Jharkhand Polytechnic Physics

Sample Paper – 3

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 power is the:

(A) joule

(B) newton

(C) watt

(D) pascal

Q2. Among the quantities given below, the fundamental (base) quantity is:

(A) Length

(B) Force

(C) Speed

(D) Area

Q3. A train moves with a speed of 90 km/h. Its speed in metre per second is:

(A) 30 m/s

(B) 25 m/s

(C) 45 m/s

(D) 20 m/s

Q4. The prefix "kilo" stands for a multiplying factor of:

(A) 10^{-3}

(B) 10^{6}

(C) 10^{2}

(D) 10^{3}

Q5. A body starts from rest and moves with a uniform acceleration of 5 m/s^2. Using $v^2 = u^2 + 2as$, its velocity after covering a distance of 10 m is:

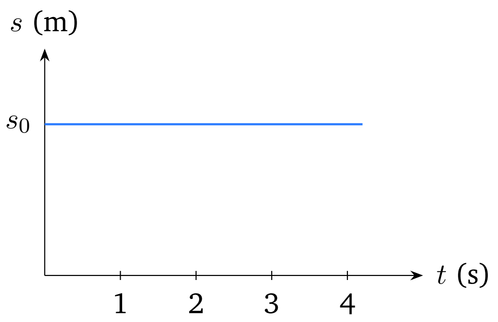
(A) 10 m/s

(B) 100 m/s

(C) 50 m/s

(D) 20 m/s

Q6. The distance–time graph of a body is shown below. The graph tells us that the body is:



(A) moving with a uniform speed

(B) moving with increasing speed

(C) at rest (stationary)

(D) moving with uniform acceleration

Q7. When a bus standing at rest suddenly starts moving, a passenger standing inside it tends to fall backward. This happens because of:

(A) inertia of motion

(B) inertia of rest

(C) inertia of direction

(D) Newton's third law of motion

Q8. A force of 20 N produces an acceleration of 4 m/s^2 in a body. The mass of the body is:

(A) 80 kg

(B) 24 kg

(C) 16 kg

(D) 5 kg

Q9. While walking, a person pushes the ground backward with the foot and the ground pushes the person forward. This is a direct example of:

(A) Newton's third law of motion

(B) Newton's first law of motion

(C) the law of conservation of energy

(D) the law of inertia

Q10. When two bodies collide and no external force acts on them, the quantity of the system that remains constant is the total:

(A) kinetic energy

(B) linear momentum

(C) velocity

(D) acceleration

Q11. A cyclist covers a distance of 100 m in 20 s. The average speed of the cyclist is:

(A) 2000 m/s

(B) 0.2 m/s

(C) 5 m/s

(D) 10 m/s

Q12. A constant force of 25 N moves a body through a distance of 2 m in the direction of the force. The work done is:

(A) 12.5 J

(B) 27 J

(C) 23 J

(D) 50 J

Q13. The kinetic energy of a body of mass 1 kg moving with a speed of 10 m/s is:

(A) 50 J

(B) 5 J

(C) 100 J

(D) 10 J

Q14. A body of mass 5 kg is raised to a height of 4 m. The gravitational potential energy gained by it is:

(A) 20 J

(B) 200 J

(C) 90 J

(D) 50 J

Q15. A force of 20 N moves a body at a constant velocity of 5 m/s in the direction of the force. The power delivered is:

(A) 4 W

(B) 25 W

(C) 100 W

(D) 15 W

Q16. According to the work–energy theorem, the work done by the net force on a body is equal to the:

(A) change in its momentum

(B) change in its potential energy

(C) change in its power

(D) change in its kinetic energy

Q17. The weight of an object of mass 12 kg on the surface of the Earth is:

(A) 120 N

(B) 1.2 N

(C) 12 N

(D) 60 N

Q18. In Newton's law of gravitation $F = G\frac{m_1 m_2}{r^2}$, the quantity G is called the:

(A) acceleration due to gravity

(B) gravitational potential

(C) universal gravitational constant

(D) weight of the body

Q19. A stone is dropped from rest and falls freely for 4 seconds. The distance it falls is (take $g = 10$ m/s^2):

(A) 40 m

(B) 80 m

(C) 160 m

(D) 20 m

Q20. In a vacuum, a feather and a stone are dropped from the same height and reach the ground at the same instant. This is because the acceleration due to gravity:

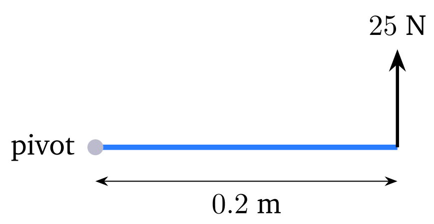
(A) is greater for the heavier stone

(B) is greater for the lighter feather

(C) depends on the shape of the body

(D) is the same for all bodies, whatever their mass

Q21. A force of 25 N is applied at the end of a lever at a perpendicular distance of 0.2 m from the pivot, as shown. The moment (turning effect) of the force about the pivot is:



