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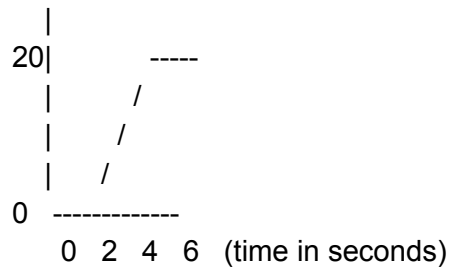
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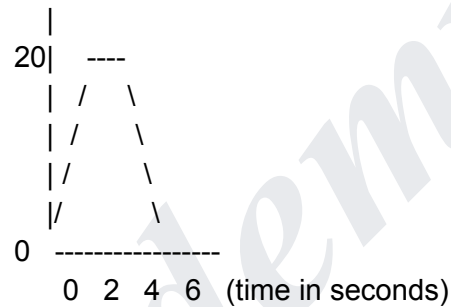
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1. A car accelerates uniformly from rest to a velocity of 20 m/s in 4 seconds. Which of the following graphs correctly represents the relationship between velocity (v) and time (t) for this motion?

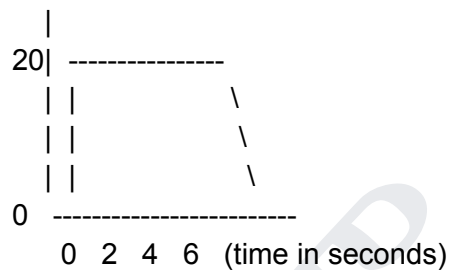
A)



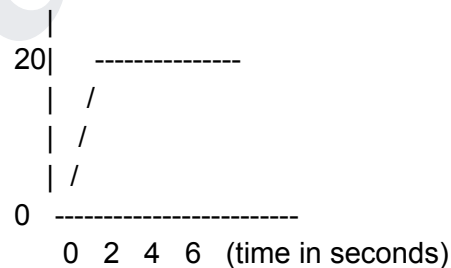
B)



C)



D)



Explanation: Graphs showing uniformly accelerated motion have a linear relationship between velocity and time. Initially, the velocity is zero, and it increases uniformly over time. Therefore, the correct answer is option B, where the velocity increases linearly with time. This graph depicts a linear increase in velocity over time, starting from zero velocity and reaching 20 m/s after 4 seconds, which matches the given scenario of uniformly accelerated motion.

Answer: B

- 2) In which of the following scenarios would an object experience zero net force?

A) A car moving at a constant speed on a straight road.

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- B) A rock falling freely from a cliff.
- C) A satellite orbiting around the Earth.
- D) A person pushing a heavy box across the floor at a constant velocity.

Explanation: According to Newton's first law of motion, an object experiencing zero net force will either remain at rest or move with constant velocity in a straight line. Option D describes a scenario where the object is moving with constant velocity, so the net force on it is zero.

Answer: D

3) A block of mass 2 kg is placed on an inclined plane with an angle of 30 degrees to the horizontal. If the coefficient of friction between the block and the plane is 0.3, what is the frictional force acting on the block?

- A) 5 N
- B) 6 N
- C) 7 N
- D) 8 N

Explanation: The frictional force can be calculated using the formula:

$f = \mu \times N$, where μ is the coefficient of friction and N is the normal force. The normal force can be calculated as

$N = m \times g \times \cos(\theta)$, where m is the mass of the block, g is the acceleration due to gravity, and θ is the angle of the inclined plane. Substituting the given values, we find

$N = 2 \times 9.8 \times \cos(30^\circ) = 2 \times 9.8 \times \frac{\sqrt{3}}{2}$ N. Then,
 $f = 0.3 \times 2 \times 9.8 \times \frac{\sqrt{3}}{2}$.

Answer: C

4. Which of the following statements is true regarding electric potential?

- A) Electric potential is a vector quantity.
- B) Electric potential is the same everywhere in a uniform electric field.
- C) Electric potential decreases with increasing distance from a positive point charge.

