Jharkhand Polytechnic Physics

Sample Paper – 7

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 electric charge is the:

(A) ampere

(B) volt

(C) coulomb

(D) joule

Q2. Identify the fundamental (base) physical quantity from the list below:

(A) mass

(B) force

(C) area

(D) speed

Q3. A cyclist moves with a speed of 20 m/s. Expressed in kilometre per hour, this speed is:

(A) 36 km/h

(B) 20 km/h

(C) 5.6 km/h

(D) 72 km/h

Q4. The metric prefix "micro" (μ) stands for a multiplying factor of:

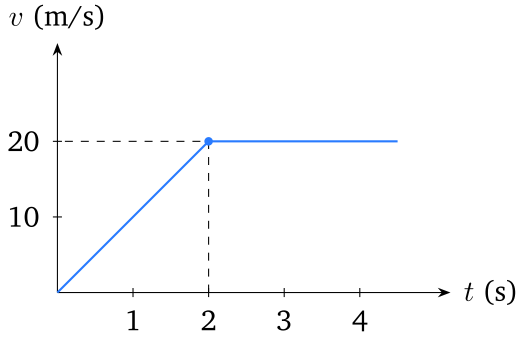
(A) 10^{-3}

(B) 10^{-6}

(C) 10^{-9}

(D) 10^{6}

Q5. The velocity–time graph of a body is shown below. The body first accelerates uniformly and then moves with a constant velocity. The maximum (final) velocity attained by the body is:



(A) 10 m/s

(B) 20 m/s

(C) 40 m/s

(D) 5 m/s

Q6. A body moving with an initial velocity of 5 m/s accelerates uniformly at 2 m/s^2 for 5 seconds. Its final velocity is:

(A) 15 m/s

(B) 10 m/s

(C) 7 m/s

(D) 25 m/s

Q7. A force of 12 N acts on a body of mass 6 kg. The acceleration produced in the body is:

(A) 6 m/s^2

(B) 72 m/s^2

(C) 2 m/s^2

(D) 0.5 m/s^2

Q8. For a body of constant mass, Newton's second law tells us that the acceleration produced is directly proportional to the:

(A) mass of the body

(B) time taken

(C) velocity of the body

(D) net force applied

Q9. When you push hard against a rigid wall, the wall pushes back on your hand with an equal and opposite force. This best illustrates Newton's:

(A) third law of motion

(B) first law of motion

(C) second law of motion

(D) law of gravitation

Q10. A force of 5 N acts on a body for a time of 4 seconds. The impulse imparted to the body is:

(A) 1.25 N s

(B) 20 N s

(C) 9 N s

(D) 0.8 N s

Q11. A boy runs once completely around a circular track and returns to his starting point. The magnitude of his displacement is:

(A) equal to the circumference of the track

(B) equal to the diameter of the track

(C) equal to the radius of the track

(D) zero

Q12. A constant force of 7 N moves a body through a distance of 6 m in the direction of the force. The work done is:

(A) 42 J

(B) 13 J

(C) 1.17 J

(D) 1 J

Q13. The kinetic energy of a body of mass 10 kg moving with a speed of 2 m/s is:

(A) 40 J

(B) 10 J

(C) 20 J

(D) 100 J

Q14. A body of mass 3 kg is lifted to a height of 4 m. The gravitational potential energy gained by it is:

(A) 12 J

(B) 120 J

(C) 70 J

(D) 30 J

Q15. A device does 250 J of work in 10 seconds. The power of the device is:

(A) 2500 W

(B) 260 W

(C) 0.04 W

(D) 25 W

Q16. According to the law of conservation of energy, energy can be:

(A) neither created nor destroyed, only changed from one form to another

(B) created but never destroyed

(C) destroyed but never created

(D) both freely created and destroyed

Q17. The weight of an object of mass 7 kg on the surface of the Earth is:

(A) 7 N

(B) 0.7 N

(C) 70 N

(D) 700 N

Q18. The weight of a body is best described as the:

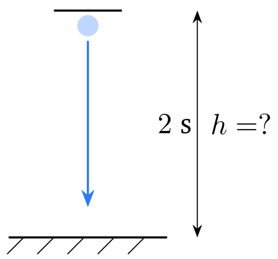
(A) quantity of matter contained in the body

(B) amount of space occupied by the body

(C) push required to set the body moving

(D) force with which the Earth attracts the body

Q19. A stone is dropped from rest from the top of a tower and falls freely for 2 seconds before reaching the ground, as shown. The height of the tower is (take $g = 10\ \text{m/s}^2$):



(A) 20 m

(B) 10 m

(C) 40 m

(D) 5 m

Q20. A body weighs 100 N on the surface of the Earth. Taking $g = 10\ \text{m/s}^2$, its mass is:

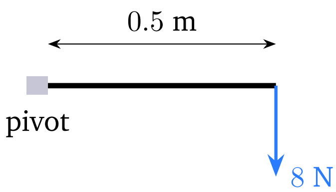
(A) 1000 kg

(B) 10 kg

(C) 100 kg

(D) 1 kg

Q21. A force of 8 N is applied at the end of a lever at a perpendicular distance of 0.5 m from the pivot, as shown. The moment (turning effect) of the force about the pivot is:



