Jharkhand Polytechnic Physics

Sample Paper – 1

Duration: 50 Minutes **Maximum Marks: 50**

Instructions

- This paper contains **50** Multiple Choice Questions (Single Correct Answer), modelled on the Physics section of the **Jharkhand Polytechnic (PECE)** entrance examination conducted by JCECEB.
- Each correct answer carries **+1 mark**. There is **a negative marking of 0.25 mark** for every wrong answer. Unattempted questions carry **no penalty**.
- Only **one** option is correct. Choose carefully.
- This is an offline OMR based test. Darken the correct bubble fully with a blue or black ball pen.
- Take $\mathbf{g = 10\ m/s^2}$ wherever required, unless stated otherwise.
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

Q1. The SI unit of force is the:

(A) Joule

(B) Newton

(C) Watt

(D) Pascal

Q2. Which one of the following is a fundamental (base) physical quantity?

(A) Force

(B) Velocity

(C) Time

(D) Density

Q3. A bus moves with a speed of 72 km/h. Its speed in metre per second is:

(A) 20 m/s

(B) 25 m/s

(C) 18 m/s

(D) 36 m/s

Q4. The SI unit of electric current is the:

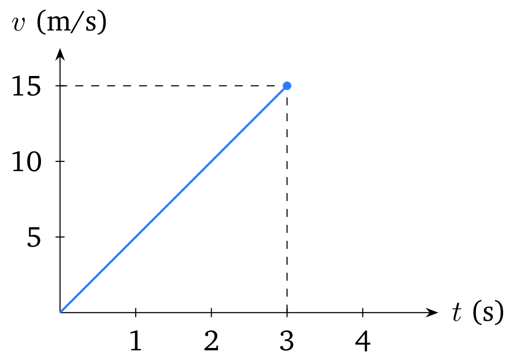
(A) volt

(B) coulomb

(C) ohm

(D) ampere

Q5. The velocity–time graph of a body starting from rest is shown below. The acceleration of the body is:



(A) 4 m/s^2

(B) 5 m/s^2

(C) 80 m/s^2

(D) 16 m/s^2

Q6. A car starts from rest and accelerates uniformly at 3 m/s^2 for 4 seconds. Its final velocity is:

(A) 12 m/s

(B) 7 m/s

(C) 48 m/s

(D) 0.75 m/s

Q7. Newton's first law of motion is also known as the law of:

(A) momentum

(B) inertia

(C) acceleration

(D) action and reaction

Q8. A force of 10 N acts on a body of mass 2 kg. The acceleration produced is:

(A) 20 m/s^2

(B) 12 m/s^2

(C) 5 m/s^2

(D) 0.2 m/s^2

Q9. Which of the following is the best example of Newton's third law of motion?

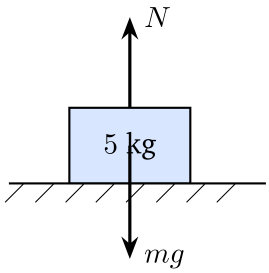
(A) A ball falling freely under gravity

(B) The recoil (backward jerk) of a gun when it is fired

(C) A car slowing down when brakes are applied

(D) A book lying at rest on a table

Q10. A block of mass 5 kg rests on a horizontal table, as shown. The normal reaction N exerted by the table on the block is:



(A) 5 N

(B) 25 N

(C) 50 N

(D) 0 N

Q11. The linear momentum of a body of mass 2 kg moving with a velocity of 5 m/s is:

(A) 2.5 kg m/s

(B) 7 kg m/s

(C) 5 kg m/s

(D) 10 kg m/s

Q12. A constant force of 20 N moves a body through a distance of 5 m in the direction of the force. The work done is:

(A) 100 J

(B) 4 J

(C) 25 J

(D) 15 J

Q13. The kinetic energy of a body of mass 2 kg moving with a speed of 3 m/s is:

(A) 18 J

(B) 6 J

(C) 9 J

(D) 36 J

Q14. A body of mass 2 kg is raised to a height of 5 m. The gravitational potential energy gained is:

(A) 25 J

(B) 50 J

(C) 12 J

(D) 100 J

Q15. A machine does 200 J of work in 10 seconds. The power of the machine is:

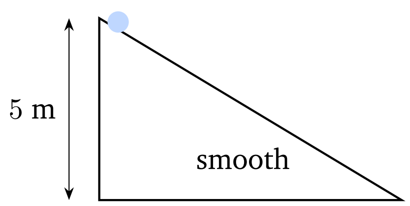
(A) 2000 W

(B) 20 W

(C) 10 W

(D) 0.05 W

Q16. A ball of mass 1 kg is released from rest at the top of a smooth slope of height 5 m, as shown. Using conservation of energy, its speed when it reaches the bottom is:



(A) 10 m/s

(B) 5 m/s

(C) 50 m/s

(D) 100 m/s

Q17. The weight of an object of mass 5 kg on the surface of the Earth is:

(A) 5 N

(B) 0.5 N

(C) 10 N

(D) 50 N

Q18. According to Newton's universal law of gravitation, the force of attraction between two bodies is inversely proportional to the:

(A) sum of their masses

(B) distance between them

(C) square of the distance between them

(D) square of their masses

Q19. A stone is dropped from a height and falls freely for 3 seconds. The distance fallen is (take $g = 10$ m/s^2):