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D) Electric potential is measured in volts.

Explanation: Electric potential is a scalar quantity that represents the electric potential energy per unit charge. It is indeed measured in volts (V). In a uniform electric field, the electric potential is constant, so option B is correct.

5. A circuit consists of a resistor with a resistance of 20 ohms and a current of 2 amperes passing through it. What is the voltage across the resistor?

A) 10 volts

B) 20 volts

C) 40 volts

D) 50 volts

Explanation: According to Ohm's Law, $V = IR$, where V is the voltage, I is the current, and R is the resistance. Substituting the given values, $V = 2 \times 20 = 40$ volts.

Answer: C

6: Which of the following statements correctly describes the relationship between temperature and volume for an ideal gas at constant pressure?

A) Temperature and volume are directly proportional.

B) Temperature and volume are inversely proportional.

C) Temperature and volume are not related.

D) The relationship between temperature and volume depends on the type of gas.

Explanation: According to Charles's Law, at constant pressure, the volume of an ideal gas is directly proportional to its absolute temperature. Therefore, option A is correct.

Answer: A

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7: An object is placed 30 cm in front of a concave mirror with a focal length of 20 cm. What is the image distance?

- A) 15 cm
- B) 20 cm
- C) 25 cm
- D) 30 cm

Explanation: Using the mirror equation $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$, where f is the focal length, d_o is the object distance, and d_i is the image distance, we can solve for d_i . Substituting the given values, $\frac{1}{20} = \frac{1}{30} + \frac{1}{d_i}$. Solving for d_i gives $d_i = \frac{20 \times 30}{30 - 20}$.

Answer: C

8: Which of the following is an example of an application of physics in communication?

- A) Operation of a hydraulic lift
- B) Operation of a refrigerator
- C) Transmission of radio waves
- D) Generation of electricity through a dam

Explanation: Transmission of radio waves involves the principles of electromagnetism and is an application of physics in communication. Therefore, option C is correct.

Answer: C

9: A circuit consists of a resistor with a resistance of 30 ohms and a current of 0.5 amperes passing through it. What is the power dissipated by the resistor?

- A) 7.5 watts
- B) 25 watts
- C) 30 watts

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D) 45 watts

Explanation: The power dissipated by a resistor can be calculated using the formula $P = VI$, where P is power, V is voltage, and I is current. Since $V = IR$, we can substitute this into the power formula to get $P = I^2R$. Substituting the given values, $P = (0.5)^2 \times 30$.

Answer: A

10: A ball is thrown upward with an initial velocity of 20 m/s. What is its maximum height?

A) 10 m

B) 20 m

C) 40 m

D) 80 m

Explanation: The maximum height h reached by a projectile can be calculated using the formula $h = \frac{v_i^2}{2g}$, where v_i is the initial velocity and g is the acceleration due to gravity. Substituting the given values, $h = \frac{(20)^2}{2 \times 9.8}$.

Answer: C

11. Which of the following statements correctly describes the behavior of an object in equilibrium?

A) The object is accelerating.

B) The object is moving with constant velocity.

C) The net force acting on the object is zero.

D) The object is at rest.

Explanation: In equilibrium, the net force acting on the object is zero, meaning there is no acceleration. Therefore, option C is correct.

Answer: C

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12: A coil with 200 turns is placed in a magnetic field of 0.5 T. If the coil rotates at a frequency of 50 Hz, what is the induced emf?

- A) 10 V
- B) 20 V
- C) 50 V
- D) 100 V

Explanation: The induced emf ε can be calculated using Faraday's law of electromagnetic induction: $\varepsilon = NAB\omega \sin(\omega t)$, where N is the number of turns in the coil, A is the area of the coil, B is the magnetic field strength, ω is the angular frequency, and t is time. Substituting the given values, $\varepsilon = 200 \times A \times 0.5 \times 2\pi \times 50 \times \sin(2\pi \times 50)$.