(A) 16 N m

(B) 0.0625 N m

(C) $8\,\mathrm{N\,m}$

(D) $4\,\mathrm{N\,m}$

Q22. A body is in rotational (turning) equilibrium when the total clockwise moment about a point is:

(A) equal to the total anticlockwise moment about the same point

(B) greater than the total anticlockwise moment

(C) less than the total anticlockwise moment

(D) zero, whatever the anticlockwise moment may be

Q23. The time period of a simple pendulum does NOT depend on the:

(A) length of the pendulum

(B) value of g at that place

(C) mass of the bob

(D) square root of its length

Q24. In simple harmonic motion, the velocity of the oscillating particle is zero at the:

(A) mean (equilibrium) position

(B) extreme position

(C) midpoint between the mean and the extreme position

(D) it is never zero anywhere

Q25. A liquid is at a temperature of $50\,°\mathrm{C}$. Its temperature on the Kelvin scale is:

(A) 50 K

(B) 223 K

(C) 273 K

(D) 323 K

Q26. How much heat is needed to raise the temperature of 3 kg of aluminium by $4\,^{\circ}$C? (Specific heat of aluminium $= 900$ J kg^{-1} $^{\circ}$C^{-1})

(A) 10800 J

(B) 3600 J

(C) 2700 J

(D) 1200 J

Q27. A hot body loses heat to its surroundings mainly by emitting:

(A) ultraviolet rays

(B) infrared radiation

(C) X-rays

(D) sound waves

Q28. Which of the following statements about thermal conductivity is correct?

(A) Wood conducts heat better than metals

(B) Metals and wood conduct heat equally well

(C) Metals are good conductors of heat while wood is a poor conductor

(D) Both metals and wood are poor conductors of heat

Q29. Ventilators are provided near the ceiling of a room so that:

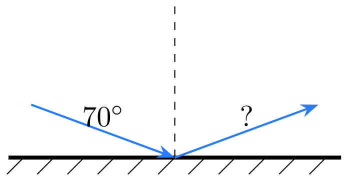
(A) sunlight can enter the room easily

(B) cold air can settle near the floor

(C) rain water can drain out quickly

(D) warm air, being lighter, can escape by convection

Q30. A ray of light strikes a plane mirror making an angle of incidence of 70° with the normal, as shown. The angle of reflection is:



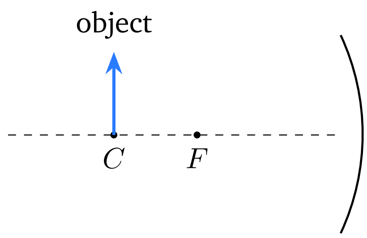
(A) 70°

(B) 20°

(C) 140°

(D) 0°

Q31. An object is placed exactly at the centre of curvature (C, i.e. at $2F$) of a concave mirror, as shown. The image formed is:



(A) virtual, erect and magnified

(B) real, inverted and diminished

(C) real, inverted and of the same size

(D) virtual, erect and diminished

Q32. The image formed by a convex mirror of any object placed in front of it is always:

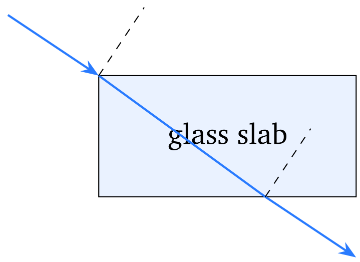
(A) real and magnified

(B) virtual, erect and diminished

(C) real and of the same size

(D) virtual and magnified

Q33. A ray of light passes through a rectangular glass slab, as shown. The ray that finally emerges from the slab is:



(A) bent permanently towards the normal

(B) completely reflected back into the air

(C) turned at 90° to the incident ray

(D) parallel to the incident ray but laterally displaced

Q34. The magnification produced by a mirror is defined as the ratio of the:

(A) height of the image to the height of the object

(B) height of the object to the height of the image

(C) object distance to the image distance

(D) focal length to the radius of curvature

Q35. An object is placed beyond twice the focal length $(2F)$ of a convex lens. The image formed is:

(A) virtual, erect and magnified

(B) real, inverted and magnified

(C) real, inverted and diminished

(D) virtual, erect and diminished

Q36. The lens present inside the human eye is a:

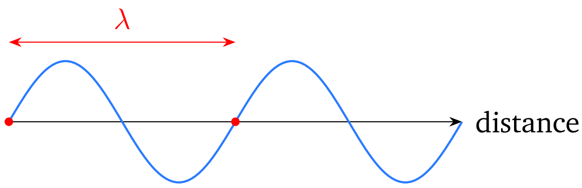
(A) concave (diverging) lens

(B) convex (converging) lens

(C) flat glass plate

(D) cylindrical lens

Q37. A sound wave of frequency 160 Hz travels through a medium at a speed of 320 m/s. Its wavelength, indicated by λ in the figure, is:



(A) 0.5 m

(B) 5 m

(C) 1 m

(D) 2 m

Q38. Sound waves cannot travel through:

(A) a vacuum

(B) air

(C) water

(D) steel

Q39. In SONAR, a sound pulse sent into water returns after a total time t on reflection from an object. If v is the speed of sound in water, the distance of the object from the source is:

(A) $v \times t$

(B) $\frac{v \times t}{2}$

(C) $2 \times v \times t$

(D) $\frac{v}{t}$

Q40. The pitch (shrillness) of a musical sound is determined mainly by its:

(A) amplitude

(B) loudness

(C) frequency

(D) speed in air

Q41. A current of 4 A flows through a resistor of resistance $5\,\Omega$. The potential difference across the resistor is:

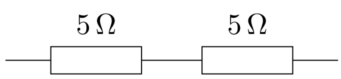
(A) 0.8 V

(B) 9 V

(C) 1.25 V

(D) 20 V

Q42. Two resistors of $5\,\Omega$ each are connected in series, as shown. Their equivalent resistance is:



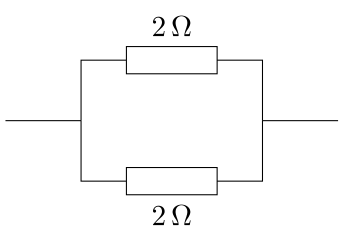
(A) $10\,\Omega$

(B) $2.5\,\Omega$

(C) $5\,\Omega$

(D) $25\,\Omega$

Q43. Two resistors of $2\,\Omega$ each are connected in parallel, as shown. Their equivalent resistance is:



(A) $4\,\Omega$

(B) $1\,\Omega$

(C) $2\,\Omega$

(D) $0.5\,\Omega$

Q44. An electric heater of resistance $10\,\Omega$ is connected to a 20 V supply. The power consumed by the heater is:

(A) 4000 W

(B) 200 W

(C) 40 W

(D) 2 W

Q45. A miniature circuit breaker (MCB) or a fuse is included in a household circuit in order to:

(A) increase the supply voltage

(B) protect the circuit by breaking it during an overload or short circuit

(C) store electrical energy for later use

(D) convert alternating current into direct current

Q46. As the temperature of a metallic conductor increases, its electrical resistance generally:

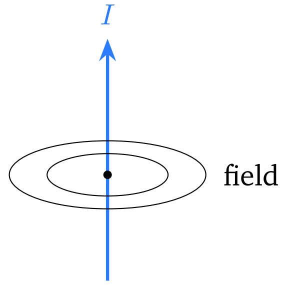
(A) increases

(B) decreases

(C) remains exactly constant

(D) becomes zero

Q47. The magnetic field lines produced around a long straight current-carrying wire are circles that lie in a plane which is:



(A) parallel to the wire

(B) along the length of the wire

(C) inclined at 45° to the wire

(D) perpendicular to the wire

Q48. Which of the following statements about an electromagnet is correct, compared with a permanent magnet?

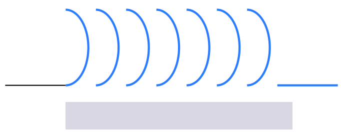
(A) It can never be switched off once made

(B) Its polarity can never be changed

(C) Its magnetism is temporary and can be switched on or off

(D) It is always weaker than every permanent magnet

Q49. A current is passed through the coil shown below, which is wound on a soft-iron core. The arrangement behaves as an:



soft-iron core

(A) capacitor

(B) fuse

(C) electromagnet

(D) thermocouple

Q50. A galvanometer is an instrument that uses the magnetic effect of an electric current to:

(A) measure the temperature of a wire

(B) detect the presence of an electric current

(C) store electric charge

(D) generate a very high voltage

Detailed Solutions

Q1.

Solution

Concept — SI units of electrical quantities: Electric charge is the basic electrical quantity, and its SI unit is named after the French physicist Charles-Augustin de Coulomb.

Step 1 — Relate charge to current: Charge is current multiplied by time, $Q = I \times t$.

Step 2 — Build the unit: Unit of charge = ampere $\times$ second = ampere-second, which is given the special name **coulomb (C)**.

Why other options are wrong:

- Ampere: SI unit of electric current.
- Volt: SI unit of potential difference.
- Joule: SI unit of work or energy.

Final Answer: The SI unit of charge is the coulomb $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q1

Q2.

Solution

Concept — Fundamental quantities: The seven 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, area and speed are each built by combining base quantities, so they are derived quantities.

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

Why other options are wrong:

- Force = mass $\times$ acceleration (derived).
- Area = length $\times$ length (derived).
- Speed = distance / time (derived).

Final Answer: Mass is the fundamental quantity $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q2

Q3.

Solution

Concept — Unit conversion: To change m/s into km/h, multiply by $\frac{18}{5}$ (which is the same as 3.6).

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

Step 2 — Substitute the value: Speed $= 20 \times \frac{18}{5}$ km/h.

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

Why other options are wrong:

- 36 uses a factor of 1.8 instead of 3.6.
- 20 leaves the value unchanged.
- 5.6 divides instead of multiplying.

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

Answer: (D) Go Back to Q3

Q4.

Solution

Concept — Metric prefixes: Each metric prefix stands for a power of ten that multiplies the base unit.

Step 1 — Recall the prefix: The prefix "micro" (μ) means one millionth.

