AIIMS B.Sc Nursing Physics

Sample Paper – 9

Duration: 36 Minutes **Maximum Marks: 30**

Instructions

- This paper contains **30 Multiple Choice Questions (single correct answer)**, modelled on the Physics section of the **AIIMS B.Sc Nursing** entrance.
- Each correct answer carries **+1 mark**. $\frac{1}{3}$ **mark is deducted** for every wrong answer, and an unattempted question gets **0 marks**.
- Only **one** option is correct. Choose carefully, since the questions are mostly numerical.
- Personal calculators, log tables, mobile phones, and other electronic gadgets are strictly prohibited.

Q1. A charge of $2\ \mu$C is moved through a potential difference of 5 V. The work done in moving the charge is:

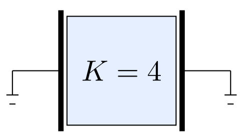
(A) $10\ \mu$J

(B) $2.5\ \mu$J

(C) $7\ \mu$J

(D) $0.4\ \mu$J

Q2. A parallel plate capacitor is connected to a battery of fixed voltage. A slab of dielectric constant $K = 4$ is now inserted, completely filling the gap, as shown. The charge stored on the plates:



battery

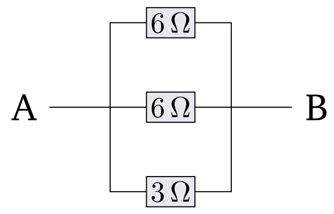
(A) becomes one-fourth

(B) stays the same

(C) is halved

(D) becomes four times as large

Q3. Three resistors of $6\,\Omega$, $6\,\Omega$ and $3\,\Omega$ are connected in parallel between A and B, as shown. The equivalent resistance between A and B is:



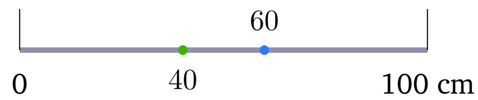
(A) $15\,\Omega$

(B) $5\,\Omega$

(C) $1.5\,\Omega$

(D) $3\,\Omega$

Q4. In a potentiometer experiment, two cells of emf E_1 and E_2 are balanced separately on a uniform wire. The balancing lengths are 60 cm and 40 cm respectively, as shown. The ratio $E_1 : E_2$ is:



(A) $2 : 3$

(B) $3 : 2$

(C) $4 : 6$

(D) $1 : 1$

Q5. An electric heater is rated 1100 W and is used on a 220 V mains supply. The minimum fuse rating that will allow it to work safely is:

(A) 5 A

(B) 2 A

(C) 10 A

(D) 0.2 A

Q6. A car travels at a steady speed of 72 km/h. Expressed in m/s, this speed is:

(A) 10 m/s

(B) 20 m/s

(C) 25 m/s

(D) 72 m/s

Q7. A runner completes exactly one full lap of a circular track of radius 35 m and returns to the starting point. The magnitude of her displacement is:

(A) 220 m

(B) 70 m

(C) 0 m

(D) 35 m

Q8. A stone is thrown vertically upward with a speed of 20 m/s. The maximum height it reaches is (take $g = 10$ m/s^2):

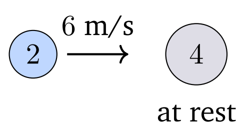
(A) 40 m

(B) 10 m

(C) 80 m

(D) 20 m

Q9. A ball of mass 2 kg moving at 6 m/s strikes a stationary ball of mass 4 kg and the two stick together, as shown. Their common velocity just after the collision is:



(A) 2 m/s

(B) 3 m/s

(C) 1 m/s

(D) 6 m/s

Q10. A particle moves in a circle of radius 4 m with a constant speed of 8 m/s. Its centripetal acceleration is:

(A) 32 m/s^2

(B) 16 m/s^2

(C) 2 m/s^2

(D) 64 m/s^2

Q11. A net force does 40 J of work on a 5 kg body initially at rest. By the work–energy theorem, the final speed of the body is:

(A) 16 m/s

(B) 8 m/s

(C) 4 m/s

(D) 2 m/s

Q12. A geostationary satellite appears to stay fixed above one point on the equator. Its time period of revolution around the Earth is:

(A) 1 hour

(B) 12 hours

(C) 48 hours

(D) 24 hours

Q13. According to Bernoulli's principle, when a fluid flows faster through a narrow part of a horizontal pipe, the pressure there is:

(A) lower than in the wide part

(B) higher than in the wide part

(C) the same as in the wide part

(D) zero

Q14. A wire is stretched by applying a force of 200 N, producing an extension of 0.5 mm. The elastic potential energy stored in the wire is:

(A) 0.1 J

(B) 0.05 J

(C) 0.5 J

(D) 100 J

Q15. The absolute (kelvin) temperature of an ideal gas is increased by a factor of 4. The rms speed of its molecules becomes:

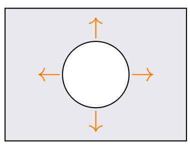
(A) 4 times the original

(B) 16 times the original

(C) 2 times the original

(D) unchanged

Q16. A metal plate has a circular hole in it. When the plate is heated uniformly, as shown, the diameter of the hole:



heated plate

(A) decreases

(B) first increases then decreases

(C) increases

(D) stays exactly the same

Q17. A refrigerator extracts 200 J of heat from its contents while the compressor does 50 J of work in each cycle. The coefficient of performance of the refrigerator is:

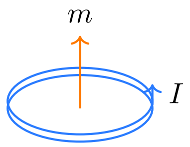
(A) 4

(B) 0.25

(C) 5

(D) 250

Q18. A flat circular coil of 50 turns and area 4×10^{-3} m^2 carries a current of 2 A, as shown. The magnetic moment of the coil is:



(A) 0.2 A m^2

(B) 0.4 A m^2

(C) 4 A m^2

(D) 0.1 A m^2

Q19. Eddy currents are loops of induced current set up in a solid conductor placed in a changing magnetic field. A useful application of eddy currents is in:

(A) a simple fixed resistor

(B) storing electric charge in a capacitor

(C) the magnetic (induction) braking of trains

(D) a wire-wound rheostat

Q20. An alternating voltage of peak value 311 V (rms about 220 V) is applied across a $44\,\Omega$ resistor. The rms current through the resistor is:

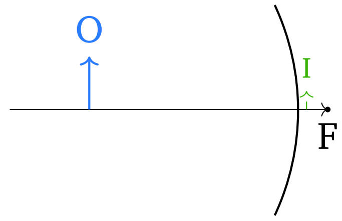
(A) 7.07 A

(B) 14.1 A

(C) 44 A

(D) 5 A

Q21. An object is placed in front of a convex mirror, as shown. The image formed by a convex mirror is always:



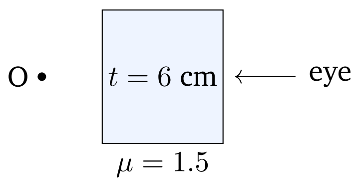
(A) virtual, erect and diminished

(B) real, inverted and magnified

(C) real, erect and the same size

(D) virtual, inverted and magnified

Q22. An object is viewed through a glass slab of thickness 6 cm and refractive index 1.5, as shown. The apparent shift of the object towards the observer is:



(A) 4 cm

(B) 2 cm

(C) 9 cm

(D) 3 cm

Q23. In Young's double-slit experiment the fringe width is β. If the separation between the two slits is doubled while everything else is kept the same, the new fringe width is:

(A) 2β

(B) 4β

(C) $\beta/2$

(D) β

Q24. In a photoelectric experiment (with the frequency of light kept above the threshold), the saturation photocurrent depends mainly on:

(A) the work function of the metal

(B) the stopping potential only

(C) the frequency of the incident light

(D) the intensity of the incident light

Q25. A hydrogen atom is excited to the $n = 4$ energy level. The maximum number of distinct spectral lines that can be emitted as the electron returns to the ground state is:

(A) 6

(B) 4

(C) 3

(D) 10

Q26. A radioactive nuclide has a decay constant $\lambda = 0.0693\ \text{s}^{-1}$. Its half-life is:

(A) 0.693 s

(B) 10 s

(C) 5 s

(D) 100 s

Q27. A body executing simple harmonic motion has amplitude A. When its displacement is doubled (amplitude $2A$, same mass and frequency), its total mechanical energy becomes:

(A) 2 times

(B) half

(C) 4 times

(D) unchanged

Q28. A source of sound moves away from a stationary observer at constant speed. Compared with the frequency emitted, the frequency heard by the observer is:

(A) higher

(B) unchanged

(C) first higher then lower

(D) lower

Q29. In a p-type semiconductor, the minority charge carriers are:

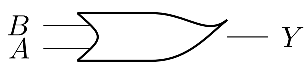
(A) electrons

(B) holes

(C) protons

(D) negative ions

Q30. The logic gate whose symbol is shown gives an output $Y = 1$ whenever at least one input is 1. For the inputs $A = 0$, $B = 1$, the output Y is:



OR gate

(A) 0

(B) undefined

(C) 2

(D) 1

Detailed Solutions

Q1.

