1. Which statement concerning the polarization of electromagnetic waves is FALSE?
   (A) Ordinary lighting sources produce unpolarized light
   (B) The direction of polarization of an electromagnetic wave is taken to be the direction in which the electric field vibrates
   (C) In unpolarized light, the electric field is randomly oriented about the direction of wave propagation
   (D) No light will be transmitted if unpolarized light falls on two polarizing sheets that have their polarization axes parallel
   (E) Unpolarized light that is reflected from a metal surface will be polarized.

2. Which statement concerning diffraction is FALSE:
   (A) it is due to interference of waves
   (B) it causes waves to spread out as they go around objects
   (C) when a laser passes through a diffraction grating, a pattern of bright spots and dark regions are formed
   (D) diffraction occurs for light and sound waves but not for water waves

3. What is the speed of light in a substance that has an index of refraction of 1.5?
   (A) 2×10^8 m/s
   (B) 3×10^8 m/s
   (C) 1×10^8 m/s
   (D) 1.5×10^8 m/s

4. The phenomenon responsible for the formation of a spectrum of colors when white light passes through a prism is
   (A) reflection
   (B) refraction
   (C) dispersion
   (D) diffraction
   (E) polarization

5. A ray of light enters a piece of glass at normal incidence as shown. What properties of light change when the light enters the glass?
   (A) frequency and wavelength
   (B) wavelength and speed
   (C) speed and frequency
   (D) speed, wavelength and frequency
6. Consider the following statements concerning mirrors and lenses:
   1. A plane mirror produces a real image
   2. A plane mirror produces a virtual image
   3. A concave mirror focuses parallel light rays to a point
   4. A convex mirror focuses parallel light rays to a point
   5. Satellite dishes are concave mirrors
   6. A diverging lens focuses parallel rays to a point
   7. A converging lens can be used as a magnifying lens
   8. A converging lens is thinner in the center and thicker at the edges

   (A) 2, 3, 5, and 7 are TRUE
   (B) 2, 3, 5, 6, and 7 are FALSE
   (C) 1, 2, 4 and 8 are FALSE
   (D) 1, 5, 6, and 7 are TRUE; 2, 3, 4 and 8 are FALSE
   (E) 2, 4, 6, and 8 are TRUE; 1, 3, 5, and 7 are FALSE

7. Which of the following diagrams correctly illustrate how convex and concave lenses work?

   (A) 1 and 2
   (B) 2 and 3
   (C) 1 and 3
   (D) 3 and 4

8. The term used to describe the bending of light upon entering a medium
   (A) reflection
   (B) refraction
   (C) dispersion
   (D) diffraction

9. Laser light is characterized as being
   (A) coherent
   (B) single wavelength
   (C) polarized
   (D) tightly collimated
   (E) all of the above
10. Light incident at a 30 degree angle to the normal is reflected by a mirror, as shown in the schematic diagram below. What is the angle between the incident and reflected rays?

(A) 30°
(B) 15°
(C) 60°
(D) 90°

11. Which of the diagrams below correctly illustrates the reflection of light from a convex and concave mirror?

(A) 1 and 3
(B) 2 and 3
(C) 1 and 4
(D) 2 and 4

12. The diagram below illustrates image formation by a diverging lens. Describe the properties of this image.

(A) real, upright, diminished
(B) virtual, upright, diminished
(C) virtual, inverted, enlarged

13. The diagram illustrates image formation by a converging lens. Describe the properties of this image.

(A) real, upright, diminished
(B) virtual, upright, diminished
(C) real, inverted, enlarged

14. The diagram illustrates image formation by a converging lens. Describe the properties of this image.

(A) real, upright, diminished
(B) virtual, upright, enlarged
(C) virtual, inverted, enlarged
15. Color depends on which characteristic of light?
   (A) frequency
   (B) wavelength
   (C) both (A) and (B)
   (D) neither (A) nor (B)
   (E) speed of light

16. Which statements are true concerning lenses used to correct vision problems?
   1. a diverging lens is used to correct nearsightedness
   2. a converging lens is used to correct nearsightedness
   3. a diverging lens is used to correct farsightedness
   4. a converging lens is used to correct farsightedness
   (A) 1 and 3
   (B) 2 and 4
   (C) 1 and 4
   (D) 2 and 3

17. A radioactive source produces alpha, beta and gamma rays. Which type of radiation will not be deflected by a magnet?
   (A) alpha
   (B) beta
   (C) gamma
   (D) all three will be deflected

18. Seaborgium-266 is a radioactive isotope that has a half-life of 30 seconds. If there are 16,000 radioactive Seaborgium-266 nuclei now, how long would it take for the number of radioactive Seaborgium-266 nuclei to decrease to 1000?
   (A) 30 seconds
   (B) 1 minute
   (C) 1.5 minutes
   (D) 2 minutes
   (E) 2.5 minutes

19. How many protons and neutrons are in Silver-110, \(^{110}_{47}Ag\)?
   (A) 63 protons, 110 neutrons
   (B) 85 protons, 37 neutrons
   (C) 47 protons, 63 neutrons
   (D) 85 protons, 48 neutrons
   (E) 58 protons, 73 neutrons

20. An infrared photon has a wavelength of 1 micron (10^{-6} m). Does this photon have more or less energy than a green photon of frequency 5 \times 10^{14} Hz?
   (A) more
   (B) less
   (C) they have the same energy
21. What type of light is most likely to produce photoelectrons?
   (A) white light
   (B) blue light
   (C) polarized light
   (D) red light
   (E) unpolarized light

22. Deuterium and tritium are both
   (A) forms of hydrogen
   (B) isotopes of the same element
   (C) both of these
   (D) none of these

23. The observation of the line spectra of atoms was important because it showed that
   (A) radiation was emitted only in discreet amounts
   (B) electrons in atoms radiated continuously
   (C) atoms of different masses all had identical radiation spectra
   (D) none of the radiation emitted by atoms was in the visible part of the spectrum

24. The first atomic weapon produced was based on the principle of
   (A) nuclear fission
   (B) nuclear fusion
   (C) cold fusion
   (D) big bang theory

25. The role of the neutrons in the nucleus is
   (A) keep the protons from touching each other
   (B) provide negative mass
   (C) provide more nuclear force
   (D) provide negative charge to hold the protons in
   (E) provide companionship for the protons
The Final Exam (Exam 4) will be on FRIDAY MAY 11
From 3 – 5 PM in LR1 VAN

ANSWERS

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