Step 2 — Write as a power of ten: One millionth $= \frac{1}{1\,000\,000} = 10^{-6}$.

Why other options are wrong:

- 10^{-3} is the prefix "milli".
- 10^{-9} is the prefix "nano".
- 10^{6} is the prefix "mega".

Final Answer: micro $= 10^{-6} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q4

Q5.

Solution

Concept — Velocity–time graph: In a v–t graph, the height of the line at any instant gives the velocity at that instant. A flat (horizontal) part means the velocity stays constant.

Step 1 — Read the rising part: The line climbs steadily from 0 until it reaches the top at $t = 2$ s.

Step 2 — Read the flat part: From $t = 2$ s onward the line is horizontal, so the velocity no longer changes.

Step 3 — Read the value: The dashed guide line meets the velocity axis at 20 m/s, so the maximum (final) velocity is 20 m/s.

Why other options are wrong:

- 10 m/s is only the mid-scale mark, not the top.
- 40 m/s is off the graph scale.
- 5 m/s is far below the flat level.

Final Answer: Maximum velocity $= 20$ m/s $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q5

Q6.

Solution

Concept — Equation of motion: For uniform acceleration, $v = u + at$.

Step 1 — List the data: $u = 5$ m/s, $a = 2$ m/s^2, $t = 5$ s.

Step 2 — Compute the product at: $at = 2 \times 5 = 10$.

Step 3 — Add the initial velocity: $v = 5 + 10 = 15$ m/s.

Why other options are wrong:

- 10 m/s is only the at part, forgetting u.
- 7 adds $5 + 2$ instead of using at.
- 25 multiplies 5×5 wrongly.

Final Answer: Final velocity $= 15$ m/s $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q6

Q7.

Solution

Concept — Newton's second law: Acceleration equals net force divided by mass, $a = \dfrac{F}{m}$.

Step 1 — List the data: $F = 12$ N, $m = 6$ kg.

Step 2 — Substitute: $a = \dfrac{12}{6}$.

Step 3 — Compute: $a = 2$ m/s^2.

Why other options are wrong:

- 6 ignores the division.
- 72 multiplies force and mass.
- 0.5 divides mass by force.

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

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — Newton's second law (proportionality): The law is written $F = ma$, which can be rearranged as $a = \dfrac{F}{m}$.

Step 1 — Hold the mass constant: If m is fixed, then a depends only on F.

Step 2 — State the relation: With m constant, $a \propto F$, so acceleration is directly proportional to the net applied force.

Why other options are wrong:

- For a fixed mass, mass is not a variable.
- Time does not appear in $F = ma$.
- Velocity is the result of acceleration, not its cause.

Final Answer: Acceleration $\propto$ net force applied $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q8

Q9.

Solution

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

Step 1 — Identify the action: Your hand pushes on the wall (action).

Step 2 — Identify the reaction: The wall pushes back on your hand with an equal force in the opposite direction (reaction).

Why other options are wrong:

- The first law deals with inertia and balanced forces.
- The second law relates force, mass and acceleration.
- The law of gravitation concerns attraction between masses, not contact pushes.

Final Answer: Wall pushing back illustrates the third law $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Impulse: Impulse is the product of force and the time for which it acts, Impulse $= F \times t$.

Step 1 — List the data: $F = 5$ N, $t = 4$ s.

Step 2 — Substitute: Impulse $= 5 \times 4$.

Step 3 — Compute: Impulse $= 20$ N s.

Why other options are wrong:

- 1.25 divides force by time.
- 9 adds force and time.
- 0.8 divides time by force.

Final Answer: Impulse $= 20$ N s $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Displacement: Displacement is the straight-line distance from the starting point to the final point, measured in a fixed direction.

Step 1 — Locate the end point: After one full lap the boy is back exactly where he began.

Step 2 — Measure the gap: The straight-line distance between the start and the end point is zero.

Why other options are wrong:

- The circumference is the total path length (distance), not displacement.
- The diameter and the radius are fixed lengths of the circle, not the gap between start and finish.

Final Answer: Displacement = zero $\Rightarrow \boxed{\text{D}}$

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: $F = 7$ N, $s = 6$ m.

Step 2 — Substitute: $W = 7 \times 6$.

Step 3 — Compute: $W = 42$ J.

Why other options are wrong:

- 13 adds force and distance.
- 1.17 divides force by distance.
- 1 subtracts the values.

Final Answer: Work done $= 42$ 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: $m = 10$ kg, $v = 2$ m/s.

Step 2 — Square the velocity: $v^2 = 2^2 = 4$.

Step 3 — Substitute and compute: $KE = \frac{1}{2} \times 10 \times 4 = 20$ J.

Why other options are wrong:

- 40 forgets the factor $\frac{1}{2}$.
- 10 uses v instead of v^2.
- 100 squares the wrong quantity.

Final Answer: Kinetic energy $= 20$ J $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q13

Q14.

Solution

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

Step 1 — List the data: $m = 3$ kg, $g = 10$ m/s^2, $h = 4$ m.

Step 2 — Multiply mass and g: $3 \times 10 = 30$.

Step 3 — Multiply by the height: $30 \times 4 = 120$ J.