Solution

Concept — Work done on a charge: The electric potential difference V between two points is defined as the work done per unit charge in moving a charge between them. Therefore the work done in moving a charge q through a potential difference V is $W = qV$. Here W is the work in joules (J), q is the charge in coulombs (C), and V is the potential difference in volts (V). Because the relation is a direct product, the work scales linearly with both the charge moved and the potential difference crossed.

Given: Charge $q = 2\ \mu\text{C} = 2 \times 10^{-6}$ C; potential difference $V = 5$ V.

Step 1 — Write the formula and substitute: $W = qV = (2 \times 10^{-6}\ \text{C})(5\ \text{V})$.

Step 2 — Multiply the numbers and units: $W = (2\times5)\times10^{-6}\ \text{C}\cdot\text{V} = 10\times10^{-6}$ J, since $1\ \text{C}\cdot\text{V} = 1$ J.

Step 3 — Express in microjoules: $W = 10 \times 10^{-6}\ \text{J} = 10\ \mu\text{J}$.

Why each other option is wrong:

- (B) $2.5\ \mu$J comes from dividing q by V ($2/5 \times \ldots$) instead of multiplying, which is dimensionally wrong.
- (C) $7\ \mu$J comes from adding the numbers $2 + 5$, but work is a product, not a sum.
- (D) $0.4\ \mu$J inverts the ratio (V/q scaling), again not the defining relation $W = qV$.

Key point: Always multiply charge by potential difference; keep the 10^{-6} factor of the microcoulomb so the answer naturally comes out in microjoules.

Final Answer: $W = 10\ \mu\text{J} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — Dielectric at constant voltage: The capacitance of a parallel-plate capacitor is $C = \frac{\varepsilon_0 A}{d}$. Filling the gap with a dielectric of constant K multiplies the capacitance by K, giving $C' = KC$. The charge stored is $Q = CV$. The crucial distinction is what is held fixed: here the battery stays connected, so the *voltage* V is constant while the charge is free to change.

Given: Dielectric constant $K = 4$; battery voltage V fixed (constant-voltage condition).

Step 1 — Capacitance with dielectric: $C' = KC$, so the new capacitance is $4C$.

Step 2 — New charge at fixed V: $Q' = C'V = (KC)V = K(CV) = K\,Q$, where $Q = CV$ is the original charge.

Step 3 — Put $K = 4$: $Q' = 4Q$. The charge on the plates becomes four times as large because the battery pumps extra charge to keep V unchanged.

Why each other option is wrong:

- (A) "becomes one-fourth" would require the charge to drop, the opposite of what a dielectric does at fixed voltage.
- (B) "stays the same" is the constant-charge result (battery disconnected); here the battery is connected, so charge changes.
- (C) "is halved" has no basis; nothing in the problem halves either C or V.

Key point: At constant voltage the charge follows the capacitance ($Q \propto C$); at constant charge it is the voltage that changes. Always check which quantity the battery condition holds fixed.

Final Answer: Charge becomes four times $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q2

Q3.

Solution

Concept — Resistors in parallel: When resistors are connected in parallel they share the same potential difference, and the reciprocals of their resistances add: $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$. Here R is the equivalent (effective) resistance in ohms. A key property is that the parallel combination is always *smaller* than the smallest individual resistor.

Given: $R_1 = 6\,\Omega$, $R_2 = 6\,\Omega$, $R_3 = 3\,\Omega$, all in parallel between A and B.

Step 1 — Write the formula and substitute: $\frac{1}{R} = \frac{1}{6\,\Omega} + \frac{1}{6\,\Omega} + \frac{1}{3\,\Omega}$.

Step 2 — Take a common denominator of 6: $\frac{1}{R} = \frac{1+1+2}{6\,\Omega} = \frac{4}{6\,\Omega} = \frac{2}{3\,\Omega}$.

Step 3 — Invert to find R: $R = \frac{3}{2}\,\Omega = 1.5\,\Omega$. This is indeed less than the smallest resistor ($3\,\Omega$), confirming the result.

