Jharkhand Polytechnic Physics

Sample Paper – 9

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 temperature is the:

(A) degree Celsius

(B) joule

(C) kelvin

(D) degree Fahrenheit

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

(A) Electric current

(B) Force

(C) Pressure

(D) Velocity

Q3. A train moves with a speed of 144 km/h. Its speed in metre per second is:

(A) 50 m/s

(B) 14.4 m/s

(C) 72 m/s

(D) 40 m/s

Q4. The prefix "nano" stands for a factor of:

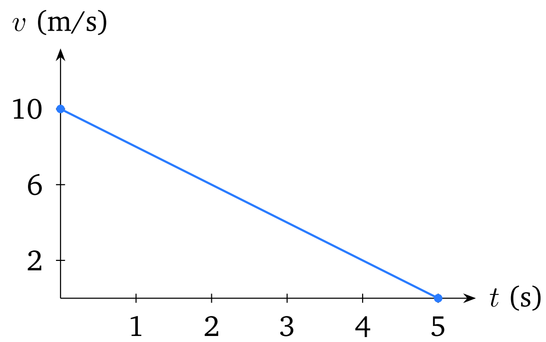
(A) 10^{-6}

(B) 10^{-9}

(C) 10^{-3}

(D) 10^{-12}

Q5. A car moving at 10 m/s slows down uniformly with a retardation of 2 m/s^2, as shown in the velocity–time graph. Its velocity after 5 seconds is:



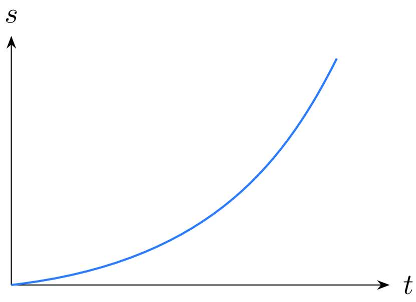
(A) 0 m/s (the car comes to rest)

(B) 5 m/s

(C) 20 m/s

(D) 2 m/s

Q6. The distance–time graph of a moving body is a curve whose slope keeps increasing, as shown. This indicates that the body is moving with:



(A) uniform (constant) speed

(B) rest (no motion)

(C) accelerated (non-uniform) motion

(D) backward motion

Q7. Seat belts in a car protect a passenger during a sudden stop. They do so by opposing the passenger's:

(A) gain in momentum

(B) inertia of motion (tendency to keep moving forward)

(C) increase in weight

(D) loss of energy

Q8. A force of 50 N acts on a body of mass 10 kg. The acceleration produced in the body is:

(A) 500 m/s^2

(B) 60 m/s^2

(C) 0.2 m/s^2

(D) 5 m/s^2

Q9. When a cannon fires a ball in the forward direction, the cannon itself moves backward. This recoil is an example of Newton's:

(A) third law of motion

(B) first law of motion

(C) second law of motion

(D) universal law of gravitation

Q10. The impulse given to a body by a force is equal to the:

(A) rate of change of its momentum

(B) change in its momentum

(C) change in its kinetic energy

(D) force applied on it

Q11. A body moving with uniform velocity along a straight line has an acceleration of:

(A) a constant non-zero value

(B) a steadily increasing value

(C) a value equal to g

(D) zero

Q12. A constant force of 13 N moves a body through 2 m in the direction of the force. The work done is:

(A) 6.5 J

(B) 15 J

(C) 26 J

(D) 11 J

Q13. The kinetic energy of a body of mass 5 kg moving with a speed of 4 m/s is:

(A) 40 J

(B) 10 J

(C) 80 J

(D) 20 J

Q14. A body of mass 6 kg is lifted to a height of 5 m. The gravitational potential energy gained by it is:

(A) 30 J

(B) 300 J

(C) 150 J

(D) 60 J

Q15. A machine pushes a body with a constant force of 25 N so that the body moves with a steady velocity of 2 m/s. The power developed by the machine is:

(A) 12.5 W

(B) 27 W

(C) 100 W

(D) 50 W

Q16. A stretched bow (just before the arrow is released) stores energy in the form of:

(A) kinetic energy

(B) heat energy

(C) elastic potential energy

(D) sound energy

Q17. The weight of an object of mass 11 kg on the surface of the Earth is:

(A) 110 N

(B) 11 N

(C) 1.1 N

(D) 1100 N

Q18. As we go higher and higher above the surface of the Earth, the value of acceleration due to gravity g:

(A) increases steadily

(B) remains exactly the same

(C) becomes zero immediately

(D) decreases

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

(A) 10 m

(B) 20 m

(C) 40 m

(D) 5 m

Q20. An object weighs 120 N on the Earth. Its weight on the Moon, where gravity is one-sixth that of the Earth, will be:

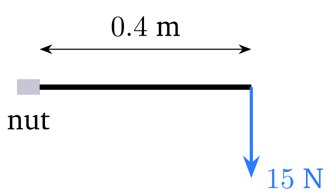
(A) 120 N

(B) 720 N

(C) 20 N

(D) 12 N

Q21. A force of 15 N is applied at the end of a spanner at a perpendicular distance of 0.4 m from the nut, as shown. The moment (turning effect) of the force about the nut is:



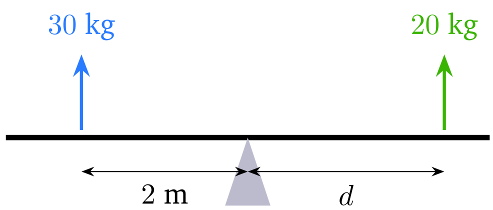
(A) 6 N m

(B) 3 N m

(C) 37.5 N m

(D) $0.6\ \text{N m}$

Q22. On a balanced seesaw, a child of weight 30 kg sits 2 m from the pivot. A second child of weight 20 kg sits on the other side, as shown. For balance, the second child must sit at a distance of:



(A) 1 m

(B) 1.5 m

(C) 2 m

(D) 3 m

Q23. A simple pendulum is taken from the Earth to the Moon, where the value of g is smaller. The time period of the pendulum will:

(A) decrease

(B) increase

(C) remain unchanged

(D) become zero

Q24. In simple harmonic motion, the acceleration of the particle is always directed:

(A) towards the mean (equilibrium) position

(B) away from the mean position

(C) along the direction of velocity

(D) towards the nearer extreme position

Q25. A temperature of $77\,^{\circ}\text{C}$, expressed on the Kelvin scale, is:

(A) 77 K

(B) 304 K

(C) 350 K

(D) 196 K

Q26. How much heat is required to raise the temperature of 0.1 kg of water by 50 °C? (Specific heat of water = $4200\ \mathrm{J\,kg^{-1}\,{}^{\circ}C^{-1}}$)

(A) 2100 J

(B) 21000 J

(C) 4200 J

(D) 42000 J

Q27. The three modes by which heat can be transferred from one place to another are:

(A) conduction, reflection and radiation

(B) convection, dispersion and conduction

(C) radiation, refraction and convection

(D) conduction, convection and radiation

Q28. Which one of the following surfaces is the best absorber of heat radiation?

(A) a dull black surface

(B) a shiny white surface

(C) a polished silver surface

(D) a mirror-like surface

Q29. Ice floats on the surface of water because:

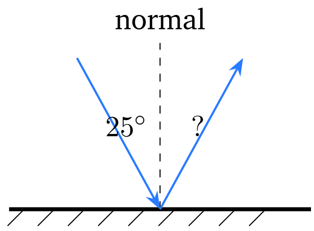
(A) ice is warmer than water

(B) ice has no weight of its own

(C) ice is less dense than water

(D) water repels ice magnetically

Q30. A ray of light strikes a plane mirror making an angle of incidence of 25° with the normal, as shown. The angle of reflection is:



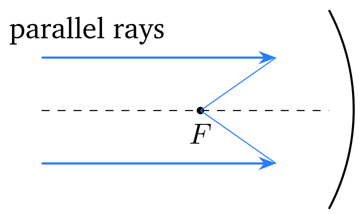
(A) 50°

(B) 25°

(C) 65°

(D) 0°

Q31. For a concave mirror, when the object is placed at infinity, the parallel rays converge after reflection, as shown. The image is formed:



(A) at the centre of curvature

(B) behind the mirror

(C) at infinity

(D) at the focus (real, inverted and point-sized)

Q32. Convex mirrors are used as rear-view mirrors in vehicles and at sharp road turnings mainly because they:

(A) give a wide field of view with erect images

(B) form magnified real images

(C) form inverted real images

(D) absorb most of the light falling on them

Q33. An object is placed 15 cm in front of a concave mirror of focal length 10 cm. Using the mirror formula $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$, the image distance v is:

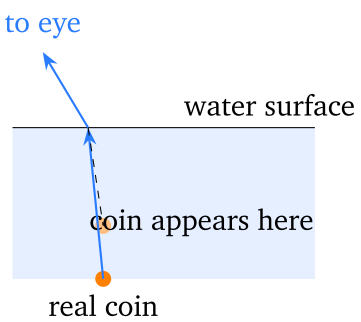
(A) -10 cm

(B) -15 cm

(C) -30 cm

(D) $+30$ cm

Q34. A coin lying at the bottom of a water tank appears to be raised when viewed from above, as shown. The apparent depth of the coin is:



(A) more than the real depth

(B) less than the real depth

(C) equal to the real depth

(D) exactly zero

Q35. The eye defect known as hypermetropia (long sight), in which a person cannot see nearby objects clearly, is corrected by using a:

(A) concave lens

(B) cylindrical lens

(C) plane glass plate

(D) convex lens

Q36. The twinkling of stars on a clear night is caused by:

(A) the atmospheric refraction of starlight

(B) the reflection of light by clouds

(C) dispersion of light inside the eye

(D) the stars actually switching on and off

Q37. A sound wave has a frequency of 300 Hz and a wavelength of 1.1 m. The speed of the wave is:

(A) 272 m/s

(B) 301 m/s

(C) 330 m/s

(D) 165 m/s

Q38. When the stretched string of a guitar is plucked, the waves that travel along the string itself are:

(A) longitudinal waves

(B) transverse waves

(C) electromagnetic waves

(D) sound waves in air

Q39. Bats can fly safely in complete darkness and locate obstacles by using:

(A) ultrasound (echolocation)

(B) infrared light

(C) X-rays

(D) only ordinary audible sound

Q40. The loudness of a sound depends mainly on the wave's:

(A) frequency

(B) wavelength

(C) speed

(D) amplitude

Q41. A current of 2.5 A flows through a resistor of resistance $4\,\Omega$. The potential difference across the resistor is:

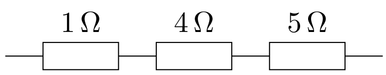
(A) 1.6 V

(B) 10 V

(C) 6.5 V

(D) 0.625 V

Q42. Three resistors of $1\,\Omega$, $4\,\Omega$ and $5\,\Omega$ are connected in series, as shown. Their equivalent resistance is:



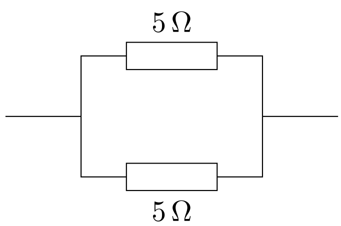
(A) $0.7\,\Omega$

(B) $5\,\Omega$

(C) $10\,\Omega$

(D) $20\,\Omega$

Q43. Two resistors, each of $5\,\Omega$, are connected in parallel, as shown. Their equivalent resistance is:



(A) $2.5\,\Omega$

(B) $10\,\Omega$

(C) $5\,\Omega$

(D) $25\,\Omega$

Q44. A current of 2 A flows through a resistor of resistance $10\,\Omega$. The electrical power dissipated in the resistor is:

(A) 20 W

(B) 5 W

(C) 80 W

(D) 40 W

Q45. In a three-pin plug, the earth pin is connected to the metal body of an appliance mainly in order to:

(A) increase the current drawn

(B) protect the user from electric shock

(C) reduce the supply voltage

(D) save electrical energy

Q46. Nichrome wire is used as the heating element in electric heaters and irons because it has:

(A) a very low resistivity

(B) zero electrical resistance

(C) a high resistivity and a high melting point

(D) the lowest melting point among metals

Q47. In a diagram of magnetic field lines, the magnetic field is strongest at a place where the field lines are:

(A) parallel and evenly spaced

(B) perfectly straight

(C) far apart from one another

(D) crowded very close together

Q48. Soft iron is preferred over steel for the core of an electromagnet because soft iron:

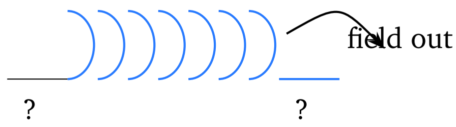
(A) loses its magnetism as soon as the current is switched off

(B) remains a permanent magnet forever

(C) cannot be magnetised at all

(D) is a good insulator of electricity

Q49. When current flows through the solenoid shown, it behaves like a bar magnet. The end from which the magnetic field lines come out behaves as the:



(A) south pole

(B) north pole

(C) a neutral (field-free) region

(D) the positive terminal of the cell

Q50. The direction of the force acting on a current-carrying conductor placed in a magnetic field is given by:

(A) Fleming's right-hand rule

(B) the right-hand thumb rule

(C) Fleming's left-hand rule

(D) Maxwell's corkscrew rule

Detailed Solutions

Q1.

Solution

Concept — SI base units: Temperature is one of the seven fundamental quantities, and each fundamental quantity has its own SI base unit.

Step 1 — Recall the unit: The SI base unit of temperature is the **kelvin (K)**.

Step 2 — Note the convention: The kelvin scale starts from absolute zero, and its size of one degree equals one degree Celsius.

Why other options are wrong:

- Degree Celsius is a commonly used unit, but it is not the SI base unit.
- Joule is the SI unit of heat energy, not of temperature.
- Degree Fahrenheit is an older non-SI scale.

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

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, pressure and velocity are all obtained by combining base quantities, so they are derived quantities.

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

Why other options are wrong:

- Force $=$ mass $\times$ acceleration (derived).
- Pressure $=$ force / area (derived).
- Velocity $=$ displacement / time (derived).

Final Answer: Electric current 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: $1 \text{ km/h} = \frac{5}{18} \text{ m/s}$.

Step 2 — Substitute the value: $\text{Speed} = 144 \times \frac{5}{18} \text{ m/s}$.

Step 3 — Simplify: $144 \div 18 = 8$, then $8 \times 5 = 40$. So speed $= 40$ m/s.

Why other options are wrong:

- 50 and 72 come from using a wrong factor.
- 14.4 divides by 10 instead of using $5/18$.

Final Answer: $144 \text{ km/h} = 40 \text{ m/s} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q3

Q4.

Solution

Concept — Metric prefixes: Standard prefixes stand for fixed powers of ten and are placed before a unit to make it larger or smaller.

Step 1 — Recall the prefix: The prefix "nano" represents the factor 10^{-9}.

Step 2 — Give a feel for it: For example, 1 nanometre $= 10^{-9}$ m, which is one-billionth of a metre.