Why other options are wrong:

- 12 multiplies only mass and height.
- 70 does not follow the formula.
- 30 leaves out the height.

Final Answer: Potential energy $= 120$ J $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

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

Step 1 — List the data: $W = 250$ J, $t = 10$ s.

Step 2 — Substitute: $P = \dfrac{250}{10}$.

Step 3 — Compute: $P = 25$ W.

Why other options are wrong:

- 2500 multiplies instead of dividing.
- 260 adds the values.
- 0.04 inverts the ratio.

Final Answer: Power $= 25$ W $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q15

Q16.

Solution

Concept — Conservation of energy: The total energy of an isolated system stays the same; energy only changes its form.

Step 1 — State the law: Energy can be neither created nor destroyed.

Step 2 — Add the key idea: It can only be transformed from one form into another, for example from potential energy into kinetic energy.

Why other options are wrong:

- Energy cannot be created out of nothing.
- Energy cannot simply vanish.
- Free creation and destruction would break the law.

Final Answer: Energy is only transformed, never created or destroyed $\Rightarrow \boxed{\text{A}}$

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: $m = 7$ kg, $g = 10$ m/s^2.

Step 2 — Substitute: $W = 7 \times 10$.

Step 3 — Compute: $W = 70$ N.

Why other options are wrong:

- 7 N is just the mass value.
- 0.7 N divides instead of multiplying.
- 700 N multiplies by an extra factor of ten.

Final Answer: Weight $= 70$ N $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q17

Q18.

Solution

Concept — Weight as a force: Weight is not matter but a force; it is the pull of gravity on a body.

Step 1 — Recall the formula: $W = mg$, where g is the acceleration due to gravity.

Step 2 — Interpret it: Because W is mass times an acceleration, it is a force, specifically the force with which the Earth attracts the body.

Why other options are wrong:

- Quantity of matter is the mass, not the weight.
- Space occupied is the volume.
- The push needed to move a body relates to applied force and friction, not weight.

Final Answer: Weight is the gravitational force of the Earth on the body $\Rightarrow \boxed{\text{D}}$

Answer: (D) 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, $t = 2$ s.

Step 2 — Square the time: $t^2 = 2^2 = 4$.

Step 3 — Substitute and compute: $s = \frac{1}{2} \times 10 \times 4 = 20$ m.

Why other options are wrong:

- 10 m uses $g \times t$ only and forgets the squaring.
- 40 m forgets the factor $\frac{1}{2}$.
- 5 m uses t in place of t^2.

Final Answer: Height of the tower $= 20$ m $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q19

Q20.

Solution

Concept — Weight and mass: Weight is the gravitational force on a body, $W = mg$. Rearranging gives the mass $m = \dfrac{W}{g}$.

Step 1 — List the data: $W = 100$ N, $g = 10$ m/s^2.

Step 2 — Substitute: $m = \dfrac{100}{10}$.

Step 3 — Compute: $m = 10$ kg.

Why other options are wrong:

- 1000 kg multiplies by g instead of dividing.
- 100 kg ignores g and uses the weight value directly.
- 1 kg divides by 100 instead of 10.

Final Answer: Mass $= 10$ kg $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q20

Q21.

Solution

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

Step 1 — List the data: $F = 8$ N, $d = 0.5$ m.

Step 2 — Substitute: Moment $= 8 \times 0.5$.

Step 3 — Compute: Moment $= 4$ N m.

Why other options are wrong:

- 16 divides force by distance.
- 0.0625 divides distance by force.
- 8 ignores the distance.

Final Answer: Moment $= 4$ N m $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q21

Q22.

Solution

Concept — Principle of moments: A body is balanced (in rotational equilibrium) when the turning effects on the two sides cancel out.

Step 1 — State the principle: Total clockwise moment = total anticlockwise moment about the same point.

Step 2 — Interpret it: When these two are equal, the body has no net turning effect and stays balanced.

Why other options are wrong:

- If the clockwise moment is greater, the body turns clockwise.
- If it is less, the body turns anticlockwise.
- Equilibrium needs the two moments to match, not the clockwise one to be zero.

Final Answer: Clockwise moment = anticlockwise moment $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q22

Q23.

Solution

Concept — Time period of a simple pendulum: The time period is $T = 2\pi\sqrt{\frac{L}{g}}$, which contains only the length L and the gravity g.

Step 1 — Check what appears: Length and g are both in the formula, and T depends on the square root of the length.

Step 2 — Check what is missing: The mass of the bob does not appear anywhere in the formula.

Why other options are wrong:

- Length is clearly inside the formula.
- g is inside the formula.
- T varies as the square root of the length, so that does affect T.

Final Answer: T does not depend on the mass of the bob $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q23

Q24.

Solution

Concept — Simple harmonic motion: In SHM the speed is greatest at the mean position and falls to zero at the turning points.

Step 1 — Picture the motion: At the extreme position the particle momentarily stops before reversing its direction.

Step 2 — Conclude: Because it changes direction there, its velocity is zero at the extreme position.

Why other options are wrong:

- At the mean position the velocity is maximum, not zero.
- Between mean and extreme the velocity has an in-between value.
- The velocity does become zero, so "never zero" is false.