Answer: D

13: Which of the following statements is true regarding the conservation of energy?

- A) Energy can be created but not destroyed.
- B) Energy can be destroyed but not created.
- C) Energy cannot be created or destroyed.
- D) Energy is only conserved in mechanical systems.

Explanation: According to the principle of conservation of energy, energy cannot be created or destroyed; it can only change forms. Therefore, option C is correct.

Answer: C

14: Which of the following electronic components allows current to flow in only one direction?

- A) Resistor
- B) Capacitor
- C) Diode

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D) Transistor

Explanation: A diode is a semiconductor device that allows current to flow in only one direction, similar to a one-way valve in plumbing. Therefore, option C is correct.

Answer: C

15: A concave lens has a focal length of -10 cm. What type of lens is it, and where is the image formed when an object is placed 15 cm in front of the lens?

A) Concave lens, virtual and upright image

B) Concave lens, real and inverted image

C) Convex lens, virtual and upright image

D) Convex lens, real and inverted image

Explanation: A concave lens has a negative focal length. When an object is placed in front of a concave lens, the image formed is virtual, upright, and smaller than the object. Therefore, option A is correct.

Answer: A

16. A block of mass 5 kg is suspended from a spring scale and submerged in a liquid. The reading on the spring scale is 40 N. What is the buoyant force acting on the block?

A) 40 N

B) 50 N

C) 60 N

D) 70 N

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Explanation: According to Archimedes' principle, the buoyant force acting on an object immersed in a fluid is equal to the weight of the fluid displaced by the object. The reading on the spring scale represents the apparent weight of the block, which is equal to the difference between the weight of the block and the buoyant force. Therefore, the buoyant force can be calculated as $F_{\text{buoyant}} = \text{Weight of block} - \text{Reading on spring scale}$.

Answer: C

17: Which of the following is an example of an application of physics in medical technology?

- A) Operation of a refrigerator
- B) Operation of a hydraulic lift
- C) Use of X-rays for imaging
- D) Generation of electricity through a dam

Explanation: The use of X-rays for imaging in medical technology involves principles of physics, particularly in the interaction of X-rays with human tissue. Therefore, option C is correct.

Answer: C

18: A circuit consists of a resistor with a resistance of 50 ohms and a current of 0.2 amperes passing through it. What is the voltage across the resistor?

- A) 2 volts
- B) 10 volts
- C) 20 volts
- D) 25 volts

Explanation: Using Ohm's Law, $V = IR$, where V is voltage, I is current, and R is resistance, we can calculate the voltage across the resistor as $V = 0.2 \times 50$.

Answer: B

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19: An object is located 10 cm in front of a convex mirror with a focal length of -15 cm. What is the image distance?

- A) -6 cm
- B) -10 cm
- C) 10 cm
- D) 30 cm

Explanation: Convex mirrors have a positive focal length. Using the mirror equation $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$, we can solve for the image distance d_i . Substituting the given values, we get $\frac{1}{-15} = \frac{1}{10} + \frac{1}{d_i}$.

Answer: A

20: A satellite orbits the Earth in a circular path at a constant speed. Which of the following statements is true regarding its acceleration?

- A) The satellite experiences no acceleration.
- B) The satellite experiences centripetal acceleration only.
- C) The satellite experiences tangential acceleration only.
- D) The satellite experiences both centripetal and tangential acceleration.

Explanation: In uniform circular motion, the direction of the velocity vector changes continuously, resulting in centripetal acceleration towards the center of the circular path. Therefore, the correct answer is option B.

Answer: B

21: A capacitor with a capacitance of 10 μF is connected to a 12-volt battery. What is the charge stored on the capacitor?