Why other options are wrong:

- 10^{-6} is the prefix "micro".
- 10^{-3} is the prefix "milli".
- 10^{-12} is the prefix "pico".

Final Answer: Nano stands for $10^{-9} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q4

Q5.

Solution

Concept — Equation of motion: For uniform acceleration, $v = u + at$. A retardation is a negative acceleration, so we write $a = -2$ m/s^2.

Step 1 — List the data: $u = 10$ m/s, $a = -2$ m/s^2, $t = 5$ s.

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

Step 3 — Compute: $v = 10 - 10 = 0$ m/s, so the car comes to rest.

Why other options are wrong:

- 5 m/s uses the wrong time.
- 20 m/s adds instead of subtracting.
- 2 m/s is just the value of the retardation.

Final Answer: Final velocity $= 0$ 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 at any point gives the speed of the body. A steeper slope means a greater speed.

Step 1 — Read the graph: The curve becomes steeper as time increases, so the slope keeps increasing.

Step 2 — Interpret: An increasing slope means the speed is increasing with time, which is accelerated (non-uniform) motion.

Why other options are wrong:

- Uniform speed would give a straight slanting line, not a curve.
- A body at rest would give a horizontal line.
- Backward motion would show the distance decreasing.

Final Answer: The body is in accelerated motion $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q6

Q7.

Solution

Concept — Newton's first law (inertia): A moving body tends to continue moving in a straight line unless an external force acts on it. This tendency is called inertia of motion.

Step 1 — Apply to the passenger: When a fast car stops suddenly, the passenger's body tends to keep moving forward because of its inertia of motion.

Step 2 — Role of the belt: The seat belt provides the external force that holds the passenger back, preventing injury.

Why other options are wrong:

- There is no gain in momentum; the car is stopping.
- The passenger's weight does not increase.
- Loss of energy does not explain the forward lurch.

Final Answer: Seat belts oppose the inertia of motion $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q7

Q8.

Solution

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

Step 1 — List the data: $F = 50$ N, $m = 10$ kg.

Step 2 — Substitute: $a = \dfrac{50}{10}$.

Step 3 — Compute: $a = 5$ m/s^2.

Why other options are wrong:

- 500 multiplies force and mass.
- 60 adds force and mass.
- 0.2 divides mass by force.

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

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 cannon: The cannon pushes the ball forward (action) and the ball pushes the cannon backward (reaction), making the cannon recoil.

Step 2 — Identify the law: This forward–backward force pair is a direct example of the third law of motion.

Why other options are wrong:

- The first law deals with inertia, not force pairs.
- The second law relates force, mass and acceleration.
- Gravitation deals with attraction between masses.

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

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Impulse: Impulse is the product of the force and the time for which it acts, $J = F \times t$. By Newton's second law this equals the change in momentum.

Step 1 — Write the relation: $F = \dfrac{\Delta p}{t}$, so $F \times t = \Delta p$.

Step 2 — Conclude: Therefore impulse equals the **change in momentum** of the body.

Why other options are wrong:

- Rate of change of momentum is the force, not the impulse.
- Change in kinetic energy is equal to the work done, not the impulse.
- Force alone is not the impulse; impulse also includes the time factor.

Final Answer: Impulse = change in momentum $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Acceleration: Acceleration is the rate of change of velocity, $a = \frac{\Delta v}{\Delta t}$.

Step 1 — Use the meaning of uniform velocity: Uniform velocity means the velocity does not change, so $\Delta v = 0$.

Step 2 — Substitute: $a = \frac{0}{\Delta t} = 0$.

Step 3 — Conclude: A body moving with uniform velocity has zero acceleration.

Why other options are wrong:

- A constant non-zero acceleration would change the velocity.
- An increasing acceleration would also change the velocity.
- Acceleration g applies to free fall, not uniform velocity.

Final Answer: Acceleration $= 0 \Rightarrow \boxed{\text{D}}$

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: $F = 13$ N, $s = 2$ m.

Step 2 — Substitute: $W = 13 \times 2$.

Step 3 — Compute: $W = 26$ J.

Why other options are wrong:

- 6.5 divides force by distance.
- 15 adds force and distance.
- 11 subtracts the values.

Final Answer: Work done $= 26$ J $\Rightarrow \boxed{\text{C}}$

Answer: (C) 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: $m = 5$ kg, $v = 4$ m/s.

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

Step 3 — Substitute and compute: $KE = \frac{1}{2} \times 5 \times 16 = 40$ J.

Why other options are wrong:

- 10 uses v instead of v^2.
- 80 forgets the factor $\frac{1}{2}$.
- 20 takes half of the mass only.

Final Answer: Kinetic energy $= 40$ 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: $m = 6$ kg, $g = 10$ m/s^2, $h = 5$ m.

Step 2 — Substitute: $PE = 6 \times 10 \times 5$.

Step 3 — Compute: $PE = 300$ J.

Why other options are wrong:

- 30 uses only $m \times h$.
- 150 takes half the correct value.
- 60 leaves out the height.

