Jharkhand Polytechnic Physics

Sample Paper – 10

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 acceleration is:

(A) m/s

(B) m/s^2

(C) m^2/s

(D) $m\,s^2$

Q2. Out of the quantities listed below, which one is a derived quantity?

(A) Pressure

(B) Time

(C) Length

(D) Temperature

Q3. A train moves with a speed of 25 m/s. Its speed expressed in kilometre per hour is:

(A) 25 km/h

(B) 45 km/h

(C) 6.94 km/h

(D) 90 km/h

Q4. Which physical quantity has the same SI unit as impulse?

(A) Force

(B) Energy

(C) Momentum

(D) Power

Q5. A body starts from rest and moves with a uniform acceleration of 10 m/s^2 for 2 seconds. The distance it covers is:

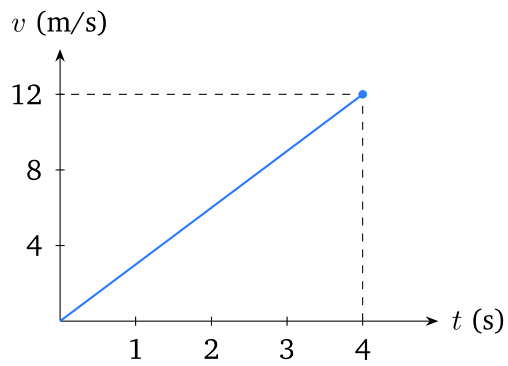
(A) 40 m

(B) 10 m

(C) 20 m

(D) 5 m

Q6. The velocity–time graph of a body starting from rest is a straight line, as shown. The acceleration of the body is:



(A) 3 m/s^2

(B) 4 m/s^2

(C) 48 m/s^2

(D) 12 m/s^2

Q7. The measure of the inertia of a body is its:

(A) velocity

(B) mass

(C) volume

(D) weight

Q8. A force acts on a body of mass 8 kg and produces an acceleration of 2.5 m/s^2. The magnitude of the force is:

(A) 3.2 N

(B) 10.5 N

(C) 16 N

(D) 20 N

Q9. Newton's third law of motion is best illustrated by which one of the following situations?

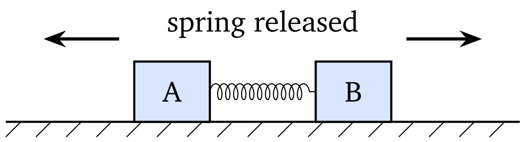
(A) A flying bird pushes the air downward and the air pushes the bird upward

(B) A stone gradually sinks in water

(C) A car speeds up along a straight road

(D) A ball rolls down a smooth slope

Q10. Two identical trolleys A and B are initially at rest with a compressed spring between them. When the spring is released, the trolleys fly apart, as shown. The total momentum of the two-trolley system just after release is:



(A) equal to the energy stored in the spring

(B) directed forward along trolley B

(C) double the momentum of one trolley

(D) zero, since the two momenta are equal and opposite

Q11. A body covers a straight displacement of 60 m in 12 seconds. Its average velocity is:

(A) 720 m/s

(B) 0.2 m/s

(C) 5 m/s

(D) 12 m/s

Q12. A constant force of 14 N moves a body through a distance of 3 m in the direction of the force. The work done is:

(A) 4.67 J

(B) 42 J

(C) 17 J

(D) 11 J

Q13. The kinetic energy of a body of mass 3 kg moving with a speed of 4 m/s is:

(A) 6 J

(B) 48 J

(C) 12 J

(D) 24 J

Q14. A body of mass 8 kg is raised to a height of 2 m. The gravitational potential energy gained is:

(A) 80 J

(B) 160 J

(C) 16 J

(D) 100 J

Q15. A machine does 500 J of work in 10 seconds. The power of the machine is:

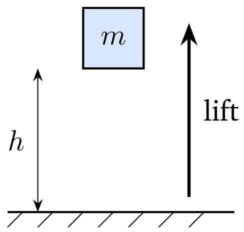
(A) 50 W

(B) 5000 W

(C) 5 W

(D) 0.02 W

Q16. A body of mass m is lifted slowly through a vertical height h, as shown. The work done against gravity is given by:



(A) $\frac{mg}{h}$

(B) $\frac{1}{2}mv^2$

(C) mgh

(D) mh

Q17. The weight of an object of mass 6 kg on the surface of the Earth is:

(A) 6 N

(B) 0.6 N

(C) 60 N

(D) 16 N

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

(A) sum of their masses

(B) product of their masses

(C) difference of their masses

(D) square of the distance between them

Q19. A stone is dropped from rest and falls freely for 1 second. Its velocity at that instant is (take $g = 10$ m/s^2):

(A) 5 m/s

(B) 20 m/s

(C) 1 m/s

(D) 10 m/s

Q20. Two objects of different masses are dropped from the same height in the absence of air resistance. They will:

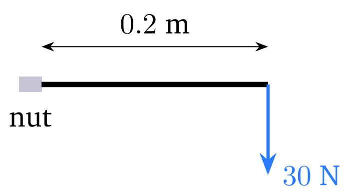
(A) reach the ground at the same time, since g is the same for all bodies at a place

