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## AP REVIEW 3

## Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.
$\qquad$ 1. For a mass hanging from a spring, the maximum displacement the spring is stretched or compressed from its equilibrium position is its
a. amplitude.
c. frequency.
b. period.
d. acceleration.
$\qquad$ 2. Which of the following is the number of cycles or vibrations per unit of time?
a. amplitude
c. frequency
b. period
d. revolution
$\qquad$ 3. By what factor should the length of a simple pendulum be changed if the period of vibration were to be tripled?
a. 3
b. 6
c. 9
d. 27
$\qquad$ 4. A mass on a spring vibrates in simple harmonic motion at an amplitude of 8.0 cm . If the mass of the object is 0.20 kg and the spring constant is $130 \mathrm{~N} / \mathrm{m}$, what is the frequency?
a. 1.5 Hz
b. 8.7 Hz
c. $\quad 4.0 \mathrm{~Hz}$
d. $\quad 1.6 \mathrm{~Hz}$
$\qquad$ 5. Which of the following is a single nonperiodic disturbance?
a. pulse wave
c. sine wave
b. periodic wave
d. transverse wave
$\qquad$ 6. A musical tone sounded on a piano has a frequency of 410 Hz and a wavelength of 0.80 m . What is the speed of the sound wave?
a. $\quad 170 \mathrm{~m} / \mathrm{s}$
b. $240 \mathrm{~m} / \mathrm{s}$
c. $\quad 330 \mathrm{~m} / \mathrm{s}$
d. $\quad 590 \mathrm{~m} / \mathrm{s}$
$\qquad$ 7. Bats can detect small objects, such as insects, that are approximately the size of one wavelength. If a bat emits a chirp at a frequency of 60.0 kHz and the speed of sound waves in air is $330 \mathrm{~m} / \mathrm{s}$, what is the size of the smallest insect that the bat can detect?
a. $\quad 1.5 \mathrm{~mm}$
b. $\quad 3.5 \mathrm{~mm}$
c. $\quad 5.5 \mathrm{~mm}$
d. 7.5 mm
8. The superposition of mechanical waves can be observed in the movement of
a. bumper cars.
c. electromagnetic radiation.
b. waves in a ripple tank.
d. an orchestra.

9. In the diagram above, use the superposition principle to find the resultant wave of waves X and Y .
a. a
c. c
b. b
d. d
10. The trough of the sine curve used to represent a sound wave corresponds to
a. condensation.
b. rarefaction.
c. the point where molecules vibrate at a right angle to the direction of wave travel.
d. a region of low elasticity.
11. Which of the following are series of compressions in graphical representations of spherical and plane waves?
a. wavelength
c. rays
b. source
d. wave fronts
12. Which portion of the electromagnetic spectrum is used in a television?
a. infrared waves
c. radio waves
b. microwaves
d. gamma waves
13. Which portion of the electromagnetic spectrum is used in a microscope?
a. infrared waves
c. visible light
b. gamma rays
d. ultraviolet light
14. Which portion of the electromagnetic spectrum is used to sterilize medical instruments?
a. infrared waves
c. X rays
b. microwaves
d. ultraviolet light
15. Snow reflects almost all of the light incident upon it. However, a single beam of light is not reflected in the form of parallel rays. This is an example of $\qquad$ reflection off of a $\qquad$ surface.
a. regular; rough
c. diffuse; specular
b. regular; specular
d. diffuse; rough
16. If a light ray strikes a flat mirror at an angle of $27^{\circ}$ from the normal, the reflected ray will be
a. $\quad 27^{\circ}$ from the mirror's surface.
b. $\quad 27^{\circ}$ from the normal.
c. $90^{\circ}$ from the mirror's surface.
d. $63^{\circ}$ from the normal.
17. If a light ray strikes a flat mirror at an angle of $30^{\circ}$ from the normal, the ray will be reflected at an angle of
a. $30^{\circ}$ from the mirror's surface.
b. $60^{\circ}$ from the mirror's surface.
c. $60^{\circ}$ from the normal.
d. $90^{\circ}$ from the normal.
18. When the reflection of an object is seen in a flat mirror, the distance from the mirror to the image depends on
a. the wavelength of light used for viewing.
b. the distance from the object to the mirror.
c. the distance of both the observer and the object to the mirror.
d. the size of the object.
19. If a virtual image is formed 10.0 cm along the principal axis from a convex mirror with a focal length of -15.0 cm , what is the object's distance from the mirror?
a. $\quad 30.0 \mathrm{~cm}$
b. 12 cm
c. $\quad 6.0 \mathrm{~cm}$
d. $\quad 3.0 \mathrm{~cm}$
20. Which best describes the image of a concave mirror when the object's distance from the mirror is less than the focal-point distance?
a. virtual, upright, and magnification greater than one
b. real, inverted, and magnification less than one
c. virtual, upright, and magnification less than one
d. real, inverted, and magnification greater than one
21. A parabolic mirror, instead of a spherical mirror, can be used to reduce the occurrence of which effect?
a. spherical aberration
c. chromatic aberration
b. mirages
d. light scattering