Final Answer: Potential energy $= 300$ J $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

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

Step 1 — List the data: $F = 25$ N, $v = 2$ m/s.

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

Step 3 — Compute: $P = 50$ W.

Why other options are wrong:

- 12.5 divides force by velocity.
- 27 adds force and velocity.
- 100 multiplies by an extra factor.

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

Answer: (D) **Go Back to Q15**

Q16.

Solution

Concept — Elastic potential energy: Work done in stretching or compressing an elastic body is stored in it as elastic potential energy.

Step 1 — Examine the bow: When the bow is stretched, the archer does work against the elastic restoring force of the bow.

Step 2 — Identify the stored energy: This work is stored as **elastic potential energy**, which is released to give the arrow kinetic energy.

Why other options are wrong:

- Kinetic energy appears only when the arrow is moving after release.
- Heat energy is not the main form of stored energy here.
- Sound energy is only a small by-product on release.

Final Answer: A stretched bow stores elastic potential energy $\Rightarrow \boxed{\text{C}}$

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: $m = 11$ kg, $g = 10$ m/s^2.

Step 2 — Substitute: $W = 11 \times 10$.

Step 3 — Compute: $W = 110$ N.

Why other options are wrong:

- 11 N is the mass value, not the weight.
- 1.1 N divides instead of multiplying.
- 1100 N multiplies by an extra factor of ten.

Final Answer: Weight $= 110$ N $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Variation of g with height: The value of g at a height h above the Earth's surface is smaller than its value on the surface, because the distance from the Earth's centre increases.

Step 1 — Use the inverse-square idea: Gravity weakens as the square of the distance from the centre, so moving higher reduces g.

Step 2 — Conclude: As we go higher, the value of g **decreases**.

Why other options are wrong:

- g does not increase with height.
- g does not stay exactly the same; it falls gradually.
- g does not drop to zero immediately; it decreases slowly.

Final Answer: g decreases with altitude $\Rightarrow \boxed{\text{D}}$

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 uses t instead of t^2.
- 40 forgets the factor $\frac{1}{2}$.
- 5 takes only a quarter of the correct value.

Final Answer: Distance fallen $= 20$ m $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q19

Q20.

Solution

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

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

Step 2 — Substitute: $W_{\text{moon}} = \frac{1}{6} \times 120$.

Step 3 — Compute: $W_{\text{moon}} = 20$ N.

Why other options are wrong:

- 120 N ignores the change in gravity.
- 720 N multiplies by 6 instead of dividing.
- 12 N divides by 10, not by 6.

Final Answer: Weight on the Moon $= 20$ N $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q20

Q21.

Solution

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

Step 1 — List the data: $F = 15$ N, $d = 0.4$ m.

Step 2 — Substitute: Moment $= 15 \times 0.4$.

Step 3 — Compute: Moment $= 6$ N m.

Why other options are wrong:

- 3 N m takes half of the correct value.
- 37.5 N m divides force by distance.
- 0.6 N m misplaces the decimal point.

Final Answer: Moment of the force $= 6$ N m $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — Principle of moments: For a balanced seesaw, the clockwise moment equals the anticlockwise moment, $W_1 \times d_1 = W_2 \times d_2$.

Step 1 — Write the balance: $30 \times 2 = 20 \times d$.

Step 2 — Simplify the left side: $60 = 20 \times d$.

Step 3 — Solve for d: $d = \dfrac{60}{20} = 3$ m.

Why other options are wrong:

- 1 m and 1.5 m give too small a moment to balance.
- 2 m would balance only if both children had equal weight.

Final Answer: The second child must sit at 3 m $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q22

Q23.

Solution

Concept — Pendulum time period: The time period of a simple pendulum is $T = 2\pi\sqrt{\dfrac{L}{g}}$, so T is larger when g is smaller.

Step 1 — Compare the planets: On the Moon, g is about one-sixth of its value on the Earth.

Step 2 — Apply the formula: Since g is in the denominator under the square root, a smaller g makes T larger, so the pendulum swings more slowly.

Step 3 — Conclude: The time period **increases** on the Moon.

Why other options are wrong:

- A smaller g cannot make T decrease.
- The period changes because g changes, so it is not unchanged.
- The pendulum still swings, so T is not zero.

Final Answer: The time period increases on the Moon $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q23

Q24.

Solution

Concept — Simple harmonic motion: In SHM the restoring force, and hence the acceleration, always points back towards the mean position.

Step 1 — Use the SHM relation: The acceleration is $a = -\omega^2 x$, where x is the displacement from the mean position.

Step 2 — Interpret the minus sign: The negative sign shows the acceleration is opposite to the displacement, that is, directed towards the mean position.

Why other options are wrong:

- Acceleration is never directed away from the mean position in SHM.
- It is not along the velocity; it is along the displacement line.
- It points towards the mean position, not towards the extreme.

Final Answer: SHM acceleration is directed towards the mean position $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q24

Q25.

Solution

Concept — Celsius to Kelvin: To convert a Celsius temperature to kelvin, add 273: $T(\text{K}) = T(^\circ\text{C}) + 273$.

Step 1 — Write the relation: $T = 77 + 273$.