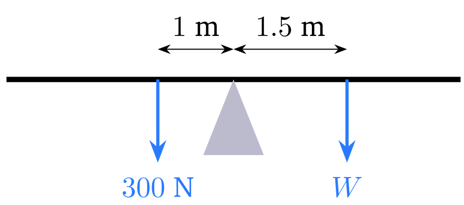
(A) 5 N m

(B) 125 N m

(C) 0.008 N m

(D) 12.5 N m

Q22. On a balanced see-saw, a child of weight 300 N sits 1 m from the pivot. To balance it, another child must sit 1.5 m from the pivot on the other side, as shown. The weight of the second child is:



(A) 450 N

(B) 200 N

(C) 300 N

(D) 100 N

Q23. If the length of a simple pendulum is increased, its time period will:

(A) decrease

(B) remain the same

(C) increase

(D) become zero

Q24. In simple harmonic motion, the restoring force on the particle always acts:

(A) towards the mean (equilibrium) position

(B) towards the extreme position

(C) in the direction of motion

(D) perpendicular to the displacement

Q25. The boiling point of water is $212\,°F$. Its value on the Celsius scale is:

(A) $180\,°C$

(B) $32\,°C$

(C) $84\,°C$

(D) $100\,°C$

Q26. How much heat is needed to raise the temperature of 1 kg of water by $20\,°C$? (Specific heat of water $= 4200\ \mathrm{J\,kg^{-1}\,°C^{-1}}$)

(A) 4200 J

(B) 84000 J

(C) 42000 J

(D) 8400 J

Q27. Heat from the Sun reaches the Earth across empty space mainly by the process of:

(A) radiation

(B) conduction

(C) convection

(D) advection

Q28. The heat required to change 1 kg of ice into water at $0\,^{\circ}$C, without any change in temperature, is called the latent heat of:

(A) vaporisation

(B) sublimation

(C) fusion

(D) condensation

Q29. During the night, cool air blows from the land towards the sea. This wind is called the:

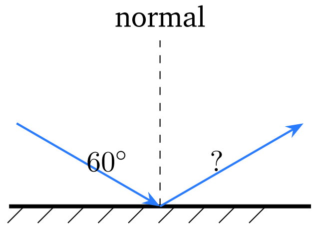
(A) sea breeze

(B) monsoon wind

(C) trade wind

(D) land breeze

Q30. A ray of light strikes a plane mirror making an angle of incidence of 60° with the normal, as shown. The angle of reflection is:



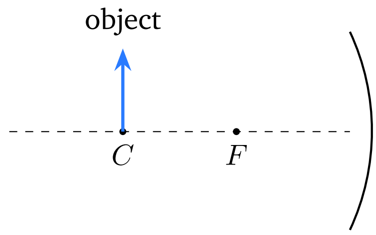
(A) 30°

(B) 60°

(C) 120°

(D) 0°

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



(A) real, inverted and of the same size

(B) virtual, erect and magnified

(C) real, inverted and magnified

(D) virtual, erect and diminished

Q32. The image of a real object formed by a convex mirror is always:

(A) real and inverted

(B) real and magnified

(C) virtual and erect

(D) real and of the same size

Q33. An object is placed 30 cm in front of a concave mirror of focal length 15 cm. Using $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ (with $f = -15$ cm, $u = -30$ cm), the image distance v is:

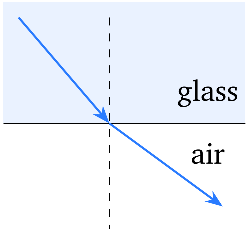
(A) -10 cm

(B) -15 cm

(C) -45 cm

(D) -30 cm

Q34. A ray of light travels from a glass block into the surrounding air, as shown. On entering the air, the ray bends:



(A) towards the normal

(B) away from the normal

(C) along the normal

(D) back into the glass

Q35. A concave lens always behaves as a:

(A) diverging lens

(B) converging lens

(C) plane glass slab

(D) magnifying lens

Q36. The blue colour of the clear daytime sky is mainly due to the .... of sunlight by air molecules.

(A) reflection

(B) dispersion

(C) scattering

(D) total internal reflection

Q37. A sound wave travels with a speed of 340 m/s and has a frequency of 170 Hz. Its wavelength is:

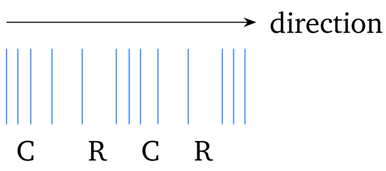
(A) 0.5 m

(B) 510 m

(C) 170 m

(D) 2 m

Q38. A sound wave passing through air is shown below as alternate close and spread-out regions. Such a wave consists of:



(A) compressions and rarefactions

(B) only crests and troughs

(C) electric and magnetic fields

(D) only nodes and antinodes

Q39. To hear a distinct echo, the minimum distance between the listener and the reflecting surface should be about:

(A) 1.7 m

(B) 17 m

(C) 34 m

(D) 340 m

Q40. The pitch (shrillness) of a sound depends on its:

(A) amplitude

(B) loudness

(C) frequency

(D) speed

Q41. A potential difference of 12 V is applied across a resistor of resistance $6\,\Omega$. The current flowing through it is:

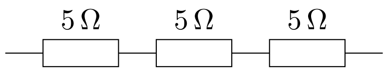
(A) 2 A

(B) 72 A

(C) 18 A

(D) 0.5 A

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



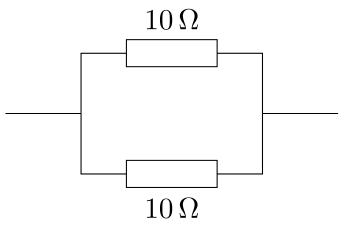
(A) $1.67\,\Omega$

(B) $5\,\Omega$

(C) $10\,\Omega$

(D) $15\,\Omega$

Q43. Two resistors, each of $10\,\Omega$, are connected in parallel, as shown. Their equivalent resistance is:



(A) $20\,\Omega$

(B) $5\,\Omega$

(C) $10\,\Omega$

(D) $100\,\Omega$

Q44. A resistor of resistance $5\,\Omega$ is connected across a potential difference of 10 V. Using $P = \dfrac{V^2}{R}$, the power dissipated is:

(A) 2 W

(B) 50 W

(C) 20 W

(D) 500 W

Q45. When the live and neutral wires touch each other directly, the resistance of the circuit becomes very small and a very large current flows. This condition is called a:

(A) short circuit

(B) open circuit

(C) overloading

(D) earthing

Q46. To measure the current flowing through a circuit element, an ammeter is always connected in:

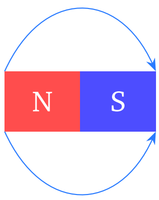
(A) parallel with the element

(B) place of the cell

(C) the earth wire

(D) series with the element

Q47. Outside a bar magnet, the magnetic field lines are directed from the:



(A) south pole to the north pole

(B) north pole to the south pole

(C) north pole to another north pole

(D) middle of the magnet outward

Q48. Soft iron is used as the core of an electromagnet because, while the current flows, it acts as a:

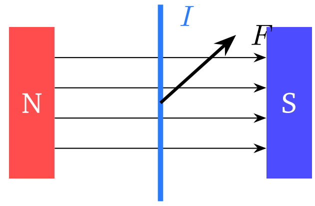
(A) permanent magnet

(B) non-magnetic material

(C) strong natural magnet

(D) temporary magnet

Q49. A straight current-carrying conductor is placed in a magnetic field, as shown. The direction of the force acting on the conductor is given by:



(A) the right-hand thumb rule

(B) Fleming's right-hand rule

(C) Fleming's left-hand rule

(D) Lenz's law

Q50. The strength of an electromagnet can be increased by:

(A) decreasing the number of turns in the coil

(B) increasing the number of turns in the coil

(C) using a copper core instead of an iron core

(D) reducing the current in the coil

Detailed Solutions

Q1.

Solution

Concept — Units and Measurement: Power is the rate of doing work. Its SI unit is derived from the units of energy and time.

Step 1 — Build the unit: Power $= \dfrac{\text{work}}{\text{time}} = \dfrac{\text{joule}}{\text{second}}$.

Step 2 — Name the unit: One joule per second is given the special name **watt (W)**, after James Watt.

Why other options are wrong:

- Joule: SI unit of work or energy.
- Newton: SI unit of force.
- Pascal: SI unit of pressure.

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

Answer: (C) 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, speed and area are all formed by combining base quantities, so they are derived quantities.

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

Why other options are wrong:

- Force = mass × acceleration (derived).
- Speed = distance / time (derived).
- Area = length × length (derived).

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

Answer: (A) 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 $= 90 \times \frac{5}{18}$ m/s.

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

Why other options are wrong:

- 30 and 45 come from using a wrong factor.
- 20 corresponds to 72 km/h, not 90 km/h.

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

Answer: (B) Go Back to Q3

Q4.

Solution

Concept — SI prefixes: Prefixes stand for powers of ten that multiply a unit.

Step 1 — Recall the prefix: The prefix "kilo" means one thousand.

Step 2 — Write as a power of ten: One thousand $= 10^3$, so kilo $= 10^3$.

Why other options are wrong:

- 10^{-3} is the prefix milli.
- 10^6 is the prefix mega.
- 10^2 is the prefix hecto.

Final Answer: kilo $= 10^3 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Equation of motion: For uniform acceleration, $v^2 = u^2 + 2as$.

Step 1 — List the data: $u = 0$ (starts from rest), $a = 5$ m/s^2, $s = 10$ m.

Step 2 — Substitute: $v^2 = 0^2 + (2 \times 5 \times 10)$.

Step 3 — Compute the square: $v^2 = 100$.

Step 4 — Take the square root: $v = \sqrt{100} = 10$ m/s.

Why other options are wrong:

- 100 m/s is v^2, not v.
- 50 m/s forgets the factor 2 and the square root.
- 20 m/s misapplies the formula.

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

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — Distance–time graph: On a distance–time graph, the slope gives the speed. A horizontal line has zero slope.

Step 1 — Read the graph: The distance stays constant at s_0 as time increases; the line is flat.

Step 2 — Find the slope: Slope $= \dfrac{\Delta s}{\Delta t} = \dfrac{0}{\Delta t} = 0$, so the speed is zero.

