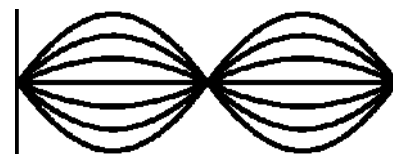


(Through electric circuits)

1. A simple pendulum swings in simple harmonic motion. At maximum displacement,
 - A. the acceleration reaches a maximum.
 - B. the velocity reaches a maximum.
 - C. the acceleration reaches zero.
 - D. the restoring forces reach zero.
2. If a force of 50 N stretches a spring 0.10 m, what is the spring constant?
 - A. 5 N/m
 - B. 500 N/m
 - C. -5 N/m
 - D. -500 N/m
3. Which of the following is the time it takes to complete a cycle of motion?
 - A. amplitude
 - B. period
 - C. frequency
 - D. revolution
4. Which of the following is the number of cycles or vibrations per unit of time?
 - A. amplitude
 - B. period
 - C. frequency
 - D. revolution
5. What is the period of a 4.12 m long pendulum?
 - A. 0.648 s
 - B. 2.04 s
 - C. 4.07 s
 - D. 9.69 s
6. A periodic wave has a wavelength of 0.50 m and a speed of 20 m/s. What is the wave frequency?
 - A. 0.02 Hz
 - B. 20 Hz
 - C. 40 Hz
 - D. 10 Hz
7. 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. 170 m/s
 - B. 240 m/s
 - C. 330 m/s
 - D. 590 m/s
8. 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 m/s, what is the size of the smallest insect that the bat can detect?
 - A. 1.5 mm
 - B. 3.5 mm
 - C. 5.5 mm
 - D. 7.5 mm
9. Waves propagate along a stretched string at a speed of 8.0 m/s. The end of the string vibrates up and down once every 1.5 s. What is the wavelength of the waves traveling along the string?
 - A. 3.0 m
 - B. 12 m
 - C. 6.0 m
 - D. 5.3 m
10. Standing waves are produced by periodic waves of
 - A. any amplitude and wavelength traveling in the same direction.
 - B. the same amplitude and wavelength traveling in the same direction.
 - C. any amplitude and wavelength traveling in opposite directions.
 - D. the same frequency, amplitude, and wavelength traveling in opposite directions.
11. How many nodes and antinodes are shown in the standing wave to the right?
 - A. two nodes and three antinodes
 - B. three nodes and one antinode
 - C. one node and two antinodes
 - D. three nodes and two antinodes
12. Sound waves
 - A. are a part of the electromagnetic spectrum.
 - B. do not require a medium for transmission.
 - C. are longitudinal waves.
 - D. are transverse waves.
13. Which of the following is the region of a longitudinal wave in which the density and pressure are less than normal?
 - A. rarefaction
 - B. compression
 - C. spherical wave
 - D. Doppler effect
14. Which statement about sound waves is correct?
 - A. They generally travel faster through solids than through gases.
 - B. They generally travel faster through gases than through solids.
 - C. They generally travel faster through gases than liquids.
 - D. They generally travel faster than light.
15. Humans are able to hear sounds approximately in what range?