(B) the heavier one reaching the ground first

(C) the lighter one reaching the ground first

(D) the heavier one taking twice the time of the lighter one

Q21. A force of 30 N is applied at the end of a spanner at a perpendicular distance of 0.2 m from the nut, as shown. The moment of the force about the nut is:



(A) 150 N m

(B) 0.0067 N m

(C) 6 N m

(D) 30.2 N m

Q22. A door handle is always fixed at the edge farthest from the hinges. This is because:

(A) it simply looks better in that position

(B) a larger distance from the hinge gives a greater turning moment for the same force

(C) it reduces the total weight of the door

(D) it makes the door harder to open

Q23. The approximate time period of a simple pendulum of length 1 m at a place where $g = 10$ m/s^2 is about:

(A) 0.5 s

(B) 1 s

(C) 4 s

(D) 2 s

Q24. In simple harmonic motion, the displacement of the particle from the mean position is maximum at the:

(A) extreme position

(B) mean (equilibrium) position

(C) midpoint between the mean and the extreme positions

(D) same value everywhere along the path

Q25. The melting point of ice is $0\,°C$. Its value on the Fahrenheit scale is:

(A) $32\,°F$

(B) $0\,°F$

(C) $273\,°F$

(D) $100\,°F$

Q26. How much heat is required to raise the temperature of 4 kg of aluminium by $2\,°C$? (Specific heat of aluminium $= 900\ \mathrm{J\,kg^{-1}\,°C^{-1}}$)

(A) 1800 J

(B) 3600 J

(C) 7200 J

(D) 900 J

Q27. Sea breeze and land breeze near a coast are caused mainly by the process of:

(A) conduction

(B) convection

(C) radiation

(D) reflection

Q28. Which of the following materials is the best heat insulator (poorest conductor of heat)?

(A) copper

(B) aluminium

(C) iron

(D) wood

Q29. Steam at $100\,^\circ\text{C}$ causes a more severe burn than the same mass of boiling water at $100\,^\circ\text{C}$ because:

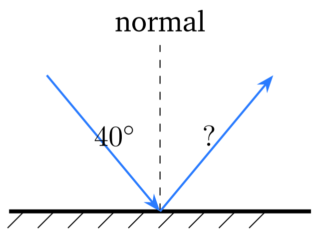
(A) steam is actually at a much higher temperature

(B) water is heavier than steam

(C) steam is lighter than air

(D) steam carries the additional latent heat of vaporisation

Q30. A ray of light strikes a plane mirror making an angle of incidence of 40° with the normal, as shown. The angle of reflection is:



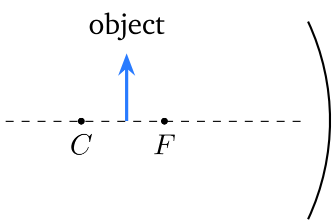
(A) 40°

(B) 50°

(C) 80°

(D) 20°

Q31. An object is placed between the focus (F) and 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, inverted and magnified

(D) a point-sized image at the focus

Q32. The radius of curvature of a concave mirror is 24 cm. Its focal length is:

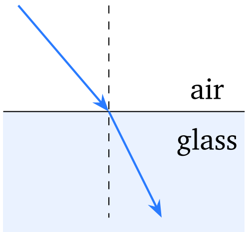
(A) 24 cm

(B) 12 cm

(C) 48 cm

(D) 6 cm

Q33. A ray of light passes from air into a denser glass block, as shown. As the light enters the glass, its speed:



(A) increases

(B) remains unchanged

(C) decreases

(D) becomes zero

Q34. For a convex lens, when an object is placed exactly at the focus, the image is formed:

(A) at infinity

(B) at the focus on the same side as the object

(C) at twice the focal length

(D) at the optical centre of the lens

Q35. The power of a concave (diverging) lens is:

(A) always positive

(B) exactly zero

(C) infinite

(D) negative

Q36. A rainbow in the sky is produced mainly by the:

(A) simple reflection of light from clouds

(B) dispersion and total internal reflection of sunlight inside water droplets

(C) refraction of light through a plane mirror

(D) scattering of light by dust particles

Q37. A sound wave has a frequency of 110 Hz and a wavelength of 3 m. The speed of the wave is:

(A) 36.7 m/s

(B) 113 m/s

(C) 110 m/s

(D) 330 m/s

Q38. In a sound wave travelling through air, a rarefaction is a region of:

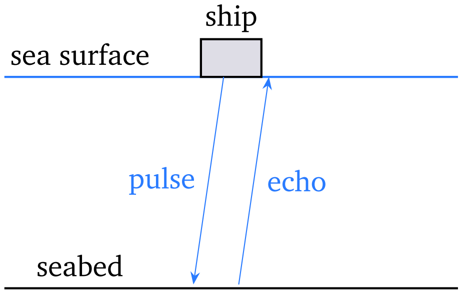
(A) high pressure and high density

(B) exactly zero pressure

(C) low pressure and low density

(D) constant, unchanging pressure

Q39. A SONAR on a ship sends a sound pulse straight down. The echo from the seabed returns after a total time of 4 s. If the speed of sound in water is 1500 m/s, the depth of the sea is:



(A) 6000 m

(B) 3000 m

(C) 1500 m

(D) 375 m

Q40. A female voice usually sounds higher in pitch than a male voice because it has a higher:

(A) frequency

(B) amplitude

(C) wavelength

(D) speed

Q41. A potential difference of 12 V is applied across a resistor of resistance $3\,\Omega$. The current flowing through it is:

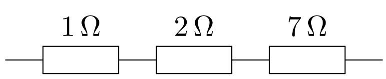
(A) 4 A

(B) 36 A

(C) 0.25 A

(D) 9 A

Q42. Three resistors of $1\,\Omega$, $2\,\Omega$ and $7\,\Omega$ are connected in series, as shown. Their equivalent resistance is:



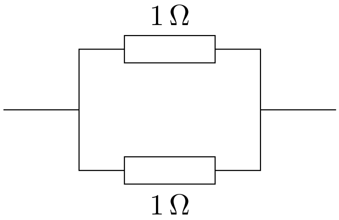
(A) $0.7\,\Omega$

(B) $10\,\Omega$

(C) $7\,\Omega$

(D) $14\,\Omega$

Q43. Two resistors, each of $1\,\Omega$, are connected in parallel, as shown. Their equivalent resistance is:



(A) $2\,\Omega$

(B) $1\,\Omega$

(C) $0.25\,\Omega$

(D) $0.5\,\Omega$

Q44. An electric heater operates at 220 V and draws a current of 4 A. The power consumed by it is:

(A) 55 W

(B) 224 W

(C) 880 W

(D) 440 W

Q45. The current rating of a fuse used in an electric circuit is usually chosen to be:

(A) much lower than the normal current

(B) slightly higher than the normal operating current of the circuit

(C) exactly equal to zero

(D) equal to the supply voltage

Q46. If the length of a wire is doubled while its area of cross-section is kept unchanged, its resistance:

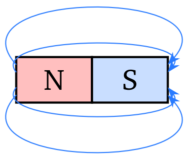
(A) becomes half

(B) remains the same

(C) becomes double

(D) becomes one-fourth

Q47. The magnetic field lines of a bar magnet, sketched below, always:



(A) form closed, continuous loops

(B) start and end abruptly in mid-air

(C) cross one another at many points

(D) remain as perfectly straight lines

Q48. An electromagnet is the key working part of which of the following devices?

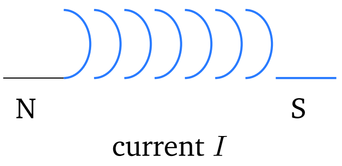
(A) a simple pendulum clock

(B) a mercury thermometer

(C) an ordinary spring balance

(D) an electric bell

Q49. In the current-carrying solenoid shown, if the direction of the current is reversed, the magnetic polarity of its ends will:



(A) stay exactly the same

(B) disappear completely

(C) become twice as strong

(D) get reversed, with the N and S ends interchanging

Q50. Which one of the following devices works on the magnetic effect of electric current?

(A) Electric iron

(B) Electric motor

(C) Electric bulb

(D) Electric kettle

Detailed Solutions

Q1.

Solution

Concept — Units and Measurement: Acceleration is the rate of change of velocity with time. Its unit is built from the units of velocity and time.

Step 1 — Write the definition: Acceleration $= \dfrac{\text{change in velocity}}{\text{time}}$.

Step 2 — Build the unit: The unit becomes $\dfrac{\text{m/s}}{\text{s}} = \text{m/s}^2$.

Why other options are wrong:

- m/s is the unit of velocity, not acceleration.
- m^2/s and m s^2 are not standard units of any common quantity here.

Final Answer: The SI unit of acceleration is $\text{m/s}^2 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — Fundamental and derived quantities: A derived quantity is obtained by combining one or more of the seven fundamental quantities. The fundamental ones include length, mass, time and temperature.

Step 1 — Test pressure: Pressure $= \dfrac{\text{force}}{\text{area}}$, and force itself comes from mass and acceleration, so pressure is a derived quantity.

Step 2 — Check the others: Time, length and temperature are all fundamental (base) quantities.

Why other options are wrong:

- Time, length and temperature are base quantities, not derived.

Final Answer: Pressure is the derived 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 $\frac{3600}{1000} = \frac{18}{5}$.

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

Step 2 — Substitute the value: Speed $= 25 \times \frac{18}{5}$ km/h.

Step 3 — Simplify: $25 \div 5 = 5$, then $5 \times 18 = 90$. So speed $= 90$ km/h.

Why other options are wrong:

- 25 km/h forgets to convert at all.
- 6.94 km/h divides instead of multiplying.
- 45 km/h uses a wrong factor.

Final Answer: $25 \text{ m/s} = 90 \text{ km/h} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q3

Q4.

Solution

Concept — Impulse: Impulse equals force multiplied by time, and it also equals the change in momentum of a body. So impulse and momentum share the same unit.

Step 1 — Use the impulse–momentum relation: Impulse $= F \times t = \Delta p$ (change in momentum).

Step 2 — Compare units: The unit of impulse is N s, and N s = kg m/s, which is exactly the unit of momentum.

Why other options are wrong:

- Force has the unit newton (N).
- Energy has the unit joule (J).
- Power has the unit watt (W).

Final Answer: Impulse has the same unit as momentum $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q4

Q5.

Solution

Concept — Equation of motion: For uniform acceleration, $s = ut + \frac{1}{2}at^2$.

Step 1 — List the data: $u = 0$ (starts from rest), $a = 10$ m/s^2, $t = 2$ s.