Why each other option is wrong:

- (A) $15\,\Omega$ is the *series* total $6+6+3$, but these resistors are in parallel.
- (B) $5\,\Omega$ is the arithmetic average of the three values, which is not how parallel resistors combine.
- (D) $3\,\Omega$ ignores the two $6\,\Omega$ resistors and just keeps the smallest; parallel resistance must be below that.

Key point: Add reciprocals for parallel, then invert at the end. A quick sanity check: the answer must be smaller than the smallest branch resistance.

Final Answer: $R = 1.5\,\Omega \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — Potentiometer comparison of emfs: A potentiometer wire carries a steady current, so the potential drop per unit length (the potential gradient k) is uniform. At the balance point no current flows through the cell, so the cell's emf equals the potential drop across the balancing length: $E = k\ell$. Since k is the same for both cells, $E \propto \ell$ and $\frac{E_1}{E_2} = \frac{\ell_1}{\ell_2}$.

Given: Balancing length for E_1 is $\ell_1 = 60$ cm; for E_2 it is $\ell_2 = 40$ cm.

Step 1 — Write the ratio and substitute: $\frac{E_1}{E_2} = \frac{\ell_1}{\ell_2} = \frac{60\text{ cm}}{40\text{ cm}}$.

Step 2 — Simplify the fraction: $\frac{60}{40} = \frac{3}{2}$ (the centimetre units cancel, leaving a pure ratio).

Step 3 — State the ratio: $E_1 : E_2 = 3 : 2$.

Why each other option is wrong:

- (A) $2:3$ is the inverted ratio $\ell_2:\ell_1$, i.e. $E_2:E_1$, not what was asked.
- (C) $4:6$ is just $2:3$ unreduced, again the inverse of the correct ratio.
- (D) $1:1$ would require equal balancing lengths, but 60 cm $\neq 40$ cm.

Key point: In a potentiometer the larger emf always balances at the greater length; keep the lengths in the same order as the emfs asked for.

Final Answer: $E_1:E_2 = 3:2 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q4

Q5.

Solution

Concept — Fuse rating from power: For a resistive appliance, the electrical power is $P = VI$, so the operating current is $I = \frac{P}{V}$. A fuse is a thin wire that melts when the current exceeds its rating; to let the appliance run safely, the fuse rating must be *at least* the normal operating current. The minimum safe rating is therefore the operating current itself.

Given: Power $P = 1100$ W; mains voltage $V = 220$ V.

Step 1 — Write the formula and substitute: $I = \frac{P}{V} = \frac{1100\text{ W}}{220\text{ V}}$.

Step 2 — Evaluate with units: $I = 5\,\frac{\text{W}}{\text{V}} = 5$ A, since 1 W/V $= 1$ A.

Step 3 — Interpret: The heater draws 5 A normally, so the smallest fuse that will not blow during normal use is a 5 A fuse.

Why each other option is wrong:

- (B) 2 A is below the 5 A operating current, so this fuse would melt as soon as the heater is switched on.
- (C) 10 A would work but is twice the needed value, so it is not the *minimum* rating asked for.
- (D) 0.2 A comes from computing V/P or misplacing a decimal; such a fuse would blow instantly.

Key point: The minimum fuse rating equals the operating current P/V; choosing too low blows the fuse, choosing too high defeats its protective purpose.

Final Answer: 5 A $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — Unit conversion (km/h to m/s): One kilometre is 1000 m and one hour is 3600 s. To convert a speed from km/h to m/s, multiply by the conversion factor $\frac{1000 \text{ m}}{3600 \text{ s per h}} = \frac{5}{18}$. This factor is less than 1, so the numerical value in m/s is always smaller than the value in km/h.

Given: Speed $= 72$ km/h.

Step 1 — Apply the conversion factor: $v = 72 \frac{\text{km}}{\text{h}} \times \frac{5}{18} \frac{\text{m/s}}{\text{km/h}}$.

Step 2 — Cancel and divide: $\frac{72}{18} = 4$, so $v = 4 \times 5$ m/s.

Step 3 — Evaluate: $v = 20$ m/s.

Why each other option is wrong:

- (A) 10 m/s uses the wrong factor $\frac{5}{36}$ (dividing by 36 instead of 18).
- (C) 25 m/s does not match any correct conversion factor for 72 km/h.
- (D) 72 m/s simply forgets to convert and keeps the original number.