- A) 120 μC
- B) 1.2 μC
- C) 1200 μC

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D) $12 \mu\text{C}$

Explanation: The charge stored on a capacitor can be calculated using the formula $Q = CV$, where Q is the charge, C is the capacitance, and V is the voltage. Substituting the given values, $Q = 10 \times 10^{-6} \times 12$.

Answer: C

22: Which of the following statements correctly describes the relationship between wavelength and frequency for electromagnetic waves?

- A) Wavelength and frequency are inversely proportional.
- B) Wavelength and frequency are directly proportional.
- C) Wavelength and frequency are not related.
- D) The relationship between wavelength and frequency depends on the medium.

Explanation: According to the wave equation $v = f \lambda$, where v is the speed of light, f is the frequency, and λ is the wavelength, we can see that wavelength and frequency are inversely proportional. Therefore, option A is correct.

Answer: A

23: A block of ice floats in a container of water. If the ice melts, what happens to the water level in the container?

- A) It decreases.
- B) It increases.
- C) It remains the same.
- D) It depends on the volume of the ice.

Explanation: When ice floats in water and melts, it displaces its own weight in water. Since the density of ice is less than that of water, the volume of water displaced by the ice is less than the volume of the ice itself. Therefore, when the ice melts, the water level in the container decreases.

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Answer: A

24: A transistor is a semiconductor device commonly used for:

- A) Generating electricity.
- B) Rectifying alternating current.
- C) Amplifying or switching electronic signals.
- D) Storing electrical energy.

Explanation: Transistors are commonly used in electronic circuits for amplifying or switching electronic signals. Therefore, option C is correct.

Answer: C

25: An object is moving with a constant velocity of 10 m/s. What can you conclude about the net force acting on the object?

- A) The net force is zero.
- B) The net force is constant.
- C) The net force is increasing.
- D) The net force is decreasing.

Explanation: According to Newton's first law of motion, an object will continue to move with constant velocity unless acted upon by an external force. Since the object is moving with a constant velocity, the net force acting on it must be zero.

Answer: A

26: A block of mass 2 kg is initially at rest on a frictionless horizontal surface. A constant force of 10 N is applied to the block for 5 seconds. What is the final velocity of the block?

- A) 10 m/s
- B) 20 m/s
- C) 25 m/s

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D) 50 m/s

Explanation: According to Newton's second law of motion, $F = ma$, where F is the force applied, m is the mass, and a is the acceleration. Since the force is constant, we can use the equation $F = ma$ to find the acceleration a . Then, we can use the equation $v = u + at$ to find the final velocity v . Substituting the given values, $v = 0 + (10 \times 5)$.

Answer: B

27: Which of the following is an example of an application of physics in defense technology?

- A) Operation of a refrigerator
- B) Operation of a hydraulic lift
- C) Generation of electricity through a dam
- D) Design of radar systems

Explanation: Radar systems use principles of physics, particularly electromagnetism, for detection and tracking purposes, making them an application of physics in defense technology. Therefore, option D is correct.

Answer: D

28: A convex lens has a focal length of +20 cm. An object is placed 30 cm from the lens. What is the image distance?

- A) -12 cm
- B) +12 cm
- C) -60 cm
- D) +60 cm

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Explanation: Since the lens is convex, its focal length is positive. Using the lens equation $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$, where f is the focal length, d_o is the object distance, and d_i is the image distance, we can solve for d_i . Substituting the given values, we get $\frac{1}{20} = \frac{1}{30} + \frac{1}{d_i}$.

Answer: D

29: Which of the following statements correctly describes the behavior of light waves when they pass from air into glass?

- A) The speed of light decreases, and the wavelength decreases.
- B) The speed of light increases, and the wavelength decreases.
- C) The speed of light decreases, and the wavelength increases.
- D) The speed of light increases, and the wavelength increases.

Explanation: When light waves pass from air into a denser medium like glass, the speed of light decreases, and the wavelength decreases. Therefore, option A is correct.