(A) 45 m

(B) 30 m

(C) 90 m

(D) 15 m

Q20. An object weighs 60 N on the Earth. Its weight on the Moon, where gravity is one-sixth that of the Earth, will be:

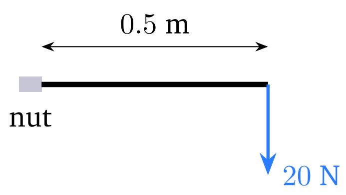
(A) 60 N

(B) 10 N

(C) 360 N

(D) 6 N

Q21. A force of 20 N is applied at the end of a spanner at a perpendicular distance of 0.5 m from the nut, as shown. The moment (turning effect) of the force about the nut is:



(A) 40 N m

(B) 20 N m

(C) 0.025 N m

(D) 10 N m

Q22. The turning effect of a force about a fixed point or axis is called:

(A) torque (moment of force)

(B) momentum

(C) impulse

(D) power

Q23. The time period of a simple pendulum depends on its:

(A) mass of the bob

(B) amplitude of swing

(C) length of the pendulum

(D) material of the bob

Q24. In simple harmonic motion, the acceleration of the particle is maximum at the:

(A) mean (equilibrium) position

(B) extreme position

(C) position midway between mean and extreme

(D) it remains constant everywhere

Q25. Normal human body temperature is $37\,^{\circ}\mathrm{C}$. Its value on the Fahrenheit scale is:

(A) $98.6\,^{\circ}$F

(B) $310\,^{\circ}$F

(C) $66.6\,^{\circ}$F

(D) $50\,^{\circ}$F

Q26. How much heat is required to raise the temperature of 0.5 kg of water by $10\,^{\circ}$C? (Specific heat of water $= 4200$ J kg^{-1} $^{\circ}$C^{-1})

(A) 4200 J

(B) 2100 J

(C) 42000 J

(D) 21000 J

Q27. The heat absorbed or released during a change of state at constant temperature is called:

(A) specific heat

(B) thermal capacity

(C) latent heat

(D) heat capacity

Q28. Heat transfer through a solid metal rod takes place mainly by the process of:

(A) convection

(B) conduction

(C) radiation

(D) advection

Q29. Small gaps are left between successive rails of a railway track to allow for:

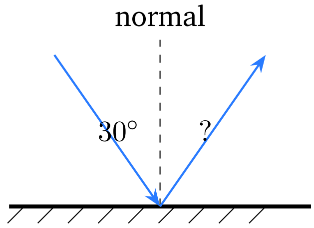
(A) expansion of the rails in summer

(B) contraction of the rails in summer

(C) rusting of the rails

(D) vibration of the rails

Q30. A ray of light strikes a plane mirror making an angle of incidence of 30° with the normal, as shown. The angle of reflection is:



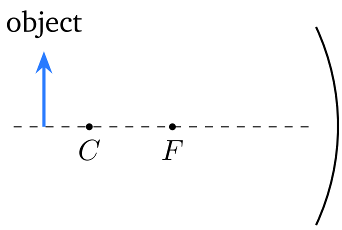
(A) 60°

(B) 90°

(C) 0°

(D) 30°

Q31. An object is placed beyond the centre of curvature (C) of a concave mirror, as shown. The image formed is:



(A) virtual, erect and magnified

(B) real, inverted and diminished

(C) real, erect and of the same size

(D) formed at infinity

Q32. The radius of curvature of a concave mirror is 20 cm. Its focal length is:

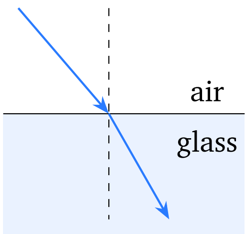
(A) 40 cm

(B) 20 cm

(C) 10 cm

(D) 5 cm

Q33. A ray of light passes from air into a denser glass block, as shown. On entering the glass, the ray bends:



(A) towards the normal

(B) away from the normal

(C) without any bending

(D) back into the air (total reflection)

Q34. The power of a convex lens of focal length 50 cm is:

(A) 50 D

(B) 0.5 D

(C) 100 D

(D) 2 D

Q35. A person who cannot see distant objects clearly but can see nearby objects well suffers from the eye defect called:

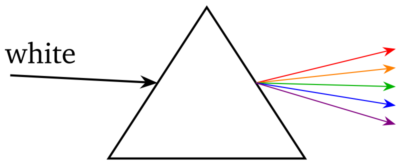
(A) hypermetropia (long sight)

(B) presbyopia

(C) myopia (short sight)

(D) astigmatism

Q36. When a beam of white light passes through a glass prism, it splits into its seven constituent colours, as shown. This phenomenon is called:



(A) reflection

(B) dispersion

(C) refraction

(D) scattering

Q37. A sound wave has a frequency of 200 Hz and a wavelength of 1.5 m. The speed of the wave is:

(A) 300 m/s

(B) 133 m/s

(C) 201 m/s

(D) 1.5 m/s

Q38. Sound waves travelling through air are:

(A) transverse waves

(B) electromagnetic waves

(C) stationary waves

(D) longitudinal waves

Q39. An echo is produced due to the:

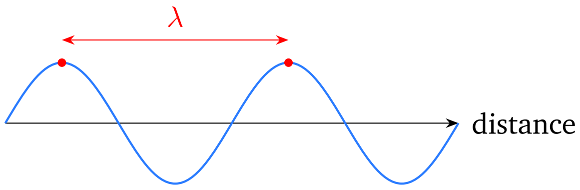
(A) refraction of sound

(B) reflection of sound

(C) dispersion of sound

(D) absorption of sound

Q40. In the transverse wave shown below, the wavelength is the distance between:



(A) a crest and the nearest trough

(B) the maximum displacement and the axis

(C) two consecutive crests

(D) two points having different phase

Q41. A current of 2 A flows through a resistor of resistance $5\,\Omega$. The potential difference across the resistor is:

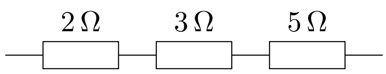
(A) 10 V

(B) 2.5 V

(C) 7 V

(D) 0.4 V

Q42. Three resistors of $2\,\Omega$, $3\,\Omega$ and $5\,\Omega$ are connected in series, as shown. Their equivalent resistance is:



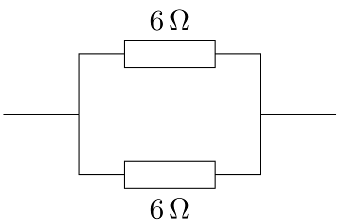
(A) $0.97\,\Omega$

(B) $1\,\Omega$

(C) $5\,\Omega$

(D) $10\,\Omega$

Q43. Two resistors, each of $6\,\Omega$, are connected in parallel, as shown. Their equivalent resistance is:



(A) $12\,\Omega$

(B) $3\,\Omega$

(C) $6\,\Omega$

(D) $36\,\Omega$

Q44. An electric appliance operates at 220 V and draws a current of 0.5 A. The power consumed by it is:

(A) 440 W

(B) 220 W

(C) 110 W

(D) 44 W

Q45. In a household electric circuit, a fuse is always connected in:

(A) parallel with the appliance

(B) series with the neutral wire

(C) the earth wire

(D) series with the live wire

Q46. If a current of 2 A flows through a wire for 5 seconds, the amount of electric charge that passes through it is:

(A) 10 C

(B) 2.5 C

(C) 7 C

(D) 0.4 C

Q47. The magnetic field lines around a long straight current-carrying conductor are in the form of:

(A) straight lines parallel to the wire

(B) straight lines perpendicular to the wire

(C) concentric circles around the wire

(D) radial lines pointing away from the wire

Q48. A strong electromagnet is made by winding an insulated current-carrying coil around a core of:

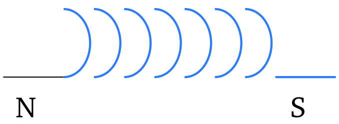
(A) hard copper

(B) soft iron

(C) hardened steel

(D) plastic

Q49. A current-carrying solenoid, shown below, behaves like a:



(A) capacitor

(B) resistor

(C) heating element

(D) bar magnet

Q50. An electric motor is a device that converts:

(A) electrical energy into mechanical energy

(B) mechanical energy into electrical energy

(C) heat energy into electrical energy

(D) chemical energy into electrical energy

Detailed Solutions

Q1.

Solution

Concept — Units and Measurement: Force is a derived quantity. From Newton's second law, force = mass × acceleration, so its unit is built from the base units of mass and acceleration.

Step 1 — Build the unit: Unit of force $= \text{kg} \times \text{m/s}^2 = \text{kg}\,\text{m}\,\text{s}^{-2}$.

Step 2 — Name the unit: This combination is given the special name **newton (N)** in honour of Sir Isaac Newton.

Why other options are wrong:

- Joule: SI unit of work or energy.
- Watt: SI unit of power.
- Pascal: SI unit of pressure.

Final Answer: The SI unit of force is the newton $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — Fundamental quantities: The seven fundamental (base) quantities are length, mass, time, electric current, temperature, amount of substance and luminous intensity. All others are derived from these.

Step 1 — Test each option: Force, velocity and density are all obtained by combining base quantities, so they are derived quantities.

Step 2 — Identify the base quantity: Among the choices, only **time** is one of the seven fundamental quantities.

Why other options are wrong:

- Force = mass × acceleration (derived).
- Velocity = displacement / time (derived).
- Density = mass / volume (derived).

Final Answer: Time is the fundamental quantity $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q2

Q3.

Solution

Concept — Unit conversion: To change km/h into m/s, multiply by $\frac{1000}{3600} = \frac{5}{18}$.

Step 1 — Write the conversion factor: 1 km/h $= \frac{5}{18}$ m/s.

Step 2 — Substitute the value: Speed $= 72 \times \frac{5}{18}$ m/s.

Step 3 — Simplify: $72 \div 18 = 4$, then $4 \times 5 = 20$. So speed $= 20$ m/s.

Why other options are wrong:

- 25 and 36 come from using a wrong factor.
- 18 is the denominator of the factor, not the answer.

Final Answer: 72 km/h $= 20$ m/s $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q3

Q4.

Solution

Concept — SI base units: Electric current is one of the seven fundamental quantities, and its SI base unit is the ampere.

Step 1 — Recall the unit: The unit of electric current is the **ampere (A)**, defined through the flow of charge per unit time.

Step 2 — Relate to charge: 1 ampere $= 1$ coulomb per second.

Why other options are wrong:

- Volt: unit of potential difference.
- Coulomb: unit of electric charge.
- Ohm: unit of resistance.