Step 2 — Add the numbers: $77 + 273 = 350$.

Step 3 — State the result: $T = 350$ K.

Why other options are wrong:

- 77 K forgets to add 273.
- 304 K adds 227 by mistake.
- 196 K subtracts instead of adding.

Final Answer: $77\,^\circ\text{C} = 350$ K $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q25

Q26.

Solution

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

Step 1 — List the data: $m = 0.1$ kg, $c = 4200\ \text{J kg}^{-1}\,^\circ\text{C}^{-1}$, $\Delta T = 50\,^\circ\text{C}$.

Step 2 — Substitute: $Q = 0.1 \times 4200 \times 50$.

Step 3 — Compute step by step: $0.1 \times 4200 = 420$; then $420 \times 50 = 21000$ J.

Why other options are wrong:

- 2100 uses $\Delta T = 5$ instead of 50.
- 4200 leaves out both the mass and the temperature change.
- 42000 doubles the correct value.

Final Answer: Heat required $= 21000$ J $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q26

Q27.

Solution

Concept — Modes of heat transfer: Heat can travel from one place to another in three distinct ways.

Step 1 — Name the modes: These are conduction (through solids), convection (in fluids) and radiation (without any medium).

Step 2 — Match the option: Only one option lists all three correctly as conduction, convection and radiation.

Why other options are wrong:

- Reflection, dispersion and refraction are properties of light, not modes of heat transfer.
- The options that include these light terms are therefore incorrect.

Final Answer: The three modes are conduction, convection and radiation $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q27

Q28.

Solution

Concept — Absorption of radiation: Dark, dull surfaces absorb heat radiation well, while shiny, light-coloured surfaces reflect most of it.

Step 1 — Compare the surfaces: A dull black surface absorbs almost all the radiation falling on it.

Step 2 — Conclude: Therefore a dull black surface is the best absorber of heat radiation.

Why other options are wrong:

- A shiny white surface reflects most radiation.
- A polished silver surface is a strong reflector.
- A mirror-like surface reflects almost all radiation.

Final Answer: A dull black surface is the best absorber $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q28

Q29.

Solution

Concept — Anomalous expansion of water: When water freezes into ice, it expands, so a given mass of ice occupies more volume than the same mass of water. This makes ice less dense than water.

Step 1 — Compare densities: Ice has a density of about 0.92 g/cm^3, while water has a density of about 1.0 g/cm^3.

Step 2 — Apply the floating rule: A substance floats if it is less dense than the liquid, so ice floats on water.

Why other options are wrong:

- Ice is colder, not warmer, than liquid water.
- Ice certainly has weight.
- Magnetism has nothing to do with floating.

Final Answer: Ice floats because it is less dense than water $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q29

Q30.

Solution

Concept — Law 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 $25°$.

Step 2 — Apply the law: Angle of reflection $=$ angle of incidence $= 25°$.

Why other options are wrong:

- $50°$ wrongly doubles the angle.
- $65°$ measures from the mirror surface, not the normal.
- $0°$ would mean the ray strikes along the normal, which it does not.

Final Answer: Angle of reflection $= 25° \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q30

Q31.

Solution

Concept — Concave mirror, object at infinity: Rays coming from a very distant object are parallel. After reflection from a concave mirror they all pass through the principal focus.

Step 1 — Trace the rays: The parallel rays converge at the focus F of the mirror.

Step 2 — Describe the image: The image is formed at the focus and is real, inverted and reduced to a point (highly diminished).

Why other options are wrong:

- The image is not at the centre of curvature for an object at infinity.
- A concave mirror forms this real image in front, not behind, the mirror.
- The image is not at infinity; only the object is.

Final Answer: The image is formed at the focus $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q31

Q32.

Solution

Concept — Convex mirror: A convex mirror always forms a virtual, erect and diminished image, and it can gather light from a wide area.

Step 1 — State the property: Because the image is small and erect, a convex mirror shows a large field of view in a small mirror.

Step 2 — Apply it: This is why convex mirrors are used as rear-view mirrors and at blind turnings, where a wide view of traffic is needed.

Why other options are wrong:

- A convex mirror never forms a magnified real image.
- It does not form inverted real images.
- It reflects light well rather than absorbing it.

Final Answer: Convex mirrors give a wide erect field of view $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q32

Q33.

Solution

Concept — Mirror formula: The mirror formula is $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$. Using the sign convention, for a concave mirror f and u are negative.

Step 1 — List the data with signs: $f = -10$ cm, $u = -15$ cm.

Step 2 — Rearrange: $\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-10} - \frac{1}{-15}$.

Step 3 — Combine the fractions: $\frac{1}{v} = -\frac{1}{10} + \frac{1}{15} = \frac{-3+2}{30} = -\frac{1}{30}$.

Step 4 — Invert: $v = -30$ cm.

Why other options are wrong:

- -10 cm is the focal length, not the image distance.
- -15 cm is the object distance.
- $+30$ cm has the wrong sign; a real image is in front of the mirror.

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

Answer: (C) Go Back to Q33

Q34.