Answer: A

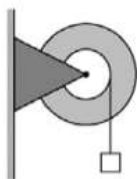
30: Which of the following electronic components is used to store electrical charge?

- A) Resistor
- B) Capacitor
- C) Diode
- D) Transistor

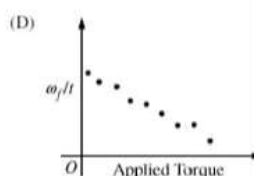
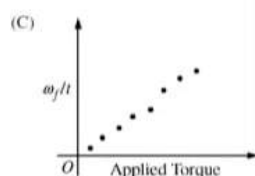
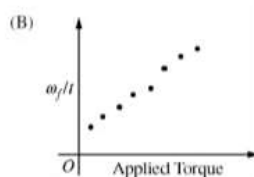
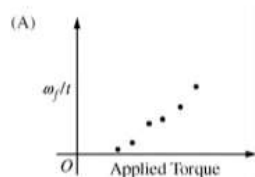
Explanation: A capacitor is an electronic component used to store electrical charge. It consists of two conductive plates separated by an insulating material. Therefore, option B is correct.

Answer: B

31.



A student conducts an experiment to determine the relationship between **applied torque** and the **change in angular velocity**. The student uses the apparatus shown in the figure above, consisting of two disks that are glued together and mounted on a horizontal axle. Blocks of varying mass are hung from a string wound around the smaller disk. The blocks are released from rest, exerting different torques on the disks, and are allowed to fall a fixed distance. For each block, the time of fall t and the final angular velocity ω_f are measured. There is considerable friction between the disks and the axle. Which of the following best represents a plot that can be obtained from the student's data?



The relationship between applied torque (τ) and change in angular velocity (ω) is governed by Newton's second law for rotation:

$$\tau = I\alpha$$

Where:

- τ is the torque applied,
- I is the moment of inertia of the system, and
- α is the angular acceleration.

However, due to considerable friction between the disks and the axle, the actual relationship might deviate from this ideal behavior. Friction affects the system's response, causing a non-linear relationship between torque and angular acceleration. Therefore, the plot obtained from the student's data would likely exhibit a non-linear trend, possibly starting slowly, then increasing more rapidly before leveling off, reflecting the complex interplay between torque, friction, and other factors influencing the system.

Answer : C

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32. Which of the following statements is true regarding the behavior of waves when they pass through a narrow slit or aperture?

- A) Waves spread out in all directions after passing through the slit.
- B) Waves maintain their original direction after passing through the slit.
- C) Waves experience diffraction, spreading out after passing through the slit.
- D) Waves experience refraction, changing direction after passing through the slit.

Explanation: When waves pass through a narrow slit or aperture, they experience diffraction, causing them to spread out in all directions beyond the slit. Therefore, option C is correct.

Answer: C

33: An object is located 20 cm in front of a convex mirror with a focal length of -10 cm. What is the magnification of the image?

- A) -0.5
- B) +0.5
- C) -2
- D) +2

Explanation: Magnification (m) is defined as the ratio of the height of the image to the height of the object. Since the image formed by a convex mirror is virtual and upright, the magnification is positive. Using the magnification formula $m = -\frac{d_i}{d_o}$, where d_i is the image distance and d_o is the object distance, we can find the magnification. Substituting the given values, $m = -\frac{-10}{20}$.

Answer: B

34: Which of the following is an example of an application of physics in the field of engineering?

- A) Operation of a refrigerator
- B) Use of X-rays for medical imaging
- C) Design of bridges and buildings

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D) Operation of a hydraulic lift

Explanation: The design of bridges and buildings involves principles of physics, particularly mechanics and materials science, making it an application of physics in engineering. Therefore, option C is correct.

Answer: C

35: A parallel plate capacitor is connected to a battery, causing it to become charged. If the distance between the plates is doubled while keeping the voltage constant, how does the capacitance change?