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

Step 3 — Substitute: $s = (0 \times 2) + \frac{1}{2} \times 10 \times 4$.

Step 4 — Compute: $s = 0 + \frac{1}{2} \times 40 = 20$ m.

Why other options are wrong:

- 40 m forgets the factor $\frac{1}{2}$.
- 10 m uses t instead of t^2.
- 5 m divides incorrectly.

Final Answer: Distance covered $= 20$ m $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q5

Q6.

Solution

Concept — Velocity–time graph: For a straight-line v–t graph, the 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 12 m/s as the time goes from 0 to 4 s (the line meets the dashed guide at $v = 12$ m/s, $t = 4$ s).

Step 2 — Apply the slope formula: $a = \frac{\Delta v}{\Delta t} = \frac{12 - 0}{4 - 0}$.

Step 3 — Compute: $a = \frac{12}{4} = 3$ m/s^2.

Why other options are wrong:

- 4 m/s^2 swaps the numerator and denominator.
- 48 m/s^2 multiplies instead of dividing.
- 12 m/s^2 is the final velocity, not the acceleration.

Final Answer: Acceleration $= 3$ m/s^2 $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q6

Q7.

Solution

Concept — Inertia: Inertia is the tendency of a body to resist a change in its state of rest or of motion. The greater the mass, the greater the inertia.

Step 1 — Link mass and inertia: A heavier body is harder to start, stop or turn, so its inertia is larger.

Step 2 — Conclude: The quantity that measures inertia is therefore the **mass** of the body.

Why other options are wrong:

- Velocity describes motion, not the resistance to change in motion.
- Volume is the space occupied, unrelated to inertia.
- Weight is the gravitational force, which changes with location, while inertia does not.

Final Answer: Mass is the measure of inertia $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept — Newton's second law: The force on a body is the product of its mass and acceleration, $F = ma$.

Step 1 — List the data: $m = 8$ kg, $a = 2.5$ m/s^2.

Step 2 — Substitute: $F = 8 \times 2.5$.

Step 3 — Compute: $F = 20$ N.

Why other options are wrong:

- 3.2 N divides mass by acceleration.
- 10.5 N adds mass and acceleration.
- 16 N uses a wrong multiplier.

Final Answer: Force $= 20$ N $\Rightarrow \boxed{\text{D}}$

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 — Apply to the bird: A flying bird pushes the air downward with its wings (action); the air pushes the bird upward with an equal force (reaction).

Step 2 — Identify the pair: The downward push on the air and the upward push on the bird form an action–reaction pair.

Why other options are wrong:

- A stone sinking in water shows gravity overcoming buoyancy.
- A car speeding up shows the second law.
- A ball rolling down a slope shows motion under gravity.

Final Answer: A bird flying by pushing air downward illustrates the third law $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Conservation of momentum: In the absence of external forces, the total momentum of a system stays constant. Before release the trolleys are at rest, so the total momentum is zero.

Step 1 — Find the initial momentum: Both trolleys are at rest, so total momentum before release $= 0$.

Step 2 — Apply conservation: The total momentum after release must also be 0.

Step 3 — Interpret: The two trolleys move apart with equal and opposite momenta, which add up to zero.

Why other options are wrong:

- Momentum is not equal to the spring's stored energy (different quantities).
- There is no single forward direction; the momenta are opposite.
- The total is not doubled; the opposite momenta cancel.

Final Answer: Total momentum after release $= 0 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q10

Q11.

Solution

Concept — Average velocity: Average velocity is the total displacement divided by the total time taken.

Step 1 — List the data: displacement $= 60$ m, time $= 12$ s.

Step 2 — Substitute: velocity $= \dfrac{60}{12}$.

Step 3 — Compute: velocity $= 5$ m/s.

Why other options are wrong:

- 720 m/s multiplies instead of dividing.
- 0.2 m/s inverts the ratio.
- 12 m/s simply repeats the time value.

Final Answer: Average velocity $= 5$ m/s $\Rightarrow \boxed{\text{C}}$

Answer: (C) 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: $F = 14$ N, $s = 3$ m.

Step 2 — Substitute: $W = 14 \times 3$.

Step 3 — Compute: $W = 42$ J.

Why other options are wrong:

- 4.67 J divides force by distance.
- 17 J adds force and distance.
- 11 J subtracts the values.

Final Answer: Work done $= 42$ J $\Rightarrow \boxed{\text{B}}$

Answer: (B) 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: $m = 3$ kg, $v = 4$ m/s.

Step 2 — Square the velocity: $v^2 = 4^2 = 16$.

Step 3 — Substitute and compute: $KE = \frac{1}{2} \times 3 \times 16 = \frac{1}{2} \times 48 = 24$ J.

Why other options are wrong:

- 6 J uses v instead of v^2.
- 48 J forgets the factor $\frac{1}{2}$.
- 12 J leaves out a factor.

Final Answer: Kinetic energy $= 24$ J $\Rightarrow \boxed{\text{D}}$

Answer: (D) 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: $m = 8$ kg, $g = 10$ m/s^2, $h = 2$ m.

Step 2 — Substitute: $PE = 8 \times 10 \times 2$.

Step 3 — Compute: $PE = 80 \times 2 = 160$ J.