Key point: Multiply by $\frac{5}{18}$ to go km/h $\rightarrow$ m/s, and by $\frac{18}{5}$ for the reverse; the m/s value should always be the smaller number.

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

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — Distance vs displacement: Distance is the total path length actually travelled (a scalar), whereas displacement is the straight-line vector drawn from the initial position to the final position. Their magnitudes are equal only for motion in a straight line without reversal. The defining rule here is: if the final position coincides with the initial position, the displacement is exactly zero regardless of how long the path was.

Given: Circular track of radius $r = 35$ m; the runner completes exactly one full lap and returns to the start.

Step 1 — Locate start and finish: After one complete lap the runner is back at the exact point where she started, so the start and end positions are the same.

Step 2 — Apply the definition of displacement: The straight-line vector from start to finish has zero length, so the magnitude of the displacement is 0 m.

Step 3 — Contrast with distance: The distance covered equals the circumference $2\pi r = 2 \times \frac{22}{7} \times 35 = 220$ m, which is non-zero, highlighting the difference between the two quantities.

Why each other option is wrong:

- (A) 220 m is the distance (circumference) travelled, not the displacement.
- (B) 70 m is the diameter $2r$; that would be the displacement only after *half* a lap, not a full one.
- (D) 35 m is just the radius and has no special meaning as a displacement here.

Key point: Return-to-start motion always gives zero displacement even though the distance can be large; never confuse path length with the start-to-finish vector.

Final Answer: Displacement $= 0$ m $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — Maximum height of vertical projection: For a body thrown straight up with initial speed u, gravity decelerates it until its velocity is momentarily zero at the top. Using $v^2 = u^2 - 2gH$ with $v = 0$ at the highest point gives the maximum height $H = \dfrac{u^2}{2g}$, where u is the launch speed and g the acceleration due to gravity.

Given: Initial speed $u = 20$ m/s; $g = 10$ m/s^2.

Step 1 — Write the formula and substitute: $H = \dfrac{u^2}{2g} = \dfrac{(20 \text{ m/s})^2}{2(10 \text{ m/s}^2)}$.

Step 2 — Compute the numerator and denominator: $H = \dfrac{400 \text{ m}^2/\text{s}^2}{20 \text{ m/s}^2}$.

Step 3 — Divide, with units: $H = 20$ m (the m^2/s^2 over m/s^2 correctly leaves metres).

Why each other option is wrong:

- (A) 40 m drops the factor of 2 in the denominator (using u^2/g).
- (B) 10 m comes from $u^2/(4g)$ or a stray extra factor of 2.

- (C) 80 m over-counts, e.g. using u^2/g with a wrong g or doubling the height.

Key point: At the top the speed is zero; use $H = u^2/2g$ and keep the factor of 2 in the denominator.

Final Answer: $H = 20$ m $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — Perfectly inelastic collision: In any collision with no external horizontal force, linear momentum is conserved. In a *perfectly inelastic* collision the bodies stick together and move with a single common velocity v afterwards. Conservation of momentum gives $m_1u_1 + m_2u_2 = (m_1 + m_2)v$. (Kinetic energy is *not* conserved here, but momentum still is.)

Given: $m_1 = 2$ kg moving at $u_1 = 6$ m/s; $m_2 = 4$ kg at rest, $u_2 = 0$.

Step 1 — Apply momentum conservation: $m_1u_1 + m_2u_2 = (m_1 + m_2)v$, so $v = \dfrac{m_1u_1 + m_2u_2}{m_1 + m_2}$.

Step 2 — Substitute the data: $v = \dfrac{(2\text{ kg})(6\text{ m/s}) + (4\text{ kg})(0)}{(2+4)\text{ kg}} = \dfrac{12\text{ kg m/s}}{6\text{ kg}}$.

Step 3 — Evaluate: $v = 2$ m/s.

Why each other option is wrong:

- (B) 3 m/s divides the momentum by only the moving mass m_1, forgetting the stuck-on 4 kg.
- (C) 1 m/s divides by twice the total mass (used 12 kg instead of 6 kg).
- (D) 6 m/s keeps the original speed, ignoring that the second ball must also be accelerated.

Key point: After sticking, divide the total momentum by the *combined* mass; the common velocity is always less than the original speed of the moving body.