Final Answer: The SI unit of current is the ampere $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Velocity–time graph: For a straight-line v–t graph, acceleration equals the slope, that is the change in velocity divided by the change in time.

Step 1 — Read the graph: The velocity rises from 0 to 15 m/s as the time goes from 0 to 3 s (the line meets the dashed guide at $v = 15$ m/s, $t = 3$ s).

Step 2 — Apply the slope formula: $a = \dfrac{\Delta v}{\Delta t} = \dfrac{15-0}{3-0}$.

Step 3 — Compute: $a = \dfrac{15}{3} = 5$ m/s^2.

Why other options are wrong:

- 4 m/s^2 misreads the graph values.
- 80 multiplies instead of dividing.
- 16 uses the wrong time interval.

Final Answer: Acceleration $= 5$ m/s^2 $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q5

Q6.

Solution

Concept — Equation of motion: For uniform acceleration, $v = u + at$, where u is initial velocity, a is acceleration and t is time.

Step 1 — List the data: $u = 0$ (starts from rest), $a = 3$ m/s^2, $t = 4$ s.

Step 2 — Substitute: $v = 0 + (3 \times 4)$.

Step 3 — Compute: $v = 12$ m/s.

Why other options are wrong:

- 7 adds $3 + 4$ instead of multiplying.
- 48 multiplies by an extra factor.
- 0.75 divides instead of multiplying.

Final Answer: Final velocity $= 12$ m/s $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q6

Q7.

Solution

Concept — Newton's first law: A body continues in its state of rest or of uniform motion in a straight line unless acted upon by an external force. This property is called inertia.

Step 1 — Connect to inertia: Because the law describes the natural tendency of a body to resist a change in its state, it is called the law of inertia.

Step 2 — Confirm: The first law defines inertia and force qualitatively.

Why other options are wrong:

- Momentum relates to the second law.
- Acceleration appears in the second law.
- Action and reaction is the third law.

Final Answer: Newton's first law is the law of inertia $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept — Newton's second law: The acceleration of a body equals the net force divided by its mass, $a = \dfrac{F}{m}$.

Step 1 — List the data: $F = 10$ N, $m = 2$ kg.

Step 2 — Substitute: $a = \dfrac{10}{2}$.

Step 3 — Compute: $a = 5$ m/s^2.

Why other options are wrong:

- 20 multiplies force and mass.
- 12 adds force and mass.
- 0.2 divides mass by force.

Final Answer: Acceleration $= 5$ m/s^2 $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q8

Q9.

Solution

Concept — Newton's third law: To every action there is an equal and opposite reaction. The two forces act on two different bodies.

Step 1 — Apply to the gun: When a bullet is fired, the gun pushes the bullet forward (action) and the bullet pushes the gun backward (reaction), causing the recoil.

Step 2 — Confirm the pair: The forward force on the bullet and the backward force on the gun form an action–reaction pair.

Why other options are wrong:

- A freely falling ball illustrates gravity.
- Braking shows friction and deceleration.
- A book at rest illustrates balanced forces (first law).

Final Answer: Recoil of a gun illustrates the third law $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q9

Q10.

Solution

Concept — Free-body diagram: A block resting on a horizontal table is in equilibrium, so the upward normal reaction balances the downward weight.

Step 1 — Write the balance: $N = mg$.

Step 2 — Substitute: $N = 5 \times 10$ (with $g = 10$ m/s^2).

Step 3 — Compute: $N = 50$ N.

Why other options are wrong:

- 5 N is only the mass value, not the force.
- 25 N uses a wrong factor.
- 0 N would mean no support, which is false for a resting block.

Final Answer: Normal reaction $= 50$ N $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q10

Q11.

Solution

Concept — Linear momentum: Momentum $p = mv$, the product of mass and velocity.

Step 1 — List the data: $m = 2$ kg, $v = 5$ m/s.

Step 2 — Substitute: $p = 2 \times 5$.

Step 3 — Compute: $p = 10\ \text{kg m/s}$.

Why other options are wrong:

- 2.5 divides mass by velocity.
- 7 adds mass and velocity.
- 5 ignores the mass.

Final Answer: Momentum $= 10\ \text{kg m/s} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q11

Q12.

Solution

Concept — Work done: When a force acts along the direction of motion, work $W = F \times s$.

Step 1 — List the data: $F = 20$ N, $s = 5$ m.

Step 2 — Substitute: $W = 20 \times 5$.

Step 3 — Compute: $W = 100$ J.

Why other options are wrong:

- 4 divides force by distance.
- 25 adds force and distance.
- 15 subtracts the values.

Final Answer: Work done $= 100\ \text{J} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q12

Q13.

Solution

Concept — Kinetic energy: The kinetic energy of a moving body is $KE = \frac{1}{2}mv^2$.

Step 1 — List the data: $m = 2$ kg, $v = 3$ m/s.

Step 2 — Square the velocity: $v^2 = 3^2 = 9$.

Step 3 — Substitute and compute: $KE = \frac{1}{2} \times 2 \times 9 = 9$ J.

Why other options are wrong:

- 18 forgets the factor $\frac{1}{2}$.
- 6 uses v instead of v^2.
- 36 squares the whole product wrongly.

Final Answer: Kinetic energy $= 9$ J $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q13

Q14.

Solution

Concept — Gravitational potential energy: The energy gained on raising a body is $PE = mgh$.

Step 1 — List the data: $m = 2$ kg, $g = 10$ m/s^2, $h = 5$ m.