Why other options are wrong:

- 80 J leaves out the height factor.
- 16 J ignores the value of g.
- 100 J uses incorrect numbers.

Final Answer: Potential energy $= 160$ 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: $W = 500$ J, $t = 10$ s.

Step 2 — Substitute: $P = \dfrac{500}{10}$.

Step 3 — Compute: $P = 50$ W.

Why other options are wrong:

- 5000 W multiplies instead of dividing.
- 5 W divides by a wrong number.
- 0.02 W inverts the ratio.

Final Answer: Power $= 50$ W $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q15

Q16.

Solution

Concept — Work against gravity: To lift a body slowly through a height h, the applied force must balance the weight mg, and it acts over the distance h.

Step 1 — Find the force: The minimum upward force equals the weight, $F = mg$.

Step 2 — Apply work = force × distance: $W = F \times h = mg \times h$.

Step 3 — Write the result: $W = mgh$.

Why other options are wrong:

- $\frac{mg}{h}$ divides by the height instead of multiplying.
- $\frac{1}{2}mv^2$ is kinetic energy, not the lifting work.
- mh leaves out the value of g.

Final Answer: Work done against gravity $= mgh \Rightarrow \boxed{\text{C}}$

Answer: (C) 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: $m = 6$ kg, $g = 10$ m/s^2.

Step 2 — Substitute: $W = 6 \times 10$.

Step 3 — Compute: $W = 60$ N.

Why other options are wrong:

- 6 N is the mass value, not the weight.
- 0.6 N divides instead of multiplying.
- 16 N adds mass and g.

Final Answer: Weight $= 60$ N $\Rightarrow \boxed{\text{C}}$

Answer: (C) 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 the masses: The numerator $m_1 m_2$ shows the force is directly proportional to the product of the two masses.

Step 2 — Confirm: Doubling either mass doubles the force.

Why other options are wrong:

- The sum or difference of the masses does not appear in the law.
- Force is inversely, not directly, proportional to the square of the distance.

Final Answer: Force $\propto$ product of the masses $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q18

Q19.

Solution

Concept — Free fall: For a body dropped from rest, the velocity after time t is $v = gt$.

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

Step 2 — Substitute: $v = 10 \times 1$.

Step 3 — Compute: $v = 10$ m/s.

Why other options are wrong:

- 5 m/s uses half of g.
- 20 m/s doubles the result.
- 1 m/s simply repeats the time value.

Final Answer: Velocity after 1 s = 10 m/s $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q19

Q20.

Solution

Concept — Acceleration due to gravity: At a given place, g is the same for all bodies and does not depend on their masses. In free fall (no air resistance) every body has the same acceleration.

Step 1 — Compare the accelerations: Both objects fall with the same acceleration g, independent of mass.

Step 2 — Same height, same time: Starting from the same height with the same acceleration, they take equal times to reach the ground.

Why other options are wrong:

- Without air resistance, the heavier object does not fall faster.
- The lighter object does not fall faster either.
- Time of fall does not depend on mass.

Final Answer: They reach the ground at the same time $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q20

Q21.

Solution

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

Step 1 — List the data: $F = 30$ N, $d = 0.2$ m.

Step 2 — Substitute: $M = 30 \times 0.2$.

Step 3 — Compute: $M = 6$ N m.

Why other options are wrong:

- 150 N m divides force by distance.
- 0.0067 N m inverts the calculation.
- 30.2 N m adds the values instead of multiplying.

Final Answer: Moment $= 6$ N m $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q21

Q22.

Solution

Concept — Turning effect of a force: The moment of a force equals force times perpendicular distance from the pivot. For the same force, a larger distance gives a larger moment.

Step 1 — Identify the pivot: The hinges act as the axis of rotation of the door.

Step 2 — Maximise the distance: Fixing the handle at the far edge makes the distance from the hinge as large as possible, so a small push produces a large turning moment.

Why other options are wrong:

- Appearance is not a physics reason.
- The handle position does not change the door's weight.
- A larger moment makes the door easier, not harder, to open.

Final Answer: A larger distance gives a greater turning moment $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q22

Q23.

Solution

Concept — Time period of a simple pendulum: $T = 2\pi\sqrt{\frac{L}{g}}$, where L is the length and g is the acceleration due to gravity.

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

Step 2 — Find the ratio: $\frac{L}{g} = \frac{1}{10} = 0.1$, so $\sqrt{0.1} \approx 0.316$.

Step 3 — Multiply: $T = 2\pi \times 0.316 \approx 6.28 \times 0.316 \approx 2$ s.

Why other options are wrong:

- 0.5 s and 1 s are far too small for a 1 m pendulum.
- 4 s is roughly double the correct value.

Final Answer: Time period ≈ 2 s $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q23

Q24.

Solution

Concept — Simple harmonic motion: In SHM a particle oscillates about a mean position. Its displacement from the mean is zero at the centre and largest at the turning points.

Step 1 — Locate the turning points: The extreme positions are the farthest points the particle reaches on either side of the mean.

Step 2 — Conclude: The displacement from the mean position is therefore maximum at the **extreme position**.

Why other options are wrong:

- At the mean position the displacement is zero.
- Midway the displacement is only partial.
- The displacement clearly changes along the path, so it is not constant.

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

Answer: (A) Go Back to Q24

Q25.