A. 40 Hz – 4000Hz B. 20kHz – 8,000MHz C. 100Hz – 100,000 Hz D. 20Hz – 20kHz

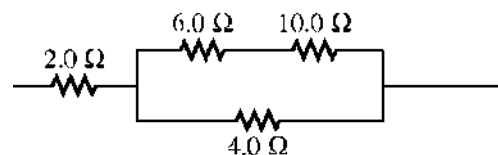
16. A hawk is flying at top speed towards a video camera, which records the hawk screeching loudly. An ornithologist measures the sound on the recording and calculates a frequency of 1800Hz. The actual frequency the hawk screeched at was most likely
 - A. 1900 Hz, which was reduced because the sound waves were slowed down.
 - B. 1800 Hz, because the Doppler effect is corrected by the camera.
 - C. 1700 Hz, because the Doppler effect made the observed frequency higher.
 - D. 1850 Hz, because the Doppler effect lengthened the actual wavelength.
17. A sound wave will resonate in a pipe if the displacement has a node at a closed end and an antinode at an open end. If a pipe is open at one end, which of these lengths can the pipe have to allow a standing wave to form?
 - A. λ
 - B. $\lambda/2$
 - C. $\lambda/4$
 - D. $\lambda/5$
18. Beats occur when two waves have
 - A. the same frequency and different speeds
 - B. the same number of nodes and antinodes
 - C. different frequencies and wavelengths
 - D. both transverse and longitudinal modes
19. What is the wavelength of microwaves of 3.0×10^9 Hz frequency?
 - A. 0.060 m
 - B. 0.10 m
 - C. 10 m
 - D. 110 nm
20. What is the frequency of infrared light of 1.0×10^{-4} wavelength?
 - A. 3.0×10^{-2} Hz
 - B. 3.0×10^4 Hz
 - C. 3.0×10^{12} Hz
 - D. 3.0×10^2 Hz
21. Yellow-green light has wavelength of 560 nm. What is its frequency?
 - A. 5.4×10^{16} Hz
 - B. 1.9×10^{-15} Hz
 - C. 5.4×10^{11} Hz
 - D. 5.4×10^{14} Hz
22. In a vacuum, electromagnetic radiation of short wavelengths travels
 - A. as fast as radiation of long wavelengths.
 - C. faster than radiation of long wavelengths.
 - B. slower than radiation of long wavelengths.
 - D. both faster and slower than radiation of long wavelengths.
23. In a double-slit interference pattern the path length from one slit to the first dark fringe of a double-slit interference pattern is longer than the path length from the other slit to the fringe by
 - A. three-quarters of a wavelength.
 - C. one-quarter of a wavelength.
 - B. one-half of a wavelength.
 - D. one full wavelength.
24. In Young's double-slit experiment, a wave from one slit arrives at a point on a screen exactly one wavelength behind the wave from the other slit. What is observed at that point?
 - A. dark fringe from destructive interference
 - B. bright fringe from constructive interference
 - C. multicolored fringe from dispersion
 - D. gray fringe, neither dark nor bright
25. What happens when a rubber rod is rubbed with a piece of fur, giving it a negative charge?
 - A. Protons are removed from the rod.
 - C. The fur is also negatively charged.
 - B. Electrons are added to the rod.
 - D. The fur is left neutral.
26. When a glass rod is rubbed with silk and becomes positively charged,
 - A. electrons are removed from the rod.
 - C. protons are added to the silk.
 - B. protons are removed from the silk.
 - D. the silk remains neutral.
27. Which sentence best characterizes electric conductors?
 - A. They have low mass density.
 - C. They have high tensile strength
 - B. They are poor heat conductors.
 - D. They have electric charges that move freely.
28. Which sentence best characterizes electric insulators?
 - A. Charges on their surface do not move.
 - C. Electric charges move freely in them.
 - B. They have high tensile strength
 - D. They are good heat conductors.
29. If two point charges are separated by 1.5 cm and have charge values of $2.0 \mu\text{C}$ and $-4.0 \mu\text{C}$, respectively, what is the value of the mutual force between them? ($k_c = 8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$) ($\mu = \text{micro} = 10^{-6}$)
 - A. 320 N
 - B. 4.8 N
 - C. 0.048 N
 - D. 0.032 N