Step 3 — Interpret: A zero speed means the body does not change its position, so it is at rest.

Why other options are wrong:

- Uniform speed would give a straight slanting line.
- Increasing speed would give an upward curving line.
- Uniform acceleration also gives a curve, not a flat line.

Final Answer: The body is at rest $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q6

Q7.

Solution

Concept — Inertia of rest: A body at rest tends to remain at rest unless an external force acts on it. This tendency is called inertia of rest.

Step 1 — Apply to the passenger: While the bus is stationary, the passenger's body is also at rest.

Step 2 — The bus starts: When the bus suddenly moves forward, the lower part of the body moves with the bus, but the upper part tends to stay at rest.

Step 3 — Result: The upper body is left behind, so the passenger falls backward.

Why other options are wrong:

- Inertia of motion makes a passenger lurch forward when the bus stops.
- Inertia of direction relates to a change in direction, not starting.
- This effect is due to inertia (first law), not the third law.

Final Answer: It is due to inertia of rest $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept — Newton's second law: Force $=$ mass $\times$ acceleration, $F = ma$, so mass $m = \dfrac{F}{a}$.

Step 1 — List the data: $F = 20$ N, $a = 4$ m/s^2.

Step 2 — Rearrange the formula: $m = \dfrac{F}{a}$.

Step 3 — Substitute and compute: $m = \dfrac{20}{4} = 5$ kg.

Why other options are wrong:

- 80 kg multiplies force and acceleration.
- 24 kg adds force and acceleration.
- 16 kg subtracts the values.

Final Answer: Mass $= 5$ kg $\Rightarrow \boxed{\text{D}}$

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: The foot pushes the ground backward (action).

Step 2 — Identify the reaction: The ground pushes the foot forward with an equal and opposite force (reaction).

Step 3 — Result: This forward reaction force moves the person ahead, so walking is a third-law example.

Why other options are wrong:

- The first law deals with inertia, not with paired forces.
- Conservation of energy is about energy, not the action–reaction pair.
- The law of inertia is just another name for the first law.

Final Answer: Walking illustrates Newton's third law $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Conservation of momentum: If no external force acts on a system, its total linear momentum stays constant before and after a collision.

Step 1 — State the law: Total momentum (before) = total momentum (after).

Step 2 — Apply to a collision: During a collision the internal forces are equal and opposite, so they do not change the total momentum.

Step 3 — Conclude: The conserved quantity is the total linear momentum.

Why other options are wrong:

- Kinetic energy is not always conserved (it is lost in inelastic collisions).
- Velocity of individual bodies changes during the collision.
- Acceleration is not a conserved quantity.

Final Answer: Total linear momentum is conserved $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Average speed: Average speed $= \dfrac{\text{total distance}}{\text{total time}}$.

Step 1 — List the data: distance $= 100$ m, time $= 20$ s.

Step 2 — Substitute: Average speed $= \dfrac{100}{20}$.

Step 3 — Compute: Average speed $= 5$ m/s.

Why other options are wrong:

- 2000 m/s multiplies instead of dividing.
- 0.2 m/s inverts the ratio.
- 10 m/s uses a wrong time.

Final Answer: Average speed $= 5$ 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: $F = 25$ N, $s = 2$ m.

Step 2 — Substitute: $W = 25 \times 2$.

Step 3 — Compute: $W = 50$ J.

Why other options are wrong:

- 12.5 J divides force by distance.
- 27 J adds force and distance.
- 23 J subtracts the values.

Final Answer: Work done $= 50$ J $\Rightarrow \boxed{\text{D}}$

Answer: (D) **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: $m = 1$ kg, $v = 10$ m/s.

Step 2 — Square the velocity: $v^2 = 10^2 = 100$.

Step 3 — Substitute and compute: $KE = \frac{1}{2} \times 1 \times 100 = 50$ J.

Why other options are wrong:

- 5 J uses v instead of v^2.
- 100 J forgets the factor $\frac{1}{2}$.
- 10 J ignores the squaring of velocity.

Final Answer: Kinetic energy $= 50$ J $\Rightarrow \boxed{\text{A}}$

Answer: (A) 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: $m = 5$ kg, $g = 10$ m/s^2, $h = 4$ m.

Step 2 — Substitute: $PE = 5 \times 10 \times 4$.

Step 3 — Compute: $PE = 200$ J.

Why other options are wrong:

- 20 J leaves out the height (or a factor).
- 90 J adds the values instead of multiplying.
- 50 J uses a wrong factor.

Final Answer: Potential energy $= 200$ J $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Power: When a force moves a body at constant velocity, power $P = F \times v$.

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

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

Step 3 — Compute: $P = 100$ W.

Why other options are wrong:

- 4 W divides force by velocity.
- 25 W adds the two values.
- 15 W subtracts the values.

Final Answer: Power $= 100$ W $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Work–energy theorem: The net work done on a body equals the change produced in its kinetic energy.

Step 1 — State the theorem: $W_{\text{net}} = \Delta KE = KE_{\text{final}} - KE_{\text{initial}}$.

Step 2 — Interpret: If positive work is done, the kinetic energy increases; if negative, it decreases.