A) It doubles.

B) It halves.

C) It quadruples.

D) It remains the same.

Explanation: The capacitance of a parallel plate capacitor is directly proportional to the area of the plates and inversely proportional to the distance between them. Doubling the distance between the plates while keeping the voltage constant will decrease the capacitance by a factor of 2, as per the formula $C = \frac{k\epsilon_0 A}{d}$, where k is the dielectric constant, ϵ_0 is the vacuum permittivity, A is the area of the plates, and d is the distance between them.

Answer: B

36. A car travels along a straight road for 3 hours at a constant speed of 60 km/h and then continues for another 2 hours at a constant speed of 80 km/h. What is the total distance traveled by the car?

A) 240 km

B) 300 km

C) 360 km

D) 340 km

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Explanation: The total distance traveled can be calculated by adding the distances traveled during each time interval. For the first 3 hours, the distance traveled is $60 \times 3 = 180$ km. For the next 2 hours, the distance traveled is $80 \times 2 = 160$ km. Therefore, the total distance traveled is $180 + 160 = 340$ km.

Answer: D



37 : Which of the following statements correctly describes the behavior of waves when they pass from a less dense medium to a denser medium?

- A) The speed of the waves decreases, and the wavelength increases.
- B) The speed of the waves increases, and the wavelength decreases.
- C) The speed of the waves decreases, and the wavelength decreases.
- D) The speed of the waves increases, and the wavelength increases.

Explanation: When waves pass from a less dense medium to a denser medium, such as from air to water, their speed decreases, and their wavelength decreases. Therefore, option C is correct.

Answer: C

38: Which of the following is an example of an application of physics in medical technology?

- A) Design of radar systems
- B) Operation of a hydraulic lift
- C) Use of ultrasound for imaging
- D) Operation of a refrigerator

Explanation: The use of ultrasound for medical imaging involves principles of physics, particularly in the interaction of sound waves with body tissues, making it an application of physics in medical technology. Therefore, option C is correct.

Answer: C

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39: A convex lens with a focal length of +15 cm forms an image of an object placed 10 cm in front of the lens. What is the magnification of the image?

- A) -0.5
- B) +0.5
- C) -1.5
- D) +1.5

Explanation: Magnification (m) is defined as the ratio of the height of the image to the height of the object. Since the image formed by a convex lens is real and inverted, the magnification is negative. Using the magnification formula $m = -\frac{d_i}{d_o}$, where d_i is the image distance and d_o is the object distance, we can find the magnification. Substituting the given values, $m = -\frac{15}{10}$.

Answer: B

40: An object is placed 20 cm in front of a concave mirror with a focal length of -10 cm. What is the nature and size of the image formed?

- A) Virtual and enlarged
- B) Virtual and diminished
- C) Real and enlarged
- D) Real and diminished

Explanation: When an object is placed between the focal point and the concave mirror, the image formed is virtual, upright, and enlarged. Therefore, option A is correct.

Answer: A

41: A resistor with a resistance of 50 ohms is connected in series with another resistor of 30 ohms. What is the equivalent resistance of the combination?

- A) 20 ohms
- B) 30 ohms
- C) 50 ohms

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D) 80 ohms

Explanation: The equivalent resistance of resistors connected in series is the sum of their individual resistances. Therefore, the equivalent resistance is $(50 + 30 = 80)$ ohms.

Answer: D

42: A ball is thrown vertically upward with an initial velocity of 20 m/s. What is the maximum height reached by the ball? (Assume no air resistance.)

A) 10 m

B) 20 m

C) 40 m

D) 80 m

Explanation: The maximum height reached by the ball can be calculated using the kinematic equation for motion under constant acceleration: $h = \frac{v_i^2}{2g}$, where h is the maximum height, v_i is the initial velocity, and g is the acceleration due to gravity. Substituting the given values, $h = \frac{(20)^2}{2 \times 9.8}$.