Solution

Concept — Apparent depth: When we view an object in water from above, refraction bends the light at the surface, making the object look nearer to the surface than it really is.

Step 1 — Use the relation: Apparent depth $= \frac{\text{real depth}}{n}$, where n is the refractive index of water ($n \approx 1.33 > 1$).

Step 2 — Compare the depths: Dividing the real depth by a number greater than 1 gives a smaller value.

Step 3 — Conclude: So the apparent depth is **less** than the real depth, and the coin appears raised.

Why other options are wrong:

- The apparent depth is smaller, not larger.
- It is not equal to the real depth because refraction occurs.
- It is not zero; the coin is still seen below the surface.

Final Answer: Apparent depth is less than the real depth $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q34

Q35.

Solution

Concept — Hypermetropia: In hypermetropia (long sight) the image of a nearby object is formed behind the retina because the eye's converging power is too weak.

Step 1 — Find what is needed: To bring the image forward onto the retina, we need extra converging power.

Step 2 — Choose the lens: A **convex (converging) lens** adds the required converging power and corrects the defect.

Why other options are wrong:

- A concave lens diverges light and corrects short sight (myopia), not long sight.
- A cylindrical lens corrects astigmatism.
- A plane glass plate has no focusing power.

Final Answer: Hypermetropia is corrected by a convex lens $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q35

Q36.

Solution

Concept — Atmospheric refraction: The Earth's atmosphere has layers of air of slightly different densities, which keep changing. Starlight bends as it passes through these changing layers.

Step 1 — Trace the light: As the air conditions vary, the apparent position and brightness of a star keep changing slightly.

Step 2 — Conclude: This continuous change due to atmospheric refraction makes the star appear to twinkle.

Why other options are wrong:

- Clouds reflecting light is not the cause of twinkling.
- Dispersion in the eye does not cause twinkling.
- Stars shine steadily; they do not switch on and off.

Final Answer: Twinkling of stars is due to atmospheric refraction $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q36

Q37.

Solution

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

Step 1 — List the data: $f = 300$ Hz, $\lambda = 1.1$ m.

Step 2 — Substitute: $v = 300 \times 1.1$.

Step 3 — Compute: $v = 330$ m/s.

Why other options are wrong:

- 272 uses a wrong wavelength.
- 301 adds the values instead of multiplying.
- 165 takes half of the correct value.

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

Answer: (C) Go Back to Q37

Q38.

Solution

Concept — Transverse waves: In a transverse wave the particles of the medium vibrate at right angles to the direction in which the wave travels.

Step 1 — Examine the string: When a guitar string is plucked, each part of the string moves up and down while the wave runs along the length of the string.

Step 2 — Identify the wave: Since the vibration is perpendicular to the travel direction, the wave on the string is a **transverse wave**.

Why other options are wrong:

- Longitudinal waves vibrate along the travel direction (like sound in air).
- Electromagnetic waves need no medium and are not waves on a string.
- The wave on the string is not the sound wave in the surrounding air.

Final Answer: The wave on a plucked string is transverse $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q38

Q39.

Solution

Concept — Ultrasound and echolocation: Sound of frequency above 20 000 Hz is called ultrasound. Bats produce ultrasound and listen for the reflected echoes.

Step 1 — Trace the process: A bat emits ultrasonic squeaks, which reflect off obstacles and prey and return to the bat.

Step 2 — Conclude: By judging these echoes, the bat locates objects in the dark. This is echolocation using ultrasound.

Why other options are wrong:

- Infrared light is not used by bats to detect obstacles.
- X-rays are not produced or used by bats.
- Ordinary audible sound alone does not give the fine detail of echolocation.

Final Answer: Bats navigate using ultrasound (echolocation) $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q39

Q40.

Solution

Concept — Loudness and amplitude: The loudness of a sound depends on the amount of energy carried by the wave, which is decided by its amplitude.

Step 1 — Link energy to amplitude: A larger amplitude means the wave carries more energy and sounds louder.

Step 2 — Conclude: Therefore loudness depends mainly on the amplitude of the wave.

Why other options are wrong:

- Frequency decides the pitch, not the loudness.
- Wavelength is linked to frequency and speed, not directly to loudness.
- The speed depends on the medium, not on how loud the sound is.

Final Answer: Loudness depends on amplitude $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q40

Q41.

Solution

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

Step 1 — List the data: $I = 2.5$ A, $R = 4\,\Omega$.

Step 2 — Substitute: $V = 2.5 \times 4$.

Step 3 — Compute: $V = 10$ V.

Why other options are wrong:

- 1.6 V divides current by resistance.
- 6.5 V adds the values instead of multiplying.
- 0.625 V divides resistance by current.

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

Answer: (B) Go Back to Q41

Q42.

Solution

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

Step 1 — List the data: $R_1 = 1\,\Omega$, $R_2 = 4\,\Omega$, $R_3 = 5\,\Omega$.

Step 2 — Add them: $R = 1 + 4 + 5$.

Step 3 — Compute: $R = 10\,\Omega$.

Why other options are wrong:

- $0.7\,\Omega$ is the parallel result, not the series result.
- $5\,\Omega$ uses only one resistor.
- $20\,\Omega$ doubles the correct sum.