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

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Centripetal acceleration: A particle moving in a circle at constant speed still accelerates because its velocity direction continually changes. This acceleration points towards the centre and has magnitude $a = \frac{v^2}{r}$, where v is the speed and r the radius. It depends on the *square* of the speed and inversely on the radius.

Given: Radius $r = 4$ m; constant speed $v = 8$ m/s.

Step 1 — Write the formula and substitute: $a = \frac{v^2}{r} = \frac{(8\text{ m/s})^2}{4\text{ m}}$.

Step 2 — Square the speed: $a = \frac{64\text{ m}^2/\text{s}^2}{4\text{ m}}$.

Step 3 — Divide, with units: $a = 16\text{ m/s}^2$ (one factor of metres cancels, leaving m/s^2).

Why each other option is wrong:

- (A) 32 m/s^2 uses $2v^2/r$ or otherwise doubles the result incorrectly.
- (C) 2 m/s^2 divides by v^2 instead of squaring it (i.e. used r/v^2 scaling).
- (D) 64 m/s^2 forgets to divide by the radius r.

Key point: Square the speed first, then divide by the radius; centripetal acceleration grows rapidly because of the v^2 dependence.

Final Answer: $a = 16\text{ m/s}^2 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Work–energy theorem: The net work done on a body equals the change in its kinetic energy, $W_{net} = \Delta KE = \frac{1}{2}mv^2 - \frac{1}{2}mu^2$. For a body starting from rest ($u = 0$) this reduces to $W = \frac{1}{2}mv^2$, where m is the mass and v the final speed.

Given: Net work $W = 40$ J; mass $m = 5$ kg; initial speed $u = 0$.

Step 1 — Rearrange for v: From $W = \frac{1}{2}mv^2$, $v = \sqrt{\frac{2W}{m}}$.

Step 2 — Substitute the data: $v = \sqrt{\frac{2(40\ \text{J})}{5\ \text{kg}}} = \sqrt{\frac{80}{5}\ \frac{\text{J}}{\text{kg}}} = \sqrt{16\ \text{m}^2/\text{s}^2}$ (using $1\ \text{J/kg} = 1\ \text{m}^2/\text{s}^2$).

Step 3 — Take the square root: $v = 4$ m/s.

Why each other option is wrong:

- (A) 16 m/s is the value of v^2 (i.e. $2W/m$), not v; the square root was skipped.
- (B) 8 m/s comes from omitting the mass (using $\sqrt{2W}$).
- (D) 2 m/s drops the factor 2 (using $\sqrt{W/m}$).

Key point: Set work equal to $\frac{1}{2}mv^2$ and remember to take the square root at the end; the factor 2 and the mass must both stay in.

Final Answer: $v = 4$ m/s $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q11

Q12.

Solution

Concept — Geostationary satellite: A geostationary satellite is one that appears permanently fixed above a single point on the equator. For this to happen, its angular velocity around the Earth must exactly match the Earth's angular velocity of rotation. Equal angular velocities mean equal time periods, so the satellite's orbital period must equal the Earth's rotation period (one sidereal day, taken as 24 hours for this level).

Given: The satellite stays above one fixed point on the equator; Earth's rotation period ≈ 24 hours.

Step 1 — Match angular velocities: "Appears fixed" $\Rightarrow$ satellite's ω equals Earth's ω, hence equal periods T.

Step 2 — Identify Earth's period: The Earth completes one rotation in about 24 hours.

Step 3 — Conclusion: The satellite's time period of revolution is therefore 24 hours.

Why each other option is wrong:

- (A) 1 hour is far too short; the satellite would race ahead of the ground point.

- (B) 12 hours would carry it twice around per day, so it would not appear fixed.
- (C) 48 hours is twice the Earth's period, so the Earth would turn twice per orbit and the point would drift.

Key point: "Geostationary" means synchronised with Earth's spin: same period of 24 hours and an equatorial orbit.

Final Answer: 24 hours $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Bernoulli's principle: For the steady, non-viscous flow of an incompressible fluid along a horizontal streamline, $P + \frac{1}{2}\rho v^2 =$ constant, where P is the pressure, ρ the density and v the flow speed. (The height term ρgh is constant for a horizontal pipe and drops out.) Because the sum is fixed, an increase in the kinetic-energy term $\frac{1}{2}\rho v^2$ must be balanced by a decrease in the pressure term P.

Step 1 — Equation of continuity: For an incompressible fluid $Av =$ constant, so where the pipe is narrow (small area A) the speed v is large.