Step 2 — Substitute: $PE = 2 \times 10 \times 5$.

Step 3 — Compute: $PE = 100$ J.

Why other options are wrong:

- 25 and 50 leave out a factor.
- 12 adds the values instead of multiplying.

Final Answer: Potential energy $= 100$ J $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q14

Q15.

Solution

Concept — Power: Power is the rate of doing work, $P = \dfrac{W}{t}$.

Step 1 — List the data: $W = 200$ J, $t = 10$ s.

Step 2 — Substitute: $P = \dfrac{200}{10}$.

Step 3 — Compute: $P = 20$ W.

Why other options are wrong:

- 2000 multiplies instead of dividing.
- 10 swaps the numbers.
- 0.05 inverts the ratio.

Final Answer: Power $= 20$ W $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q15

Q16.

Solution

Concept — Conservation of energy: On a smooth slope, the potential energy at the top fully converts into kinetic energy at the bottom: $mgh = \frac{1}{2}mv^2$.

Step 1 — Cancel the mass: $gh = \frac{1}{2}v^2$, so $v = \sqrt{2gh}$.

Step 2 — Substitute: $v = \sqrt{2 \times 10 \times 5} = \sqrt{100}$.

Step 3 — Compute: $v = 10$ m/s.

Why other options are wrong:

- 5 forgets the square root step.
- 50 is $2gh$, not its square root.
- 100 is v^2, not v.

Final Answer: Speed at the bottom $= 10$ m/s $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q16

Q17.

Solution

Concept — Weight: The weight of a body is the gravitational force on it, $W = mg$.

Step 1 — List the data: $m = 5$ kg, $g = 10$ m/s^2.

Step 2 — Substitute: $W = 5 \times 10$.

Step 3 — Compute: $W = 50$ N.

Why other options are wrong:

- 5 N is the mass value, not the weight.
- 0.5 N divides instead of multiplying.
- 10 N is just the value of g.

Final Answer: Weight $= 50$ N $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q17

Q18.

Solution

Concept — Universal law of gravitation: The force between two masses is $F = G\frac{m_1 m_2}{r^2}$, directly proportional to the product of the masses and inversely proportional to the square of the distance.

Step 1 — Focus on distance: The r^2 in the denominator shows the force is inversely proportional to the square of the distance between the bodies.

Step 2 — Confirm: Doubling the separation reduces the force to one-fourth.

Why other options are wrong:

- Sum of masses does not appear in the law.
- Force varies as $1/r^2$, not as $1/r$.
- Force is proportional to the product of masses, not inversely to their square.

Final Answer: Force $\propto \frac{1}{r^2} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — Free fall: For a body dropped from rest, the distance fallen is $s = \frac{1}{2}gt^2$.

Step 1 — List the data: $u = 0$, $g = 10$ m/s^2, $t = 3$ s.

Step 2 — Square the time: $t^2 = 3^2 = 9$.

Step 3 — Substitute and compute: $s = \frac{1}{2} \times 10 \times 9 = 45$ m.

Why other options are wrong:

- 30 uses $g \times t$ only.
- 90 forgets the factor $\frac{1}{2}$.
- 15 uses t instead of t^2.

Final Answer: Distance fallen $= 45$ m $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q19

Q20.

Solution

Concept — Weight and gravity: Weight depends on the local value of g. On the Moon, g is one-sixth that on the Earth, so the weight is one-sixth.

Step 1 — Write the relation: $W_{\text{moon}} = \frac{1}{6} \times W_{\text{earth}}$.

Step 2 — Substitute: $W_{\text{moon}} = \frac{1}{6} \times 60$.

Step 3 — Compute: $W_{\text{moon}} = 10$ N.

Why other options are wrong:

- 60 N ignores the change in gravity.
- 360 N multiplies by 6 instead of dividing.
- 6 N divides by 10, not by 6.

Final Answer: Weight on the Moon $= 10$ N $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q20

Q21.

Solution

Concept — Moment of a force: The moment (turning effect) about a point is force times perpendicular distance, $\tau = F \times d$.

Step 1 — List the data: $F = 20$ N, $d = 0.5$ m.

Step 2 — Substitute: $\tau = 20 \times 0.5$.

Step 3 — Compute: $\tau = 10$ N m.

Why other options are wrong:

- 40 divides by 0.5 instead of multiplying.
- 20 ignores the distance.
- 0.025 inverts the calculation.

Final Answer: Moment of the force $= 10$ N m $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q21

Q22.

Solution

Concept — Torque: The turning or rotational effect of a force about an axis is called torque, or the moment of the force.

Step 1 — Match the definition: The quantity that measures how strongly a force tends to rotate a body is torque.

Step 2 — Confirm: Torque $=$ force $\times$ perpendicular distance from the axis.

Why other options are wrong:

- Momentum is mass times velocity (linear motion).
- Impulse is force times time.
- Power is the rate of doing work.

Final Answer: Turning effect of force $=$ torque $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q22

Q23.

Solution

Concept — Simple pendulum: The time period is $T = 2\pi\sqrt{\frac{L}{g}}$, so it depends only on the length L and the value of g.

Step 1 — Inspect the formula: Mass of the bob and amplitude (for small swings) do not appear in the formula.

Step 2 — Identify the factor: Among the options, the time period depends on the **length of the pendulum**.