Why other options are wrong:

- Change in momentum is linked to impulse, not work.
- Potential energy change relates to conservative forces, not the net work in this theorem.
- Power is the rate of doing work, not the work itself.

Final Answer: Net work $=$ change in kinetic energy $\Rightarrow \boxed{\text{D}}$

Answer: (D) 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: $m = 12$ kg, $g = 10$ m/s^2.

Step 2 — Substitute: $W = 12 \times 10$.

Step 3 — Compute: $W = 120$ N.

Why other options are wrong:

- 1.2 N divides instead of multiplying.
- 12 N is the mass value, not the weight.
- 60 N uses a wrong value of g.

Final Answer: Weight $= 120$ N $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Universal law of gravitation: The force between two masses is $F = G\frac{m_1 m_2}{r^2}$, where G is a constant of proportionality.

Step 1 — Identify G: G is the same for all pairs of bodies anywhere in the universe.

Step 2 — Name it: For this reason it is called the **universal gravitational constant**, with value about 6.67×10^{-11} N m^2 kg^{-2}.

Why other options are wrong:

- Acceleration due to gravity is g, not G.
- Gravitational potential is a different quantity.
- Weight is a force mg, not the constant G.

Final Answer: G is the universal gravitational constant $\Rightarrow \boxed{\text{C}}$

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, $t = 4$ s.

Step 2 — Square the time: $t^2 = 4^2 = 16$.

Step 3 — Substitute and compute: $s = \frac{1}{2} \times 10 \times 16 = 80$ m.

Why other options are wrong:

- 40 m uses $g \times t$ only.
- 160 m forgets the factor $\frac{1}{2}$.
- 20 m uses t instead of t^2.

Final Answer: Distance fallen $= 80$ m $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q19

Q20.

Solution

Concept — Acceleration due to gravity: In free fall, every body falls with the same acceleration g, regardless of its mass, provided air resistance is absent.

Step 1 — Remove air resistance: In a vacuum there is no air to slow the light feather.

Step 2 — Compare the fall: Both the feather and the stone accelerate at the same g, so they cover the same height in the same time.

Step 3 — Conclude: They reach the ground together because g does not depend on mass.

Why other options are wrong:

- g is not greater for the stone; mass does not affect g.
- g is not greater for the feather either.
- Shape matters only when air resistance is present, which it is not here.

Final Answer: g is the same for all bodies $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept — Moment of a force: The turning effect, or moment, is moment $=$ force $\times$ perpendicular distance.

Step 1 — List the data: $F = 25$ N, perpendicular distance $d = 0.2$ m.

Step 2 — Substitute: moment $= 25 \times 0.2$.

Step 3 — Compute: moment $= 5$ N m.

Why other options are wrong:

- 125 N m divides force by distance wrongly (or multiplies by 5).
- 0.008 N m divides distance by force.
- 12.5 N m uses a wrong distance.

Final Answer: Moment $= 5$ N m $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — Principle of moments: For a balanced see-saw, the clockwise moment equals the anticlockwise moment about the pivot.

Step 1 — Write the balance: $W_1 \times d_1 = W_2 \times d_2$.

Step 2 — Put in the known values: $300 \times 1 = W_2 \times 1.5$.

Step 3 — Simplify the left side: $300 = W_2 \times 1.5$.

Step 4 — Solve for W_2: $W_2 = \dfrac{300}{1.5} = 200$ N.

Why other options are wrong:

- 450 N multiplies instead of dividing.
- 300 N ignores the difference in distances.
- 100 N uses a wrong distance.

Final Answer: Weight of the second child $= 200$ N $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q22

Q23.

Solution

Concept — Simple pendulum: The time period is $T = 2\pi\sqrt{\dfrac{L}{g}}$, so T increases with the length L.

Step 1 — Look at the relation: T is proportional to $\sqrt{L}$.

Step 2 — Increase the length: A larger L gives a larger $\sqrt{L}$, so T becomes larger.

Step 3 — Conclude: Increasing the length increases the time period.

Why other options are wrong:

- The period does not decrease when length increases.
- It does not stay the same; it depends on length.
- It cannot become zero.

Final Answer: The time period increases $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q23

Q24.

Solution

Concept — Restoring force in SHM: In simple harmonic motion, a force always pulls the particle back towards its mean position, and it grows with displacement.

Step 1 — Direction of the force: Whenever the particle moves away from the mean position, the restoring force points back towards it.

Step 2 — Conclude: Hence the restoring force is always directed towards the mean (equilibrium) position.

Why other options are wrong:

- It does not point towards the extreme position.
- It often opposes the motion, so it is not always along the motion.
- It acts along the line of displacement, not perpendicular to it.

Final Answer: The restoring force acts towards the mean position $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q24

Q25.

Solution

Concept — Temperature conversion: To change Fahrenheit into Celsius, use $C = \frac{5}{9}(F - 32)$.

Step 1 — List the value: $F = 212\,°\text{F}$.

Step 2 — Subtract 32**:** $F - 32 = 212 - 32 = 180$.

Step 3 — Multiply by $\frac{5}{9}$**:** $C = \frac{5}{9} \times 180 = \frac{900}{9} = 100$.