Solution

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

Step 1 — List the data: $C = 0\,°\text{C}$.

Step 2 — Substitute: $F = \frac{9}{5} \times 0 + 32$.

Step 3 — Compute: $F = 0 + 32 = 32\,°\text{F}$.

Why other options are wrong:

- $0\,°\text{F}$ forgets to add 32.
- $273\,°\text{F}$ confuses the Kelvin offset with Fahrenheit.
- $100\,°\text{F}$ uses the wrong reference point.

Final Answer: $0\,°\text{C} = 32\,°\text{F} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q25

Q26.

Solution

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

Step 1 — List the data: $m = 4$ kg, $c = 900\ \text{J kg}^{-1}\,°\text{C}^{-1}$, $\Delta T = 2\,°\text{C}$.

Step 2 — Multiply mass and specific heat: $4 \times 900 = 3600$.

Step 3 — Multiply by the temperature rise: $Q = 3600 \times 2 = 7200$ J.

Why other options are wrong:

- 1800 J halves the result.
- 3600 J leaves out the temperature change.
- 900 J uses only the specific heat.

Final Answer: Heat required $= 7200\text{ J} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q26

Q27.

Solution

Concept — Convection: In convection, warm fluid (air or water) rises and cooler fluid moves in to take its place, setting up a current. Sea and land breezes are large-scale convection currents of air.

Step 1 — During the day: Land heats faster than the sea, the warm air over land rises, and cooler air from the sea flows in as the sea breeze.

Step 2 — Identify the process: This movement of air masses is convection.

Why other options are wrong:

- Conduction needs direct contact through a solid.
- Radiation does not involve moving air currents.
- Reflection is an optical effect, not heat transfer in air.

Final Answer: Sea and land breezes are due to convection $\Rightarrow \boxed{\text{B}}$

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

Q28.

Solution

Concept — Conductors and insulators of heat: Metals are good conductors of heat, while materials such as wood, plastic and air are poor conductors (insulators).

Step 1 — Compare the options: Copper, aluminium and iron are all metals and conduct heat well.

Step 2 — Pick the insulator: Among the choices, only **wood** is a poor conductor, making it the best insulator.

Why other options are wrong:

- Copper, aluminium and iron are good conductors, not insulators.

Final Answer: Wood is the best heat insulator $\Rightarrow \boxed{\text{D}}$

$\boxed{\text{Answer: (D)}}$ Go Back to Q28

Q29.

Solution

Concept — Latent heat of vaporisation: When steam condenses into water at $100\,^{\circ}\mathrm{C}$, it releases a large amount of latent heat before the water even begins to cool.

Step 1 — Compare steam and water: Steam and boiling water are both at $100\,^{\circ}\mathrm{C}$, so the temperature is the same.

Step 2 — Account for the extra heat: Steam first gives out its latent heat of vaporisation as it condenses on the skin, supplying extra heat that boiling water does not.

Step 3 — Conclude: This extra latent heat makes the burn from steam more severe.

Why other options are wrong:

- Steam is not at a higher temperature; both are at $100\,^{\circ}\mathrm{C}$.
- The relative weight of water and steam is not the reason.
- Steam being lighter than air is irrelevant to the burn.

Final Answer: Steam carries extra latent heat of vaporisation $\Rightarrow \boxed{\mathrm{D}}$

Answer: (D) Go Back to Q29

Q30.

Solution

Concept — Laws of reflection: The angle of reflection is always equal to the angle of incidence, both measured from the normal.

Step 1 — Read the data: The angle of incidence is 40°.

Step 2 — Apply the law: Angle of reflection $=$ angle of incidence $= 40^{\circ}$.

Why other options are wrong:

- 50° measures from the mirror surface, not the normal.
- 80° doubles the angle of incidence.
- 20° halves it.

Final Answer: Angle of reflection $= 40^{\circ} \Rightarrow \boxed{\mathrm{A}}$

Answer: (A) Go Back to Q30

Q31.

Solution

Concept — Concave mirror images: For a concave mirror, when the object lies between the focus F and the centre of curvature C, the image is formed beyond C.

Step 1 — Locate the image: With the object between F and C, the reflected rays meet beyond C, forming a real image.

Step 2 — Describe the image: This image is real, inverted and magnified (larger than the object). This is the principle used in a projector.

Why other options are wrong:

- A virtual erect magnified image forms only when the object is between the pole and F.
- A real inverted diminished image forms when the object is beyond C.
- A point-sized image at the focus forms only for a very distant object.

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

Answer: (C) Go Back to Q31

Q32.

Solution

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

Step 1 — List the data: $R = 24$ cm.

Step 2 — Substitute: $f = \dfrac{24}{2}$.

Step 3 — Compute: $f = 12$ cm.

Why other options are wrong:

- 24 cm uses R itself as f.
- 48 cm doubles R instead of halving it.
- 6 cm divides by 4.

Final Answer: Focal length $= 12$ cm $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q32

Q33.

Solution

Concept — Refraction and speed of light: Light travels fastest in a rare medium and slows down when it enters a denser medium. The bending towards the normal in the figure is a direct sign of this slowing.

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

Step 2 — Conclude about the speed: On entering glass, the speed of light **decreases**.

Why other options are wrong:

- The speed does not increase in a denser medium.
- It does not remain unchanged; that is why the ray bends.
- It does not fall to zero; the light still travels through the glass.