30. A wire carries a steady current of 0.1 A over a period of 20 s. What total charge moves through the wire in this time interval?
 A. 200 C B. 20 C C. 2 C D. 0.005 C
31. What is the potential difference across a resistor of $5.0\ \Omega$ that carries a current of 5.0 A?
 A. 125 V B. 25 V C. 4.0 V D. 1.0 V
32. A flashlight bulb with a potential difference of 4.5 V across it has a resistance of $8.0\ \Omega$. How much current is in the bulb filament?
 A. 3.7 A B. 1.8 A C. 9.4 A D. 0.56 A
33. The power ratings on light bulbs are measures of the
 A. rate that they give off heat and light. C. density of the charge carriers.
 B. voltage they require. D. total amount of negative charge in the filament
34. If a 75 W light bulb operates at a voltage of 120 V, what is the current in the bulb?
 A. 0.63 A B. 1.6 A C. 9.0×10^3 A D. 1.1×10^{-4} A
35. If a 5.00×10^2 W heater has a current of 4.00 A, what is the potential difference across the ends of the heating element?
 A. 2.00×10^3 V B. 125 V C. 2.50×10^2 V D. 8.00×10^{-3} V
36. If a 325 W heater has a current of 6.0 A, what is the resistance of the heating element?
 A. $88\ \Omega$ B. $54\ \Omega$ C. $9.0\ \Omega$ D. $11\ \Omega$
37. If a lamp has a resistance of $120\ \Omega$ when it operates at a power of 1.00×10^2 W, what is the potential difference across the lamp?
 A. 110 V B. 120 V C. 130 V D. 220 V
38. An electric toaster requires 1100 W at 110 V. What is the resistance of the heating coil?
 A. $0.091\ \Omega$ B. $9.0\ \Omega$ C. $1.0 \times 10^1\ \Omega$ D. $11\ \Omega$
39. Three resistors with values of $4.0\ \Omega$, $6.0\ \Omega$, and $8.0\ \Omega$, respectively, are connected in series. What is their equivalent resistance?
 A. $18\ \Omega$ B. $6\ \Omega$ C. $0.54\ \Omega$ D. $1.8\ \Omega$
40. Three resistors connected in series carry currents labeled I_1 , I_2 , and I_3 , respectively. Which of the following expresses the total current, I_t , in the system made up of the three resistors in series?
 A. $I_t = I_1 + I_2 + I_3$ C. $I_t = I_1 = I_2 = I_3$
 B. $I_t = (1/I_1 + 1/I_2 + 1/I_3)$ D. $I_t = (1/I_1 + 1/I_2 + 1/I_3)^{-1}$
41. Three resistors connected in series have voltages labeled ΔV_1 , ΔV_2 , and ΔV_3 . Which of the following expresses the total voltage taken over the three resistors together?
 A. $\Delta V_t = \Delta V_1 + \Delta V_2 + \Delta V_3$ C. $\Delta V_t = \Delta V_1 = \Delta V_2 = \Delta V_3$
 B. $\Delta V_t = (1/\Delta V_1 + 1/\Delta V_2 + 1/\Delta V_3)$ D. $\Delta V_t = (1/\Delta V_1 + 1/\Delta V_2 + 1/\Delta V_3)^{-1}$
42. Three resistors with values of $4.0\ \Omega$, $6.0\ \Omega$, and $10.0\ \Omega$ are connected in parallel. What is their equivalent resistance?
 A. $20.0\ \Omega$ B. $6.7\ \Omega$ C. $0.52\ \Omega$ D. $1.9\ \Omega$
43. Three resistors connected in parallel carry currents labeled I_1 , I_2 , and I_3 . Which of the following expresses the total current I_t in the combined system?
 A. $I_t = I_1 + I_2 + I_3$ C. $I_t = I_1 = I_2 = I_3$
 B. $I_t = (1/I_1 + 1/I_2 + 1/I_3)$ D. $I_t = (1/I_1 + 1/I_2 + 1/I_3)^{-1}$
44. Three resistors connected in parallel have voltages labeled ΔV_1 , ΔV_2 , and ΔV_3 . Which of the following expresses the total voltage across the three resistors?
 A. $\Delta V_t = \Delta V_1 + \Delta V_2 + \Delta V_3$ C. $\Delta V_t = \Delta V_1 = \Delta V_2 = \Delta V_3$
 B. $\Delta V_t = (1/\Delta V_1 + 1/\Delta V_2 + 1/\Delta V_3)$ D. $\Delta V_t = (1/\Delta V_1 + 1/\Delta V_2 + 1/\Delta V_3)^{-1}$

45. What is the equivalent resistance for the resistors in the figure to the right?

A. $2.3\ \Omega$
B. $5.2\ \Omega$

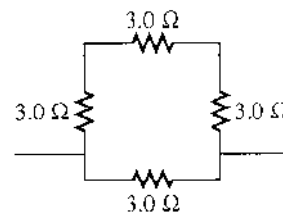
C. $12\ \Omega$
D. $22\ \Omega$



46. What is the equivalent resistance for the resistors in the figure to the right?

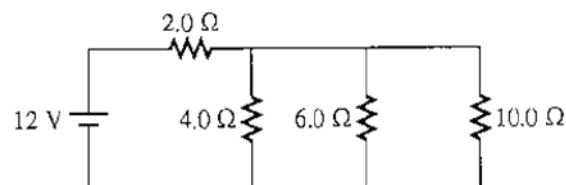
A. $1.3\ \Omega$
B. $2.3\ \Omega$

C. $0.75\ \Omega$
D. $0.44\ \Omega$



47. Three resistors connected in parallel have individual values of $4.0\ \Omega$, $6.0\ \Omega$, and $10.0\ \Omega$, as shown to the right. If this combination is connected in series with a $12.0\ \text{V}$ battery and a $2.0\ \Omega$ resistor, what is the current in the $10.0\ \Omega$ resistor?

A. $0.59\ \text{A}$ B. $1.0\ \text{A}$ C. $11\ \text{A}$ D. $16\ \text{A}$



48. A steam turbine at an electric power plant delivers $4500\ \text{kW}$ of power to an electrical generator that converts 95 percent of this mechanical energy into electrical energy. What is the current delivered by the generator if it delivers energy at $3600\ \text{V}$?

A. $660\ \text{A}$ B. $1320\ \text{A}$ C. $1190\ \text{A}$ D. $1250\ \text{A}$

49. Which of these statements about resistance is not correct?

A. Wires with a larger diameter have a higher resistance.
B. Wires with a greater length have a higher resistance.
C. Wires with a higher resistance allow less current.
D. Wires at a higher temperature have a higher resistance.

50. A student attaches a variety of resistors, one at a time, to a 12-volt voltage supply, and measures the power used by each resistor. The graph of power vs. resistance will look most like which of these?