Why other options are wrong:

- Mass and material of the bob do not affect T.
- Amplitude does not affect T for small oscillations.

Final Answer: Time period depends on length $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q23

Q24.

Solution

Concept — Simple harmonic motion: In SHM the acceleration is $a = -\omega^2 x$, so it is largest where the displacement x from the mean position is largest.

Step 1 — Find the largest displacement: The displacement is maximum at the extreme positions.

Step 2 — Conclude: Therefore the acceleration is maximum at the **extreme position** and zero at the mean position.

Why other options are wrong:

- At the mean position acceleration is zero (velocity is maximum).
- Midway it is intermediate.
- Acceleration changes with position, so it is not constant.

Final Answer: Acceleration is maximum at the extreme position $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q24

Q25.

Solution

Concept — Temperature scales: To convert Celsius to Fahrenheit use $F = \frac{9}{5}C + 32$.

Step 1 — Multiply by $\frac{9}{5}$: $\frac{9}{5} \times 37 = \frac{333}{5} = 66.6$.

Step 2 — Add 32**:** $66.6 + 32 = 98.6$.

Step 3 — State the result: $37\,°\mathrm{C} = 98.6\,°\mathrm{F}$.

Why other options are wrong:

- 310 is the Kelvin value $(37 + 273)$.
- 66.6 forgets to add 32.
- 50 uses a wrong formula.

Final Answer: $37\,°\mathrm{C} = 98.6\,°\mathrm{F} \Rightarrow \boxed{\mathrm{A}}$

Answer: (A) Go Back to Q25

Q26.

Solution

Concept — Heat and specific heat: The heat needed to change temperature is $Q = mc\,\Delta T$.

Step 1 — List the data: $m = 0.5$ kg, $c = 4200\ \mathrm{J\,kg^{-1}\,°C^{-1}}$, $\Delta T = 10\,°\mathrm{C}$.

Step 2 — Substitute: $Q = 0.5 \times 4200 \times 10$.

Step 3 — Compute: $0.5 \times 4200 = 2100$, then $2100 \times 10 = 21000$ J.

Why other options are wrong:

- 4200 uses only c.
- 2100 leaves out the temperature change.
- 42000 uses mass $= 1$ kg instead of 0.5 kg.

Final Answer: Heat required $= 21000$ J $\Rightarrow \boxed{\mathrm{D}}$

Answer: (D) Go Back to Q26

Q27.

Solution

Concept — Latent heat: During melting or boiling the temperature stays constant while heat is absorbed. This hidden heat is the latent heat.

Step 1 — Match the definition: Heat exchanged at constant temperature during a change of state is called **latent heat**.

Step 2 — Confirm: It is the energy used to change the state, not the temperature.

Why other options are wrong:

- Specific heat relates to a temperature change of $1\,^\circ\mathrm{C}$.
- Thermal capacity and heat capacity describe heat per degree rise.

Final Answer: Heat at constant temperature = latent heat $\Rightarrow \boxed{\mathrm{C}}$

Answer: (C) Go Back to Q27

Q28.

Solution

Concept — Modes of heat transfer: Conduction transfers heat through a material by molecular vibration without the material moving; it is the main mode in solids.

Step 1 — Apply to a metal rod: In a solid metal rod the particles are fixed, so heat passes by conduction.

Step 2 — Confirm: Metals are good conductors because free electrons help carry the heat.

Why other options are wrong:

- Convection needs a moving fluid (liquid or gas).
- Radiation needs no medium and is not the main mode in solids.
- Advection is bulk fluid transport, not relevant for a solid rod.

Final Answer: Heat in a solid rod travels by conduction $\Rightarrow \boxed{\mathrm{B}}$

Answer: (B) Go Back to Q28

Q29.

Solution

Concept — Thermal expansion: Most solids expand on heating. Metal rails get longer in hot weather.

Step 1 — Reason for the gaps: Small gaps are left so the rails have room to expand in summer without bending or buckling.

Step 2 — Confirm: Without the gaps, the expanding rails would push against each other and distort the track.

Why other options are wrong:

- Rails expand, not contract, in summer.
- Rusting is unrelated to the gaps.
- The gaps are not for vibration.

Final Answer: Gaps allow expansion in summer $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — Laws of reflection: The angle of incidence equals the angle of reflection, both measured from the normal.

Step 1 — Apply the law: Angle of reflection $=$ angle of incidence $= 30^\circ$.

Step 2 — Confirm: The incident ray, reflected ray and normal all lie in the same plane.

Why other options are wrong:

- 60° measures from the mirror surface, not the normal.
- 90° and 0° ignore the law of reflection.

Final Answer: Angle of reflection $= 30^\circ \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q30

Q31.

Solution

Concept — Concave mirror images: For an object placed beyond the centre of curvature C, a concave mirror forms an image between F and C.

Step 1 — Locate the image: The image lies between F and C, on the same side as the object.

Step 2 — Describe the image: It is real, inverted and smaller (diminished) than the object.

Why other options are wrong:

- Virtual and erect occurs only when the object is between the pole and F.
- Same-size image forms when the object is exactly at C.
- An image at infinity forms when the object is at F.

Final Answer: The image is real, inverted and diminished $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q31

Q32.

Solution

Concept — Mirror relation: For a spherical mirror the focal length is half the radius of curvature, $f = \dfrac{R}{2}$.

Step 1 — List the data: $R = 20$ cm.