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

Answer: (B) Go Back to Q24

Q25.

Solution

Concept — Celsius to Kelvin: To change a Celsius temperature into kelvin, add 273.

Step 1 — Write the relation: $T(\text{K}) = T(^\circ\text{C}) + 273$.

Step 2 — Substitute: $T = 50 + 273$.

Step 3 — Compute: $T = 323$ K.

Why other options are wrong:

- 50 K forgets to add 273.
- 223 K subtracts instead of adding.
- 273 K ignores the 50 °C.

Final Answer: $50\,^\circ\text{C} = 323\text{ K} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q25

Q26.

Solution

Concept — Heat absorbed: The heat needed is $Q = mc\Delta T$, where c is the specific heat and ΔT the temperature rise.

Step 1 — List the data: $m = 3$ kg, $c = 900\text{ J kg}^{-1}\,{}^\circ\text{C}^{-1}$, $\Delta T = 4\,^\circ\text{C}$.

Step 2 — Multiply mass and specific heat: $3 \times 900 = 2700$.

Step 3 — Multiply by the temperature rise: $2700 \times 4 = 10800$ J.

Why other options are wrong:

- 3600 uses only 900×4, leaving out the mass.
- 2700 leaves out the temperature rise.
- 1200 does not follow the formula.

Final Answer: Heat required $= 10800\text{ J} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q26

Q27.

Solution

Concept — Radiation: Every hot body gives out heat as electromagnetic waves, and for ordinary hot objects these are mainly infrared waves.

Step 1 — Identify the radiation: A warm body such as a heater or the human body emits invisible infrared radiation.

Step 2 — Confirm: This is why infrared cameras can "see" warm objects in the dark.

Why other options are wrong:

- Ultraviolet rays come from very hot sources like the Sun, not ordinary warm bodies.
- X-rays are produced by special high-energy processes.
- Sound waves are mechanical, not a form of radiated heat.

Final Answer: A hot body radiates mainly infrared radiation $\Rightarrow \boxed{\text{B}}$

$\boxed{\textbf{Answer: (B)}}$ Go Back to Q27

Q28.

Solution

Concept — Thermal conductivity: Materials that let heat pass through quickly are good conductors; those that resist heat flow are poor conductors (insulators).

Step 1 — Classify metals: Metals such as copper and iron allow heat to flow easily, so they are good conductors.

Step 2 — Classify wood: Wood resists the flow of heat, so it is a poor conductor and is used for handles.

Why other options are wrong:

- Wood does not conduct better than metals.
- Metals and wood do not conduct equally.
- Metals are not poor conductors.

Final Answer: Metals are good conductors, wood is a poor conductor $\Rightarrow \boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ Go Back to Q28

Q29.

Solution

Concept — Convection: When air is heated it expands, becomes lighter (less dense) and rises, while cooler heavier air sinks. This sets up convection currents.

Step 1 — Trace the warm air: The warm, used-up air in a room rises towards the ceiling.

Step 2 — Explain the ventilator: A ventilator placed high lets this warm light air escape, helping fresh air circulate.

Why other options are wrong:

- Letting in sunlight is the job of windows, not high ventilators.
- Cold air settling near the floor is a side effect, not the purpose of a high ventilator.
- Draining rain water is unrelated to ventilation.

Final Answer: Warm light air escapes by convection $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q29

Q30.

Solution

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

Step 1 — Read the given angle: The angle of incidence is $70°$.

Step 2 — Apply the law: The angle of reflection equals the angle of incidence, so it is also $70°$.

Why other options are wrong:

- $20°$ measures the angle from the mirror surface, not the normal.
- $140°$ adds the two angles together.
- $0°$ would mean the ray hits along the normal, which it does not.

Final Answer: Angle of reflection $= 70° \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q30

Q31.

Solution

Concept — Concave mirror image: When the object is placed at the centre of curvature C (which is at $2F$), the image is formed at C as well.

Step 1 — Locate the image: For an object at C, the reflected rays meet again at C.

Step 2 — Describe the image: The image is real, inverted and of the same size as the object.

Why other options are wrong:

- A virtual erect magnified image needs the object between the pole and F.
- A diminished image needs the object beyond C.
- A convex mirror, not this case, gives a virtual erect diminished image.

Final Answer: Image is real, inverted and the same size $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q31

Q32.

Solution

Concept — Convex mirror image: A convex mirror always spreads the reflected rays outward, so it forms a virtual image behind the mirror.

Step 1 — Note the nature: The image is virtual and erect for every position of the object.

Step 2 — Note the size: The image is always smaller (diminished) than the object, which is why convex mirrors give a wide field of view.

Why other options are wrong:

- A convex mirror never forms a real image of a real object.
- It does not give a same-size image.
- It does not magnify the object.

Final Answer: Image is virtual, erect and diminished $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q32

Q33.

Solution

Concept — Refraction through a glass slab: A ray entering a parallel-sided slab bends towards the normal, then bends away from the normal as it leaves, by an equal amount.

Step 1 — Compare directions: Because the two faces are parallel, the emergent ray comes out in the same direction as the incident ray.

Step 2 — Note the shift: The emergent ray is, however, shifted sideways from the original path. This sideways shift is called lateral displacement.