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

Answer: (C) Go Back to Q42

Q43.

Solution

Concept — Parallel resistance: For two equal resistors in parallel, the equivalent resistance is half of one resistor, $R = \frac{R_1}{2}$.

Step 1 — Write the formula: $\frac{1}{R} = \frac{1}{5} + \frac{1}{5}$.

Step 2 — Add the fractions: $\frac{1}{R} = \frac{2}{5}$.

Step 3 — Invert: $R = \frac{5}{2} = 2.5\,\Omega$.

Why other options are wrong:

- $10\,\Omega$ adds the resistances as if in series.
- $5\,\Omega$ uses only one resistor.
- $25\,\Omega$ multiplies the two values.

Final Answer: Equivalent parallel resistance $= 2.5\,\Omega \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q43

Q44.

Solution

Concept — Electrical power: The power dissipated in a resistor carrying a current is $P = I^2R$.

Step 1 — List the data: $I = 2$ A, $R = 10\,\Omega$.

Step 2 — Square the current: $I^2 = 2^2 = 4$.

Step 3 — Substitute and compute: $P = 4 \times 10 = 40$ W.

Why other options are wrong:

- 20 W uses I instead of I^2.
- 5 W divides resistance by current.
- 80 W doubles the correct value.

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

Answer: (D) Go Back to Q44

Q45.

Solution

Concept — Earthing: The earth pin connects the metal body of an appliance to the ground through a low-resistance wire.

Step 1 — Trace a fault: If the live wire accidentally touches the metal body, the current flows safely to the earth instead of through the user.

Step 2 — Conclude: So earthing protects the user from a dangerous electric shock.

Why other options are wrong:

- Earthing does not increase the current drawn.
- It does not reduce the supply voltage.
- It is a safety measure, not an energy-saving one.

Final Answer: The earth pin protects the user from electric shock $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q45

Q46.

Solution

Concept — Heating element: A good heating element must produce a lot of heat without melting, so it needs a high resistivity and a high melting point.

Step 1 — Recall the property: Nichrome is an alloy with a high resistivity, so it produces large heat ($P = I^2R$) for a given current.

Step 2 — Add the melting point: Nichrome also has a high melting point, so it does not melt while glowing hot.

Why other options are wrong:

- A very low resistivity would produce too little heat.
- No real wire has zero resistance at room temperature.
- A low melting point would make the element melt quickly.

Final Answer: Nichrome has high resistivity and a high melting point $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q46

Q47.

Solution

Concept — Magnetic field lines: The closeness of magnetic field lines shows the strength of the field. Where the lines are crowded, the field is strong; where they are far apart, the field is weak.

Step 1 — Read the spacing: The field is strongest at the place where the field lines are packed most closely together.

Step 2 — Conclude: So the field is strongest where the lines are crowded very close together.

Why other options are wrong:

- Evenly spaced parallel lines indicate a uniform, not the strongest, field.
- Merely being straight does not indicate strength.
- Lines far apart indicate a weak field.

Final Answer: The field is strongest where the lines are closest $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q47

Q48.

Solution

Concept — Electromagnet core: An electromagnet should be magnetic only while the current flows and should lose its magnetism the moment the current stops. This needs a temporary magnetic material.

Step 1 — Compare the metals: Soft iron is easily magnetised and also loses its magnetism almost completely as soon as the current is switched off.

Step 2 — Conclude: This temporary behaviour makes soft iron the preferred core over steel, which would stay magnetised.

Why other options are wrong:

- Soft iron does not remain a permanent magnet; that is its advantage here.
- Soft iron is in fact easily magnetised, not impossible to magnetise.
- Soft iron is a metal and a conductor, not an insulator.

Final Answer: Soft iron loses its magnetism when the current stops $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q48

Q49.

Solution

Concept — Solenoid as a magnet: A current-carrying solenoid behaves like a bar magnet, with magnetic field lines emerging from one end and entering the other.

Step 1 — Recall the pole rule: Magnetic field lines come out of the north pole and go into the south pole of a magnet.

Step 2 — Apply to the solenoid: The end from which the field lines come out is therefore the **north pole**.

Why other options are wrong:

- Field lines enter at the south pole, so that end is not where they come out.
- There is a definite pole at the end, not a field-free region.
- North and south poles are magnetic, not electrical, terminals.

Final Answer: Field lines come out of the north pole $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q49

Q50.

Solution

Concept — Fleming's left-hand rule: This rule gives the direction of the force on a current-carrying conductor placed in a magnetic field, and is the basis of the electric motor.

Step 1 — State the rule: Stretch the thumb, forefinger and middle finger of the left hand mutually perpendicular: the forefinger points along the field, the middle finger along the current, and the thumb gives the direction of the force.

Step 2 — Conclude: So the force direction is found using Fleming's left-hand rule.

Why other options are wrong:

- Fleming's right-hand rule gives the induced current in a generator.
- The right-hand thumb rule gives the field around a straight wire.
- Maxwell's corkscrew rule also gives field direction, not the force.

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

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