Step 2 — Substitute: $f = \dfrac{20}{2}$.

Step 3 — Compute: $f = 10$ cm.

Why other options are wrong:

- 40 doubles R instead of halving.
- 20 keeps R unchanged.
- 5 divides by 4.

Final Answer: Focal length $= 10$ cm $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q32

Q33.

Solution

Concept — Refraction: When light passes from a rarer medium (air) into a denser medium (glass), it slows down and bends towards the normal.

Step 1 — Compare densities: Glass is optically denser than air.

Step 2 — Apply the rule: Going from rarer to denser, the ray bends **towards the normal**.

Why other options are wrong:

- Away from the normal happens when light goes denser to rarer.
- Light does bend (it changes speed at the boundary).
- Total internal reflection needs light to go denser to rarer beyond the critical angle.

Final Answer: The ray bends towards the normal $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q33

Q34.

Solution

Concept — Power of a lens: The power is the reciprocal of the focal length in metres, $P = \dfrac{1}{f}$.

Step 1 — Convert to metres: $f = 50$ cm $= 0.5$ m.

Step 2 — Substitute: $P = \dfrac{1}{0.5}$.

Step 3 — Compute: $P = 2$ D.

Why other options are wrong:

- 50 uses centimetres directly.
- 0.5 is the focal length in metres, not the power.
- 100 uses $f = 1$ cm by mistake.

Final Answer: Power of the lens $= 2$ D $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q34

Q35.

Solution

Concept — Eye defects: Myopia (short sight) is the inability to see distant objects clearly because the image forms in front of the retina.

Step 1 — Match the symptom: Clear near vision but blurred distant vision is the sign of myopia.

Step 2 — Correction: Myopia is corrected using a concave (diverging) lens.

Why other options are wrong:

- Hypermetropia is poor near vision.
- Presbyopia is age-related loss of accommodation.
- Astigmatism is uneven curvature of the cornea.

Final Answer: The defect is myopia $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q35

Q36.

Solution

Concept — Dispersion of light: White light is a mixture of seven colours. A prism bends each colour by a different amount, separating them into a spectrum.

Step 1 — Name the effect: The splitting of white light into its colours by a prism is called **dispersion**.

Step 2 — Reason: Violet bends most and red least, because they travel at slightly different speeds in glass.

Why other options are wrong:

- Reflection is bouncing back of light.
- Refraction is bending, but alone it does not separate colours.
- Scattering spreads light in many directions (as in the blue sky).

Final Answer: Splitting of white light = dispersion $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q36

Q37.

Solution

Concept — Wave equation: The speed of a wave is $v = f\lambda$, where f is frequency and λ is wavelength.

Step 1 — List the data: $f = 200$ Hz, $\lambda = 1.5$ m.

Step 2 — Substitute: $v = 200 \times 1.5$.

Step 3 — Compute: $v = 300$ m/s.

Why other options are wrong:

- 133 divides frequency by wavelength.
- 201 adds the two values.
- 1.5 ignores the frequency.

Final Answer: Speed of the wave $= 300$ m/s $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q37

Q38.

Solution

Concept — Nature of sound waves: Sound travels through air as a longitudinal wave, with compressions and rarefactions along the direction of travel.

Step 1 — Recall the type: In air the particles vibrate back and forth parallel to the wave direction, which defines a longitudinal wave.

Step 2 — Confirm: Sound needs a material medium to travel.

Why other options are wrong:

- Transverse waves vibrate perpendicular to travel (like light on a string).
- Electromagnetic waves do not need a medium.
- A travelling sound wave is not stationary.

Final Answer: Sound in air is a longitudinal wave $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q38

Q39.

Solution

Concept — Echo: An echo is the repetition of a sound caused when sound waves reflect from a large hard surface and return to the listener.

Step 1 — Identify the cause: The returning sound is produced by the **reflection** of sound.

Step 2 — Confirm: A minimum distance is needed so the reflected sound is heard separately from the original.

Why other options are wrong:

- Refraction is bending of sound, not its return.
- Dispersion does not apply to a single sound pulse.
- Absorption weakens sound rather than returning it.

Final Answer: An echo is due to reflection of sound $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q39

Q40.

Solution

Concept — Wavelength: The wavelength is the distance covered by one full wave, for example from one crest to the next crest.

Step 1 — Read the diagram: The marked distance λ runs between two consecutive crests.

Step 2 — Confirm: This equals the distance between any two consecutive identical points (crest to crest or trough to trough).

Why other options are wrong:

- Crest to nearest trough is only half a wavelength.
- Maximum displacement to axis is the amplitude.
- Points of different phase need not be one wavelength apart.

Final Answer: Wavelength $=$ distance between two consecutive crests $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q40

Q41.

Solution

Concept — Ohm's law: The potential difference across a resistor is $V = IR$.

Step 1 — List the data: $I = 2$ A, $R = 5\,\Omega$.

Step 2 — Substitute: $V = 2 \times 5$.

Step 3 — Compute: $V = 10$ V.

Why other options are wrong:

- 2.5 divides R by I.
- 7 adds the two values.
- 0.4 divides I by R.

Final Answer: Potential difference $= 10$ V $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q41

Q42.

Solution

Concept — Resistors in series: In a series combination the equivalent resistance is the sum of the individual resistances, $R = R_1 + R_2 + R_3$.