22. Which pair of glasses is best suited for automobile drivers? The transmission axes are shown by straight lines on the lenses. (Hint: The light reflects off the hood of the car.)
a. A
c. C
b. B
d. D
23. When a light ray passes from water $(n=1.333)$ into diamond $(n=2.419)$ at an angle of $45^{\circ}$, its path is
a. bent toward the normal.
c. parallel to the normal.
b. bent away from the normal.
d. not bent.
24. An object is placed 40.0 cm from a converging lens along the axis of the lens. If a virtual image forms at a distance of 50.0 cm from the lens on the same side as the object, what is the focal length of the lens?
a. $\quad 22.0 \mathrm{~cm}$
b. $\quad 45.0 \mathrm{~cm}$
c. $\quad 90.0 \mathrm{~cm}$
d. $\quad 2.00 \mathrm{~m}$
25. An object that is 18 cm from a converging lens forms a real image 22.5 cm from the lens. What is the magnification of the image?
a. -1.25
b. 1.25
c. -0.80
d. 0.80
26. At the first dark band in a single-slit diffraction pattern, the path lengths of selected pairs of wavelets differ by
a. one wavelength.
c. one-half wavelength.
b. more than one wavelength.
d. less than half of one wavelength.
27. How much energy does a photon of red light that has a wavelength of 640 nm contain?
$\left(h=6.63 \times 10^{-34} \mathrm{~J} \bullet s ; 1 \mathrm{eV}=1.6 \times 10^{-19} \mathrm{~J}\right)$
a. $\quad 3.2 \mathrm{eV}$
b. $\quad 2.5 \mathrm{eV}$
c. $\quad 1.9 \mathrm{eV}$
d. $\quad 1.3 \mathrm{eV}$
28. A monochromatic light beam with a quantum energy value of 3.0 eV is incident upon a photocell. The work function of the target metal is 1.60 eV . What is the maximum kinetic energy of ejected electrons?
a. $\quad 4.6 \mathrm{eV}$
b. $\quad 4.8 \mathrm{eV}$
c. $\quad 1.4 \mathrm{eV}$
d. $\quad 2.4 \mathrm{eV}$
29. Blue light with a wavelength of 460 nm is incident on a piece of potassium. The work function of potassium is 2.2 eV . What is the maximum kinetic energy of the ejected photoelectrons? $\left(h=6.63 \times 10^{-34} \mathrm{~J} \bullet \mathrm{~s} ; c\right.$ $=3.00 \times 10^{8} \mathrm{~m} / \mathrm{s} ; 1 \mathrm{eV}=1.60 \times 10^{-19} \mathrm{~J}$ )
a. $\quad 1.0 \mathrm{eV}$
b. $\quad 0.50 \mathrm{eV}$
c. 0.25 eV
d. $\quad 4.9 \mathrm{eV}$
30. A sodium surface is illuminated with light that has a frequency of $1.00 \times 10^{15} \mathrm{~Hz}$. The threshold frequency of sodium is $5.51 \times 10^{14} \mathrm{~Hz}$. The maximum kinetic energy of the photoelectrons is 1.86 eV . What is the work function of sodium?
a. $\quad 1.90 \mathrm{eV}$
b. 2.08 eV
c. $\quad 2.28 \mathrm{eV}$
d. $\quad 3.23 \mathrm{eV}$
31. The dark lines in the absorption spectrum of an element can be accounted for by the
a. absorption of photons that occurs when electrons jump from a higher-energy state to a lower-energy state.