Final Answer: The speed of light decreases in glass $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q33

Q34.

Solution

Concept — Image formation by a convex lens: When the object is placed exactly at the focus of a convex lens, the refracted rays emerge parallel to one another and meet only at infinity.

Step 1 — Trace the rays: Rays from an object at the focus become parallel after passing through the lens.

Step 2 — Locate the image: Parallel rays meet at infinity, so the image is formed at infinity (highly magnified and real).

Why other options are wrong:

- The image is not on the same side as the object.
- It is not at twice the focal length.
- It is not at the optical centre.

Final Answer: The image is formed at infinity $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q34

Q35.

Solution

Concept — Power of a lens: The power of a lens is $P = \frac{1}{f}$ (with f in metres). A concave (diverging) lens has a negative focal length by sign convention, so its power is negative.

Step 1 — Note the focal length sign: For a concave lens, f is taken as negative.

Step 2 — Find the power sign: Since $P = \frac{1}{f}$ and f is negative, the power P is also negative.

Why other options are wrong:

- A positive power belongs to a convex (converging) lens.
- The power is not zero for a real lens.
- The power is finite, not infinite.

Final Answer: The power of a concave lens is negative $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q35

Q36.

Solution

Concept — Rainbow formation: A rainbow forms when sunlight enters tiny water droplets, is dispersed into its colours, undergoes total internal reflection inside the droplet, and refracts again on leaving.

Step 1 — Dispersion: White sunlight splits into its component colours as it refracts into each droplet.

Step 2 — Internal reflection: The light reflects off the inner back surface of the droplet and emerges, sending the spread of colours to the observer.

Why other options are wrong:

- Simple reflection from clouds cannot split white light.
- A plane mirror is not involved in a natural rainbow.
- Scattering by dust produces effects like the blue sky, not a rainbow.

Final Answer: A rainbow forms by dispersion and total internal reflection in water droplets $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q36

Q37.

Solution

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

Step 1 — List the data: $f = 110$ Hz, $\lambda = 3$ m.

Step 2 — Substitute: $v = 110 \times 3$.

Step 3 — Compute: $v = 330$ m/s.

Why other options are wrong:

- 36.7 m/s divides frequency by wavelength.
- 113 m/s adds the two values.
- 110 m/s ignores the wavelength.

Final Answer: Speed of the wave $= 330$ m/s $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q37

Q38.

Solution

Concept — Compressions and rarefactions: A sound wave in air is longitudinal, made of compressions (crowded particles, high pressure) and rarefactions (spread-out particles, low pressure).

Step 1 — Describe a rarefaction: In a rarefaction the air particles are farther apart than normal.

Step 2 — Relate to pressure: Fewer particles in the same space means lower pressure and lower density.

Why other options are wrong:

- High pressure and high density describe a compression, not a rarefaction.
- The pressure is not exactly zero in a rarefaction.
- The pressure is not constant; it varies along the wave.

Final Answer: A rarefaction is a region of low pressure and low density $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q38

Q39.

Solution

Concept — SONAR and echo: The pulse travels down to the seabed and the echo travels back up, so it covers twice the depth. The depth is $d = \dfrac{v \times t}{2}$.

Step 1 — List the data: $v = 1500$ m/s, total time $t = 4$ s.

Step 2 — Find the total distance: distance $= v \times t = 1500 \times 4 = 6000$ m.

Step 3 — Halve it for the depth: $d = \dfrac{6000}{2} = 3000$ m.

Why other options are wrong:

- 6000 m forgets to halve the total path.
- 1500 m uses only the speed.
- 375 m divides by an extra factor.

Final Answer: Depth of the sea $= 3000$ m $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q39

Q40.

Solution

Concept — Pitch and frequency: The pitch of a sound is decided by its frequency; the higher the frequency, the higher the pitch.

Step 1 — Link voice and pitch: A female voice sounds higher (shriller) than a typical male voice.

Step 2 — Identify the cause: A higher pitch corresponds to a higher **frequency** of the sound waves.

Why other options are wrong:

- Amplitude controls loudness, not pitch.
- Wavelength is larger, not smaller, for a lower frequency, so it is not the direct cause stated.
- The speed of sound in air is the same for both voices.

Final Answer: A higher-pitched voice has a higher frequency $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q40

Q41.

Solution

Concept — Ohm's law: The current through a resistor is $I = \frac{V}{R}$.

Step 1 — List the data: $V = 12$ V, $R = 3\,\Omega$.

Step 2 — Substitute: $I = \frac{12}{3}$.

Step 3 — Compute: $I = 4$ A.

Why other options are wrong:

- 36 A multiplies instead of dividing.
- 0.25 A inverts the ratio.
- 9 A subtracts instead of dividing.

Final Answer: Current $= 4$ A $\Rightarrow \boxed{\text{A}}$

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: $R_1 = 1\,\Omega$, $R_2 = 2\,\Omega$, $R_3 = 7\,\Omega$.

Step 2 — Add the first two: $1 + 2 = 3\,\Omega$.

Step 3 — Add the third: $3 + 7 = 10\,\Omega$.

Why other options are wrong:

- $0.7\,\Omega$ uses the parallel formula by mistake.
- $7\,\Omega$ takes only the largest resistor.
- $14\,\Omega$ adds an extra value.