Why other options are wrong:

- The ray does not stay bent towards the normal; it straightens on exit.
- It is not totally reflected; it passes through.
- It does not turn at 90° to the incident ray.

Final Answer: Emergent ray is parallel to the incident ray but laterally displaced $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q33

Q34.

Solution

Concept — Magnification: Magnification tells how many times larger or smaller the image is than the object.

Step 1 — Write the definition: $m = \dfrac{\text{height of image}}{\text{height of object}} = \dfrac{h'}{h}$.

Step 2 — Interpret it: If $m > 1$ the image is enlarged, and if $m < 1$ the image is diminished.

Why other options are wrong:

- The reverse ratio (object over image) is the inverse of magnification.
- Object distance over image distance is related to, but not the definition of, magnification.
- Focal length over radius of curvature is a fixed mirror property, not magnification.

Final Answer: $m = \dfrac{\text{height of image}}{\text{height of object}} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q34

Q35.

Solution

Concept — Convex lens image: The image from a convex lens depends on where the object is placed relative to F and $2F$.

Step 1 — Locate the object: The object is beyond $2F$ (farther than twice the focal length).

Step 2 — Describe the image: For this position the image forms between F and $2F$ on the other side and is real, inverted and diminished.

Why other options are wrong:

- A virtual erect magnified image needs the object inside the focus.
- A real magnified image needs the object between F and $2F$.
- A convex lens does not give a virtual diminished image here.

Final Answer: Image is real, inverted and diminished $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q35

Q36.

Solution

Concept — The human eye: The eye focuses light from objects onto the retina to form a clear image.

Step 1 — Identify the lens: The eye lens must converge light to a point on the retina.

Step 2 — Name its type: Only a convex (converging) lens can bring rays together, so the eye lens is convex.

Why other options are wrong:

- A concave lens diverges light and cannot focus an image on the retina.
- A flat glass plate does not bend light to a focus.
- A cylindrical lens is used only to correct astigmatism, not as the eye's main lens.

Final Answer: The eye lens is a convex (converging) lens $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q36

Q37.

Solution

Concept — Wave equation: Speed, frequency and wavelength are related by $v = f\lambda$, so $\lambda = \frac{v}{f}$.

Step 1 — List the data: $v = 320$ m/s, $f = 160$ Hz.

Step 2 — Substitute: $\lambda = \frac{320}{160}$.

Step 3 — Compute: $\lambda = 2$ m.

Why other options are wrong:

- 0.5 m inverts the ratio.
- 5 m does not follow the formula.
- 1 m uses a wrong division.

Final Answer: Wavelength $= 2$ m $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q37

Q38.

Solution

Concept — Sound needs a medium: Sound is a mechanical wave, so it requires particles of a material to pass on the vibrations.

Step 1 — Check a vacuum: A vacuum has no particles, so there is nothing to carry the vibrations.

Step 2 — Conclude: Therefore sound cannot travel through a vacuum.

Why other options are wrong:

- Air has particles, so sound travels through it.
- Water carries sound even faster than air.
- Steel, being a solid, carries sound fastest of these.

Final Answer: Sound cannot travel through a vacuum $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q38

Q39.

Solution

Concept — SONAR (echo) ranging: The pulse travels to the object and back, so it covers twice the object's distance in time t.

Step 1 — Write the total path: Total distance travelled $= v \times t$.

Step 2 — Halve it for one way: Since this path is to the object and back, the object's distance $= \dfrac{v \times t}{2}$.

Why other options are wrong:

- $v \times t$ is the full to-and-fro path, not the one-way distance.
- $2vt$ doubles instead of halving.
- v/t has the wrong form altogether.

Final Answer: Distance $= \dfrac{v \times t}{2} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q39

Q40.

Solution

Concept — Pitch and frequency: The pitch of a sound (how shrill or how flat it sounds) is decided by the frequency of the wave.

Step 1 — Link the idea: A higher frequency is heard as a higher (shriller) pitch, and a lower frequency as a lower pitch.

Step 2 — Conclude: So pitch is determined mainly by frequency.

Why other options are wrong:

- Amplitude decides loudness, not pitch.
- Loudness is itself an effect of amplitude.
- The speed in air is nearly the same for all audible sounds and does not set the pitch.

Final Answer: Pitch is determined by frequency $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q40

Q41.

Solution

Concept — Ohm's law: The potential difference equals current times resistance, $V = IR$.

Step 1 — List the data: $I = 4$ A, $R = 5\,\Omega$.

Step 2 — Substitute: $V = 4 \times 5$.

Step 3 — Compute: $V = 20$ V.

Why other options are wrong:

- 0.8 V divides current by resistance.
- 9 V adds the values.
- 1.25 V divides resistance by current.

Final Answer: Potential difference $= 20$ V $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q41

Q42.

Solution

Concept — Resistors in series: In a series connection the equivalent resistance is the simple sum of the individual resistances.

Step 1 — Write the rule: $R_{\text{eq}} = R_1 + R_2$.

Step 2 — Substitute: $R_{\text{eq}} = 5 + 5$.

Step 3 — Compute: $R_{\text{eq}} = 10\,\Omega$.