Step 2 — Apply Bernoulli: A larger v in the narrow part makes $\frac{1}{2}\rho v^2$ larger, so P there must be smaller than in the wide part.

Step 3 — Conclusion: The pressure in the fast, narrow section is lower than in the slow, wide section.

Why each other option is wrong:

- (B) "higher than in the wide part" reverses Bernoulli's relation; faster flow cannot have higher pressure.
- (C) "the same as in the wide part" ignores the change in speed between the sections.
- (D) "zero" is unphysical here; the pressure is merely reduced, not eliminated.

Key point: Fast flow $\Rightarrow$ low pressure. This is the principle behind aerofoil lift, atomisers and the venturi meter.

Final Answer: Lower pressure $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Elastic potential energy in a stretched wire: Within the elastic limit the restoring force grows linearly from 0 to F as the wire stretches by ΔL (Hooke's law). The work done, stored as elastic potential energy, is the area under the force–extension graph, $U = \frac{1}{2}F\,\Delta L$, where F is the final stretching force and ΔL the extension. The factor $\frac{1}{2}$ comes from the average force $\frac{1}{2}F$ acting over the extension.

Given: Force $F = 200$ N; extension $\Delta L = 0.5$ mm $= 0.5 \times 10^{-3}$ m.

Step 1 — Convert and write the formula: $\Delta L = 0.5 \times 10^{-3}$ m $= 0.0005$ m; $U = \frac{1}{2}F\,\Delta L$.

Step 2 — Substitute with units: $U = \frac{1}{2}(200\text{ N})(0.0005\text{ m}) = \frac{1}{2}(0.1\text{ N m})$.

Step 3 — Evaluate: $U = 0.05$ J (since 1 N m $= 1$ J).

Why each other option is wrong:

- (A) 0.1 J omits the factor $\frac{1}{2}$, treating the full force as acting over the whole extension.
- (C) 0.5 J mishandles the millimetre-to-metre conversion (off by a factor of 10).
- (D) 100 J forgets to convert the extension to metres altogether and drops the $\frac{1}{2}$.

Key point: Use the average force, so include the $\frac{1}{2}$, and always convert millimetres to metres before substituting.

Final Answer: $U = 0.05$ J $\Rightarrow$ B

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — RMS speed and absolute temperature: From kinetic theory the root-mean-square speed of the molecules of an ideal gas is $v_{rms} = \sqrt{\frac{3RT}{M}}$, where R is the gas constant, T the absolute (kelvin) temperature and M the molar mass. With R and M fixed, $v_{rms} \propto \sqrt{T}$, so the speed depends on the *square root* of the absolute temperature.

Given: Absolute temperature is increased by a factor of 4, i.e. $T_2 = 4T_1$.

Step 1 — Form the ratio: $\frac{v_2}{v_1} = \sqrt{\frac{T_2}{T_1}} = \sqrt{\frac{4T_1}{T_1}}$.

Step 2 — Simplify: $\frac{v_2}{v_1} = \sqrt{4} = 2$.

Step 3 — Conclusion: The new rms speed is $v_2 = 2v_1$, i.e. twice the original.

Why each other option is wrong:

- (A) "4 times" wrongly assumes $v_{rms} \propto T$ instead of $\sqrt{T}$.
- (B) "16 times" assumes $v_{rms} \propto T^2$, which is the square of the wrong assumption.
- (D) "unchanged" ignores any dependence on temperature.

Key point: Because $v_{rms} \propto \sqrt{T}$, you must take the square root of the temperature factor: a fourfold rise in T only doubles the speed.

Final Answer: 2 times $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Thermal expansion of a plate with a hole: When a solid is heated, every linear dimension increases by the factor $(1+\alpha\,\Delta T)$, where α is the coefficient of linear expansion and ΔT the temperature rise. A hole in the plate behaves exactly like a disc of the same metal that has been removed: as the surrounding metal expands, it carries the boundary of the hole outward, so the hole's diameter *increases* in the same proportion. Crucially, the hole does *not* shrink.

Given: A metal plate with a circular hole of diameter d is heated uniformly by ΔT.

Step 1 — Apply linear expansion to the hole: $\Delta d = d\,\alpha\,\Delta T$. Since $\alpha > 0$ and $\Delta T > 0$, we have $\Delta d > 0$.