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

Answer: (B) Go Back to Q42

Q43.

Solution

Concept — Resistors in parallel: For two equal resistors in parallel, $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$.

Step 1 — List the data: $R_1 = 1\,\Omega$, $R_2 = 1\,\Omega$.

Step 2 — Add the reciprocals: $\frac{1}{R} = \frac{1}{1} + \frac{1}{1} = 2$.

Step 3 — Invert: $R = \frac{1}{2} = 0.5\,\Omega$.

Why other options are wrong:

- $2\,\Omega$ adds the resistances instead of using the parallel rule.
- $1\,\Omega$ forgets to combine the two.
- $0.25\,\Omega$ divides by an extra factor.

Final Answer: Equivalent parallel resistance $= 0.5\,\Omega \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q43

Q44.

Solution

Concept — Electric power: The power consumed by an appliance is $P = V \times I$.

Step 1 — List the data: $V = 220$ V, $I = 4$ A.

Step 2 — Substitute: $P = 220 \times 4$.

Step 3 — Compute: $P = 880$ W.

Why other options are wrong:

- 55 W divides instead of multiplying.
- 224 W adds the two values.
- 440 W multiplies by 2 instead of 4.

Final Answer: Power consumed $= 880$ W $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q44

Q45.

Solution

Concept — Fuse rating: A fuse is a safety device that melts and breaks the circuit when the current becomes too large. Its rating must be a little above the normal working current so that it does not blow during ordinary use but still protects against dangerous overloads.

Step 1 — Avoid nuisance tripping: If the rating were below the normal current, the fuse would blow during normal operation.

Step 2 — Allow protection: A rating slightly above the normal current lets normal current pass but melts during an overload.

Why other options are wrong:

- A rating much lower would keep blowing in normal use.
- A rating of zero would mean the fuse never conducts.
- The fuse rating is a current, not a voltage.

Final Answer: Fuse rating is slightly higher than the normal operating current $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q45

Q46.

Solution

Concept — Resistance and length: The resistance of a wire is directly proportional to its length, $R \propto L$ (when area and material stay the same).

Step 1 — Note the change: The length is doubled while the area is unchanged.

Step 2 — Apply the proportionality: Since $R \propto L$, doubling the length doubles the resistance.

Why other options are wrong:

- Halving would happen if the area were doubled, not the length.
- The resistance does not stay the same when the length changes.
- One-fourth has no basis here.

Final Answer: The resistance becomes double $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q46

Q47.

Solution

Concept — Magnetic field lines: The magnetic field lines of a bar magnet emerge from the north pole, travel through the surrounding space to the south pole, and continue inside the magnet back to the north pole, forming closed loops.

Step 1 — Trace one line: A line leaves the N pole, curves around to the S pole outside, and returns inside the magnet.

Step 2 — Conclude: Every field line is a closed, continuous loop; field lines also never cross one another.

Why other options are wrong:

- Field lines do not start or stop abruptly in mid-air.
- Two field lines never cross, because the field has one direction at each point.
- The lines are curved, not perfectly straight.

Final Answer: Magnetic field lines form closed, continuous loops $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q47

Q48.

Solution

Concept — Uses of an electromagnet: An electromagnet is a temporary magnet produced by passing current through a coil wound on a soft-iron core. It is used wherever a magnetism that can be switched on and off is needed.

Step 1 — Recall the electric bell: In an electric bell, the electromagnet attracts an iron strip to strike the gong, then releases it repeatedly.

Step 2 — Match the device: Of the options, only the electric bell relies on an electromagnet.

Why other options are wrong:

- A pendulum clock works by gravity and timing, not an electromagnet.
- A mercury thermometer works by thermal expansion.
- A spring balance works by the stretching of a spring.

Final Answer: An electromagnet is used in an electric bell $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q48

Q49.

Solution

Concept — Solenoid polarity: A current-carrying solenoid behaves like a bar magnet. The end where the current appears anticlockwise is the N pole and where it appears clockwise is the S pole. These depend on the direction of the current.

Step 1 — Reverse the current: Reversing the current reverses the sense (clockwise / anticlockwise) at each end.

Step 2 — Conclude: Therefore the N and S ends interchange, that is the polarity gets reversed.

Why other options are wrong:

- The polarity does not stay the same when the current reverses.
- The magnetism does not disappear; only its direction flips.
- The strength of the field is unchanged for the same current; only the poles swap.

Final Answer: The N and S ends interchange (polarity reverses) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q49

Q50.

Solution

Concept — Magnetic effect of current: An electric current produces a magnetic field around it. A device that uses this magnetic field to work is said to work on the magnetic effect of current.

Step 1 — Test each device: An electric iron, bulb and kettle all work on the *heating* effect of current.

Step 2 — Identify the correct one: An electric motor uses the force on a current-carrying coil placed in a magnetic field, so it works on the magnetic effect of current.

Why other options are wrong:

- Electric iron works on the heating effect of current.
- Electric bulb glows due to the heating effect of current.
- Electric kettle heats water using the heating effect of current.

Final Answer: The electric motor works on the magnetic effect of current $\Rightarrow \boxed{\text{B}}$

$\boxed{\text{Answer: (B)}}$ Go Back to Q50

Answer Key

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