Step 1 — List the data: $R_1 = 2\,\Omega$, $R_2 = 3\,\Omega$, $R_3 = 5\,\Omega$.

Step 2 — Add: $R = 2 + 3 + 5$.

Step 3 — Compute: $R = 10\,\Omega$.

Why other options are wrong:

- 0.97 is the parallel combination value.
- 1 is unrelated.
- 5 uses only one resistor.

Final Answer: Series resistance $= 10\,\Omega \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q42

Q43.

Solution

Concept — Resistors in parallel: For two equal resistors R in parallel, the equivalent resistance is $\frac{R}{2}$, since $\frac{1}{R_p} = \frac{1}{R} + \frac{1}{R}$.

Step 1 — Add reciprocals: $\frac{1}{R_p} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$.

Step 2 — Invert: $R_p = 3\,\Omega$.

Why other options are wrong:

- 12 adds the resistors (that is the series value).
- 6 keeps a single resistor.
- 36 multiplies the resistors.

Final Answer: Parallel resistance $= 3\,\Omega \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q43

Q44.

Solution

Concept — Electric power: The power consumed is $P = VI$.

Step 1 — List the data: $V = 220$ V, $I = 0.5$ A.

Step 2 — Substitute: $P = 220 \times 0.5$.

Step 3 — Compute: $P = 110$ W.

Why other options are wrong:

- 440 divides by 0.5 instead of multiplying.
- 220 ignores the current.
- 44 uses a wrong factor.

Final Answer: Power consumed $= 110$ W $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q44

Q45.

Solution

Concept — Electric fuse: A fuse is a safety device that melts and breaks the circuit when the current becomes too large.

Step 1 — Decide its position: To cut off the supply during a fault, the fuse must carry the full current, so it is placed in **series with the live wire**.

Step 2 — Confirm: When it melts, it disconnects the live wire and makes the appliance safe.

Why other options are wrong:

- In parallel it would not carry the appliance current.
- Placing it in the neutral wire would leave the appliance live after a fault.
- The earth wire is for safety grounding, not for the fuse.

Final Answer: A fuse is in series with the live wire $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q45

Q46.

Solution

Concept — Charge, current and time: Electric charge is current multiplied by time, $Q = It$.

Step 1 — List the data: $I = 2$ A, $t = 5$ s.

Step 2 — Substitute: $Q = 2 \times 5$.

Step 3 — Compute: $Q = 10$ C.

Why other options are wrong:

- 2.5 divides current by time.
- 7 adds the values.
- 0.4 divides time by current wrongly.

Final Answer: Charge $= 10$ C $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q46

Q47.

Solution

Concept — Magnetic field of a straight wire: A current-carrying straight conductor produces a magnetic field whose field lines are concentric circles around the wire.

Step 1 — Picture the field: The circles lie in planes perpendicular to the wire and are centred on it.

Step 2 — Direction: The right-hand thumb rule gives the sense of these circular field lines.

Why other options are wrong:

- The lines are not straight and are not parallel to the wire.
- They are circular, not perpendicular straight lines.
- They are closed circles, not radial lines.

Final Answer: Field lines are concentric circles $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q47

Q48.

Solution

Concept — Electromagnet: An electromagnet is made by winding a current-carrying coil around a core that is easily magnetised and demagnetised.

Step 1 — Choose the core: Soft iron is used because it becomes a strong magnet when current flows and loses its magnetism when the current stops.

Step 2 — Confirm: This temporary, controllable magnetism is exactly what an electromagnet needs.

Why other options are wrong:

- Copper is non-magnetic.
- Hardened steel keeps its magnetism (used for permanent magnets).
- Plastic cannot be magnetised.

Final Answer: The core is soft iron $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q48

Q49.

Solution

Concept — Solenoid: A current-carrying solenoid produces a magnetic field very similar to that of a bar magnet, with a north pole at one end and a south pole at the other.

Step 1 — Compare the fields: The field outside the solenoid matches the field pattern of a bar magnet.

Step 2 — Conclude: Therefore the solenoid behaves like a **bar magnet**.

Why other options are wrong:

- A capacitor stores charge, not magnetic field.
- A resistor opposes current; it is not magnetic.
- A heating element converts electricity to heat, not to a magnetic field pattern.

Final Answer: A current-carrying solenoid acts like a bar magnet $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q49

Q50.

Solution

Concept — Electric motor: An electric motor uses the magnetic effect of current to turn a coil, converting electrical energy into mechanical (rotational) energy.

Step 1 — Trace the energy: Electric current in the coil experiences a force in a magnetic field, which makes the coil rotate.

Step 2 — State the conversion: So a motor converts **electrical energy into mechanical energy**.

Why other options are wrong:

- Converting mechanical into electrical energy describes a generator.
- Heat-to-electrical describes a thermocouple.
- Chemical-to-electrical describes a cell or battery.

Final Answer: A motor converts electrical energy into mechanical energy $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q50

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	A	4	D	5	B
6	A	7	B	8	C	9	B	10	C
11	D	12	A	13	C	14	D	15	B
16	A	17	D	18	C	19	A	20	B
21	D	22	A	23	C	24	B	25	A
26	D	27	C	28	B	29	A	30	D
31	B	32	C	33	A	34	D	35	C
36	B	37	A	38	D	39	B	40	C
41	A	42	D	43	B	44	C	45	D
46	A	47	C	48	B	49	D	50	A