Why other options are wrong:

- $2.5\,\Omega$ is the parallel result, not series.
- $5\,\Omega$ counts only one resistor.
- $25\,\Omega$ multiplies the two values.

Final Answer: Equivalent resistance $= 10\,\Omega \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q42

Q43.

Solution

Concept — Two equal resistors in parallel: For two equal resistors in parallel, the equivalent resistance is half of one of them.

Step 1 — Write the rule: $\dfrac{1}{R_{eq}} = \dfrac{1}{R} + \dfrac{1}{R} = \dfrac{2}{R}$, so $R_{eq} = \dfrac{R}{2}$.

Step 2 — Substitute: $R_{eq} = \dfrac{2}{2}$.

Step 3 — Compute: $R_{eq} = 1\,\Omega$.

Why other options are wrong:

- $4\,\Omega$ adds the resistances (that is the series value).
- $2\,\Omega$ keeps one resistor unchanged.
- $0.5\,\Omega$ halves too far.

Final Answer: Equivalent resistance $= 1\,\Omega \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q43

Q44.

Solution

Concept — Electric power: When voltage and resistance are known, power is $P = \dfrac{V^2}{R}$.

Step 1 — List the data: $V = 20$ V, $R = 10\,\Omega$.

Step 2 — Square the voltage: $V^2 = 20^2 = 400$.

Step 3 — Divide by the resistance: $P = \dfrac{400}{10} = 40$ W.

Why other options are wrong:

- 4000 W forgets to divide by R.
- 200 W uses V instead of V^2.
- 2 W divides the wrong way.

Final Answer: Power $= 40$ W $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q44

Q45.

Solution

Concept — Circuit protection: A fuse or an MCB is a safety device that interrupts the current if it becomes dangerously large.

Step 1 — Identify the danger: During an overload or a short circuit the current rises sharply and can cause overheating or fire.

Step 2 — State the action: The MCB trips (or the fuse melts), breaking the circuit and stopping the current, which protects the wiring and appliances.

Why other options are wrong:

- It does not raise the supply voltage.
- It does not store energy.
- It does not change AC into DC.

Final Answer: It protects the circuit by breaking it during overload or short circuit $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q45

Q46.

Solution

Concept — Resistance and temperature: In a metallic conductor the atoms vibrate more strongly when heated, which obstructs the flow of electrons.

Step 1 — Link heat to collisions: As temperature rises, the moving electrons collide more often with the vibrating atoms.

Step 2 — State the effect: More collisions oppose the current more, so the resistance increases.

Why other options are wrong:

- Resistance does not fall for an ordinary metal on heating.
- It does not stay exactly constant.
- It does not drop to zero.

Final Answer: Resistance of a metal increases with temperature $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q46

Q47.

Solution

Concept — Field of a straight wire: A straight current-carrying wire is surrounded by circular magnetic field lines centred on the wire.

Step 1 — Picture the circles: These circular field lines wrap around the wire like rings.

Step 2 — Find the plane: Each ring lies flat in a plane that cuts across the wire at right angles, that is a plane perpendicular to the wire.

Why other options are wrong:

- The circles are not parallel to the wire.
- They do not run along the length of the wire.
- They are not inclined at $45°$; they sit square to the wire.

Final Answer: The field circles lie in a plane perpendicular to the wire $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q47

Q48.

Solution

Concept — Electromagnet vs permanent magnet: An electromagnet is magnetic only while current flows, whereas a permanent magnet keeps its magnetism all the time.

Step 1 — Note the control: Switching the current on makes the electromagnet magnetic; switching it off removes the magnetism.

Step 2 — State the property: So an electromagnet's magnetism is temporary and can be switched on or off.

Why other options are wrong:

- It can be switched off, simply by cutting the current.
- Its polarity can be reversed by reversing the current.
- A strong electromagnet can be far more powerful than a permanent magnet.

Final Answer: Its magnetism is temporary and can be switched on or off $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q48

Q49.

Solution

Concept — Solenoid with an iron core: A current-carrying coil (solenoid) produces a magnetic field, and winding it on a soft-iron core makes the field much stronger.

Step 1 — Identify the device: A coil wound on a soft-iron core that becomes magnetic when current flows is an electromagnet.

Step 2 — Confirm the behaviour: It can be switched on and off with the current, which is the defining feature of an electromagnet.

Why other options are wrong:

- A capacitor stores charge, not a magnetic field.
- A fuse is a protective device, not a magnet.
- A thermocouple produces a voltage from a temperature difference.

Final Answer: The arrangement acts as an electromagnet $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q49

Q50.

Solution

Concept — Galvanometer: A galvanometer works on the magnetic effect of current: a current in its coil experiences a turning force in a magnetic field and deflects a pointer.

Step 1 — State its use: The deflection shows whether a current is flowing and in which direction.

Step 2 — Conclude: So a galvanometer is used to detect the presence of an electric current.

Why other options are wrong:

- Temperature is measured by a thermometer.
- Charge is stored by a capacitor.
- High voltage is produced by devices such as transformers, not a galvanometer.

Final Answer: A galvanometer detects the presence of an electric current $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q50

Answer Key

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