Step 4 — State the result: $C = 100\,°\text{C}$.

Why other options are wrong:

- $180\,°\text{C}$ forgets to multiply by $\frac{5}{9}$.
- $32\,°\text{C}$ wrongly uses the offset as the answer.
- $84\,°\text{C}$ comes from a calculation error.

Final Answer: $212\,°\text{F} = 100\,°\text{C} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q25

Q26.

Solution

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

Step 1 — List the data: $m = 1$ kg, $c = 4200\ \text{J kg}^{-1}\,°\text{C}^{-1}$, $\Delta T = 20\,°\text{C}$.

Step 2 — Substitute: $Q = 1 \times 4200 \times 20$.

Step 3 — Multiply step by step: $4200 \times 20 = 84000$.

Step 4 — State the result: $Q = 84000$ J.

Why other options are wrong:

- 4200 J ignores the temperature change.
- 42000 J uses $\Delta T = 10$ instead of 20.
- 8400 J makes a place-value error.

Final Answer: Heat required $= 84000$ J $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q26

Q27.

Solution

Concept — Modes of heat transfer: Conduction and convection need a material medium, but radiation can travel through empty space.

Step 1 — Look at the path: Between the Sun and the Earth there is mostly empty space (vacuum).

Step 2 — Choose the mode: Only radiation can carry heat across a vacuum, so the Sun's heat reaches us by radiation.

Why other options are wrong:

- Conduction needs particles in contact.
- Convection needs a moving fluid (liquid or gas).
- Advection is bulk transport within a fluid, not across a vacuum.

Final Answer: Heat reaches us by radiation $\Rightarrow \boxed{A}$

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

Q28.

Solution

Concept — Latent heat: The heat absorbed or released during a change of state at constant temperature is called latent heat. For melting it is the latent heat of fusion.

Step 1 — Identify the change: Ice (solid) changes to water (liquid) at $0\,^{\circ}\mathrm{C}$.

Step 2 — Name the latent heat: The solid-to-liquid change is melting (fusion), so this is the latent heat of fusion.

Why other options are wrong:

- Vaporisation is for liquid changing to gas.
- Sublimation is solid changing directly to gas.
- Condensation is gas changing to liquid.

Final Answer: It is the latent heat of fusion $\Rightarrow \boxed{C}$

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

Q29.

Solution

Concept — Land and sea breeze: These are convection winds caused by the unequal heating and cooling of land and water.

Step 1 — Night-time cooling: At night the land cools faster than the sea, so the air over the sea is warmer and rises.

Step 2 — Direction of flow: Cooler air from the land moves out to take its place, blowing from land to sea.

Step 3 — Name it: A wind blowing from the land to the sea is called a land breeze.

Why other options are wrong:

- A sea breeze blows from sea to land during the day.
- Monsoon winds are large seasonal winds, not a daily night wind.
- Trade winds are global winds, not this local breeze.

Final Answer: It is a land breeze $\Rightarrow \boxed{\text{D}}$

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 angle: The angle of incidence given is 60°.

Step 2 — Apply the law: Angle of reflection $=$ angle of incidence $= 60^\circ$.

Why other options are wrong:

- 30° would be the angle measured from the mirror surface, not the normal.
- 120° is the angle between the incident and reflected rays, not the reflection angle.
- 0° would mean the ray strikes along the normal.

Final Answer: Angle of reflection $= 60^\circ \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q30

Q31.

Solution

Concept — Concave mirror images: The position and nature of the image depend on where the object is placed.

Step 1 — Locate the object: The object is at the centre of curvature C.

Step 2 — Recall the rule: For an object at C, the image is also formed at C.

Step 3 — Nature of 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 forms only when the object is between F and the pole.
- A magnified real image forms when the object is between F and C.
- A diminished virtual image is a convex-mirror result.

Final Answer: The image is real, inverted and of the same size $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q31

Q32.

Solution

Concept — Convex mirror: A convex mirror diverges the reflected rays, so they only appear to come from a point behind the mirror.

Step 1 — Trace the rays: For any real object, the reflected rays spread out and never actually meet in front of the mirror.

Step 2 — Nature of image: The image is therefore virtual, erect and diminished, formed behind the mirror.

Why other options are wrong:

- A convex mirror never forms a real image of a real object.
- It cannot form a real magnified image.
- It cannot form a same-size real image.

Final Answer: The image is always virtual and erect $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q32

Q33.

Solution

Concept — Mirror formula: The mirror formula is $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$.

Step 1 — List the data: $f = -15$ cm, $u = -30$ cm.

Step 2 — Rearrange for $\frac{1}{v}$: $\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$.

Step 3 — Substitute: $\frac{1}{v} = \frac{1}{-15} - \frac{1}{-30} = -\frac{1}{15} + \frac{1}{30}$.

Step 4 — Take a common denominator: $-\frac{2}{30} + \frac{1}{30} = -\frac{1}{30}$.

Step 5 — Invert: $v = -30$ cm.

Why other options are wrong:

- -10 cm and -15 cm come from sign or arithmetic slips.
- -45 cm adds the magnitudes wrongly.