b. emission of photons that occurs when electrons jump from a higher-energy state to a lower-energy state.
c. absorption of photons that occurs when electrons jump from a lower-energy state to a higher-energy state.
d. emission of photons that occurs when electrons jump from a lower-energy state to a higher-energy state.
32. What is the de Broglie wavelength for a proton that has a mass of $1.67 \times 10^{-27} \mathrm{~kg}$ and is moving at a speed of $5.0 \times 10^{-5} \mathrm{~m} / \mathrm{s} ?\left(h=6.63 \times 10^{-34} \mathrm{~J} \bullet \mathrm{~s}\right)$
a. $\quad 1.1 \times 10^{12} \mathrm{~m}$
b. $\quad 4.2 \times 10^{-13} \mathrm{~m}$
c. $\quad 1.8 \times 10^{12} \mathrm{~m}$
d. $\quad 7.9 \times 10^{-13} \mathrm{~m}$
33. According to Heisenberg, as soon as the exact location of an electron is known, its
a. exact momentum is known.
c. momentum becomes uncertain.
b. energy becomes stabilized.
d. direction becomes stabilized.
34. If the stable nuclei are plotted with neutron number versus proton number, the curve formed by the stable nuclei does not follow the line $N=\mathrm{Z}$. This is predicted by examining how the binding energy is influenced by
a. the volume of the nucleus.
c. the Coulomb repulsive force.
b. the size of the nuclear surface.
d. the proton-neutron mass difference.
35. What is the binding energy per nucleon of the tritium nucleus, ${ }_{1}^{3} \mathrm{H}$ ? ( $c^{2}=931.50 \mathrm{MeV} / \mathrm{u}$; atomic masses:
${ }_{1}^{3} \mathrm{H}=3.016049 \mathrm{u} ;{ }_{1}^{1} \mathrm{H}=1.007825 \mathrm{u} ; m_{n}=1.008665 \mathrm{u}$ )
a. $\quad 2.243 \mathrm{MeV} /$ nucleon
b. $\quad 2.454 \mathrm{MeV} /$ nucleon
c. $\quad 2.827 \mathrm{MeV} /$ nucleon
d. $2.196 \mathrm{MeV} /$ nucleon
36. The components of natural radiation, in order from least to most penetrating, are
a. alpha, beta, and gamma.
c. beta, gamma, and alpha.
b. gamma, beta, and alpha.
d. alpha, gamma, and beta.
37. Radium- 226 decays to radon- 222 by emitting
a. beta particles.
c. gamma particles.
b. alpha particles.
d. positrons.
38. How is a fission reactor different from a fusion reactor?
a. The fuel is cheaper.
c. There is less radioactive waste.
b. The fuel must be processed.
d. The transportation of fuel is safer.
39. Which of the following is an example of a baryon?
a. meson
c. lepton
b. electron
d. proton and neutron
40. Hadrons are composed of
a. leptons.
c. mesons, baryons, and antibaryons.
b. electrons.
d. neutrinos.

## AP REVIEW 3

Answer Section

## MULTIPLE CHOICE

1. A
2. C
3. C
4. C
5. A
6. C
7. C
8. B
9. A
10. B
11. D
12. C
13. C
14. D
15. D
16. B
17. B
18. B
19. A
20. A
21. A
22. C
23. A
24. D
25. A
26. C
27. C
28. C
29. B
30. C
31. C
32. D
33. C
34. C
35. C
36. A
37. B
38. B
39. A

ID: A
40. C