Answer: C

43: Which of the following statements correctly describes the process of electromagnetic induction?

A) A magnetic field is created by a current-carrying conductor.

B) A current is induced in a conductor by a changing magnetic field.

C) An electric field is created by a stationary charge.

D) A charge is induced in a conductor by a changing electric field.

Explanation: Electromagnetic induction involves the generation of an electromotive force (emf) in a conductor due to a changing magnetic field, as described by Faraday's law of electromagnetic induction. Therefore, option B is correct.

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Answer: B

44: A convex lens with a focal length of +10 cm is used to form an image of an object. If the object distance is 20 cm, what is the nature of the image formed?

- A) Real and inverted
- B) Real and upright
- C) Virtual and inverted
- D) Virtual and upright

Explanation: When the object distance is greater than the focal length, a convex lens forms a real and inverted image. Therefore, option A is correct.

Answer: A

45: A parallel plate capacitor is connected to a battery, causing it to become fully charged. If the distance between the plates is doubled while keeping the charge constant, how does the potential difference across the capacitor change?

- A) It doubles.
- B) It halves.
- C) It quadruples.
- D) It remains the same.

Explanation: The potential difference (V) across a capacitor is directly proportional to the charge (Q) stored on it and inversely proportional to the capacitance (C), according to $V = \frac{Q}{C}$. Doubling the distance between the plates while keeping the charge constant will decrease the capacitance by a factor of 2, as per the formula $C = \frac{k\epsilon_0 A}{d}$, where k is the dielectric constant, ϵ_0 is the vacuum permittivity, A is the area of the plates, and d is the distance between them. Therefore, the potential difference across the capacitor will double.

Answer: A

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46. A block of wood floats in a container of water. If the block is pushed down slightly and then released, what happens to the block when it returns to its original position?

- A) It oscillates up and down with simple harmonic motion.
- B) It sinks to the bottom of the container.
- C) It remains at the same level in the water.
- D) It rises to the surface of the water.

Explanation: When a floating object is pushed down slightly and then released, it experiences a restoring force due to buoyancy, which pushes it back to its original position. This results in simple harmonic motion about the equilibrium position. Therefore, option A is correct.

Answer: A

47: Which of the following statements correctly describes the relationship between frequency and period of a wave?

- A) Frequency and period are directly proportional.
- B) Frequency and period are inversely proportional.
- C) Frequency and period are not related.
- D) The relationship between frequency and period depends on the medium.

Explanation: Frequency and period are inversely proportional to each other. Frequency is the number of oscillations per unit time, while period is the time taken for one complete oscillation. Therefore, option B is correct.

Answer: B

48: Which of the following is an example of an application of physics in communication technology?

- A) Operation of a hydraulic lift
- B) Use of X-rays for medical imaging
- C) Design of antennas for wireless communication

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D) Operation of a refrigerator

Explanation: The design of antennas for wireless communication involves principles of physics, particularly electromagnetism, making it an application of physics in communication technology. Therefore, option C is correct.

Answer: C

49: A concave lens with a focal length of -20 cm is used to form an image of an object. If the object distance is 30 cm, what is the nature of the image formed?

A) Real and inverted

B) Real and upright

C) Virtual and inverted

D) Virtual and upright

Explanation: When the object distance is greater than the absolute value of the focal length, a concave lens forms a virtual and upright image. Therefore, option D is correct.

Answer: D

50: A charge of +2 μC experiences a force of 4 N in a uniform electric field. What is the magnitude of the electric field?

A) 0.5 N/C

B) 1 N/C

C) 2 N/C

D) 8 N/C

Explanation: The magnitude of the electric field (E) can be calculated using the formula $E = \frac{F}{q}$, where F is the force experienced by the charge and q is the magnitude of the charge. Substituting the given values, $E = \frac{4}{2 \times 10^{-6}}$.

Answer: B