Final Answer: Image distance $v = -30$ cm $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q33

Q34.

Solution

Concept — Refraction: When light passes from a denser medium to a rarer medium, it bends away from the normal.

Step 1 — Identify the media: The ray goes from glass (denser) into air (rarer).

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

Step 3 — Match the figure: The refracted ray in air makes a larger angle with the normal than the ray in glass, just as shown.

Why other options are wrong:

- Bending towards the normal happens going from rarer to denser.
- A ray along the normal passes straight without bending.
- The ray refracts into the air; it does not turn back into the glass at this angle.

Final Answer: The ray bends away from the normal $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q34

Q35.

Solution

Concept — Concave lens: A concave lens is thinner at the middle and thicker at the edges, so it spreads out a parallel beam of light.

Step 1 — Trace parallel rays: Rays passing through a concave lens diverge after refraction.

Step 2 — Name the behaviour: Because it diverges light, a concave lens is a diverging lens.

Why other options are wrong:

- A converging lens is a convex lens.
- A concave lens is not a plane glass slab.
- It forms a diminished image, so it is not used as a simple magnifier.

Final Answer: A concave lens is a diverging lens $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q35

Q36.

Solution

Concept — Scattering of light: Tiny air molecules scatter shorter wavelengths (blue) much more strongly than longer wavelengths (red).

Step 1 — Sunlight enters the air: White sunlight contains all colours.

Step 2 — Blue scatters most: The air molecules scatter blue light in all directions far more than red.

Step 3 — Result: The scattered blue light reaches our eyes from all parts of the sky, so the sky looks blue.

Why other options are wrong:

- Reflection does not separate colours like this.
- Dispersion through a prism gives a spectrum, not the blue sky.
- Total internal reflection occurs inside denser media, not here.

Final Answer: The blue sky is due to scattering $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q36

Q37.

Solution

Concept — Wave equation: The speed of a wave is $v = f\lambda$, so the wavelength is $\lambda = \frac{v}{f}$.

Step 1 — List the data: $v = 340$ m/s, $f = 170$ Hz.

Step 2 — Rearrange: $\lambda = \frac{v}{f}$.

Step 3 — Substitute: $\lambda = \frac{340}{170}$.

Step 4 — Compute: $\lambda = 2$ m.

Why other options are wrong:

- 0.5 m inverts the ratio.
- 510 m multiplies instead of dividing.
- 170 m wrongly uses the frequency value.

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

Answer: (D) Go Back to Q37

Q38.

Solution

Concept — Longitudinal sound wave: Sound travels through air as a longitudinal wave, made of regions where the air is squeezed together and regions where it is spread out.

Step 1 — Read the figure: The closely spaced lines (marked C) are compressions, and the widely spaced lines (marked R) are rarefactions.

Step 2 — Identify the wave parts: A sound wave therefore consists of alternate compressions and rarefactions.

Why other options are wrong:

- Crests and troughs belong to transverse waves.
- Electric and magnetic fields belong to electromagnetic waves, not sound.
- Nodes and antinodes appear in stationary waves, not in a travelling sound wave.

Final Answer: It consists of compressions and rarefactions $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q38

Q39.

Solution

Concept — Echo: To hear a separate echo, the reflected sound must reach the ear at least 0.1 s after the original sound.

Step 1 — Use the time gap: In 0.1 s, sound travels $d = v \times t = 340 \times 0.1 = 34$ m (to the surface and back).

Step 2 — Halve for the one-way distance: The minimum distance to the surface is $\frac{34}{2} = 17$ m.

Why other options are wrong:

- 1.7 m is far too small for the ear to separate the sounds.
- 34 m is the total to-and-fro path, not the distance to the surface.
- 340 m is the distance sound travels in a full second.

Final Answer: Minimum distance for an echo ≈ 17 m $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q39

Q40.

Solution

Concept — Pitch of sound: Pitch tells us how shrill or how flat a sound is. It is decided by the frequency of the sound wave.

Step 1 — Relate pitch and frequency: A higher frequency gives a higher (shriller) pitch, and a lower frequency gives a lower pitch.

Step 2 — Conclude: Therefore pitch depends on frequency.

Why other options are wrong:

- Amplitude decides loudness, not pitch.
- Loudness is the sensation linked to amplitude, not pitch.
- Speed of sound is set by the medium, not by pitch.

Final Answer: Pitch depends on frequency $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q40

Q41.

Solution

Concept — Ohm's law: The current is $I = \dfrac{V}{R}$.

Step 1 — List the data: $V = 12$ V, $R = 6\,\Omega$.

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

Step 3 — Compute: $I = 2$ A.

Why other options are wrong:

- 72 A multiplies V and R.
- 18 A adds V and R.
- 0.5 A inverts the ratio.

Final Answer: Current $= 2$ A $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q41

Q42.

Solution

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

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

Step 2 — Add them: $R_s = 5 + 5 + 5$.

Step 3 — Compute: $R_s = 15\,\Omega$.

Why other options are wrong:

- $1.67\,\Omega$ is the parallel value of three $5\,\Omega$ resistors.
- $5\,\Omega$ is just one resistor.
- $10\,\Omega$ adds only two of them.

