- (D) More than one black band is seen in the yellow end of the spectrum.

12. White light passing through a prism is made up of a continuous spectrum of colors.

- (A) True
- (B) False

13. Sunlight passing through a hot gas, when seen through a spectrometer, produces specific black absorption bands.

- (A) True
- (B) False