Final Answer: Equivalent resistance $= 15\,\Omega \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q42

Q43.

Solution

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

Step 1 — List the data: $R_1 = R_2 = 10\,\Omega$.

Step 2 — Add the reciprocals: $\frac{1}{R_p} = \frac{1}{10} + \frac{1}{10} = \frac{2}{10}$.

Step 3 — Simplify: $\frac{1}{R_p} = \frac{1}{5}$.

Step 4 — Invert: $R_p = 5\,\Omega$.

Why other options are wrong:

- $20\,\Omega$ adds them as if in series.
- $10\,\Omega$ is just one resistor.
- $100\,\Omega$ multiplies the two values.

Final Answer: Equivalent resistance $= 5\,\Omega \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q43

Q44.

Solution

Concept — Electric power: Power can be written as $P = \frac{V^2}{R}$.

Step 1 — List the data: $V = 10$ V, $R = 5\,\Omega$.

Step 2 — Square the voltage: $V^2 = 10^2 = 100$.

Step 3 — Divide by the resistance: $P = \frac{100}{5}$.

Step 4 — Compute: $P = 20$ W.

Why other options are wrong:

- 2 W divides V by R without squaring.
- 50 W uses $\frac{V^2}{2R}$ by mistake.
- 500 W multiplies V^2 by R.

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

Answer: (C) Go Back to Q44

Q45.

Solution

Concept — Short circuit: A short circuit happens when the live and neutral wires come into direct contact, giving a very low-resistance path.

Step 1 — Apply Ohm's law: With a very small resistance, $I = \dfrac{V}{R}$ becomes very large.

Step 2 — Name the fault: This sudden large current due to direct contact is called a short circuit.

Why other options are wrong:

- An open circuit is a break, giving zero current.
- Overloading is drawing too much current by running many appliances, not direct contact.
- Earthing is a safety connection to the ground.

Final Answer: The condition is a short circuit $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q45

Q46.

Solution

Concept — Ammeter connection: An ammeter measures current, so the whole current must pass through it. This requires a series connection.

Step 1 — Recall the rule: An ammeter is connected in series with the element whose current is to be measured.

Step 2 — Reason why: An ideal ammeter has very low resistance, so it does not change the current when placed in series.

Why other options are wrong:

- A parallel ammeter would short the element and read wrongly (that is how a voltmeter is placed).
- It is not put in place of the cell.
- It is not connected in the earth wire.

Final Answer: An ammeter is connected in series $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q46

Q47.

Solution

Concept — Magnetic field of a bar magnet: Magnetic field lines form closed loops. Outside the magnet they run from the north pole to the south pole.

Step 1 — Look outside the magnet: The arrows on the field lines point away from N and into S.

Step 2 — State the direction: Hence, outside the magnet, the field lines are directed from the north pole to the south pole.

Why other options are wrong:

- From south to north is the direction inside the magnet, not outside.
- Field lines do not go from one north pole to another north pole.
- They do not simply spread outward from the middle.

Final Answer: Outside the magnet, lines go from N to S $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q47

Q48.

Solution

Concept — Electromagnet core: A good electromagnet core must become strongly magnetic when current flows and lose its magnetism when the current stops.

Step 1 — Behaviour of soft iron: Soft iron is magnetised strongly while the current flows and demagnetises almost completely when the current is switched off.

Step 2 — Name the behaviour: Because the magnetism lasts only while the current flows, the soft-iron core acts as a temporary magnet.

Why other options are wrong:

- It does not act as a permanent magnet (steel does that).
- It is not non-magnetic; it is strongly magnetic while current flows.
- It is not a strong natural magnet by itself.

Final Answer: Soft iron acts as a temporary magnet $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q48

Q49.

Solution

Concept — Force on a current-carrying conductor: When a current-carrying conductor is placed in a magnetic field, it experiences a force whose direction is found by Fleming's left-hand rule.

Step 1 — Set up the rule: Stretch the thumb, forefinger and middle finger of the left hand at right angles to one another.

Step 2 — Assign the fingers: The forefinger points along the field, the middle finger along the current, and the thumb then points along the force.

Step 3 — Conclude: So the direction of the force is given by Fleming's left-hand rule.

Why other options are wrong:

- The right-hand thumb rule gives the field direction around a wire, not this force.
- Fleming's right-hand rule is for the induced current in a generator.
- Lenz's law gives the direction of induced current, not this force.

Final Answer: The force direction is given by Fleming's left-hand rule $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q49

Q50.

Solution

Concept — Strength of an electromagnet: The strength of an electromagnet increases with the number of turns in the coil, the current in the coil, and the use of a soft-iron core.

Step 1 — Focus on the turns: More turns of wire around the core produce a stronger magnetic field for the same current.

Step 2 — Conclude: Therefore increasing the number of turns increases the strength of the electromagnet.

Why other options are wrong:

- Decreasing the number of turns weakens the magnet.

- A copper core is non-magnetic and would not strengthen it; soft iron is used.
- Reducing the current weakens the magnet.

Final Answer: Increasing the number of turns makes it stronger $\Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q50**

Answer Key

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