Step 2 — Conclusion: The new diameter $d' = d(1+\alpha\,\Delta T) > d$, so the hole grows.

Why each other option is wrong:

- (A) "decreases" is the common misconception that the metal closes in on the hole; in fact the boundary moves outward.

- (B) "first increases then decreases" has no physical basis for uniform, steady heating.
- (D) "stays exactly the same" would require zero expansion, but $\alpha \neq 0$ for a metal.

Key point: A hole expands just like the solid material it replaces; on heating, both the plate and every hole in it grow.

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

Answer: (C) Go Back to Q16

Q17.

Solution

Concept — Coefficient of performance of a refrigerator: A refrigerator uses external work W to pump heat Q_C out of a cold space. Its effectiveness is measured by the coefficient of performance, $\text{COP} = \frac{Q_C}{W}$, the ratio of the useful heat removed to the work supplied. The COP is a pure number and is typically greater than 1.

Given: Heat extracted $Q_C = 200$ J per cycle; work done by the compressor $W = 50$ J per cycle.

Step 1 — Write the formula and substitute: $\text{COP} = \frac{Q_C}{W} = \frac{200 \text{ J}}{50 \text{ J}}$.

Step 2 — Divide (joules cancel): $\text{COP} = \frac{200}{50} = 4$.

Step 3 — Interpret: The fridge removes 4 J of heat for every 1 J of work, so $\text{COP} = 4$.

Why each other option is wrong:

- (B) 0.25 inverts the ratio (W/Q_C); that is efficiency-like, not COP.
- (C) 5 uses $Q_C/(Q_C - W)$ or otherwise the wrong denominator; the denominator should be W.
- (D) 250 adds $Q_C + W$ instead of dividing.

Key point: For a refrigerator $\text{COP} = Q_C/W$ (heat removed over work in); the heat rejected to the surroundings would be $Q_H = Q_C + W = 250$ J, but that is not the COP.

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

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Magnetic moment of a current-carrying coil: A flat coil of N turns, each enclosing area A and carrying current I, behaves like a magnetic dipole with magnetic moment $m = NIA$. Here N is the number of turns, I the current in amperes and A the area in m^2; the moment m has units of A m^2 and points along the axis of the coil.

Given: Turns $N = 50$; area $A = 4 \times 10^{-3}$ m^2; current $I = 2$ A.

Step 1 — Write the formula and substitute: $m = NIA = (50)(2\text{ A})(4 \times 10^{-3}\text{ m}^2)$.

Step 2 — Multiply the integers first: $50 \times 2 = 100$, so $m = 100 \times 4 \times 10^{-3}$ A m^2.

Step 3 — Finish the multiplication: $m = 400 \times 10^{-3}$ A m^2 $= 0.4$ A m^2.

Why each other option is wrong:

- (A) 0.2 A m^2 uses half the turns (or omits the current factor of 2).
- (C) 4 A m^2 drops the 10^{-3} from the area, an error of a factor of 10 in the power of ten chain.
- (D) 0.1 A m^2 leaves out the current I entirely.

Key point: Multiply all three factors N, I and A together, and carry the 10^{-3} from the small area through to the end.

Final Answer: $m = 0.4$ A m^2 $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q18

Q19.

Solution

Concept — Eddy currents: When the magnetic flux through a solid (bulk) conductor changes, the induced emf drives circulating loops of current within the body of the metal. These are called eddy currents. By Lenz's law they flow in a direction that opposes the change in flux, and because the metal has resistance they dissipate energy as heat. This opposing nature makes them ideal for braking, while the heating is exploited in induction furnaces.

Step 1 — Identify a useful application: In electromagnetic (induction) braking, a moving metal disc or rail attached to a train passes through a magnetic field. The changing flux induces eddy currents whose magnetic effect opposes the motion.

Step 2 — Effect of the eddy currents: The opposing force grows with speed and acts smoothly and without mechanical contact, slowing the train without friction wear.

Step 3 — Conclusion: The magnetic (induction) braking of trains is a genuine, useful application of eddy currents.

Why each other option is wrong:

- (A) a simple fixed resistor works by ordinary conduction, not by induced eddy currents.
- (B) storing charge in a capacitor is an electrostatic effect, unrelated to eddy currents.
- (D) a wire-wound rheostat varies resistance; its operation does not rely on eddy currents (indeed they are usually a nuisance to be minimised).

Key point: Eddy currents oppose changes in flux (Lenz's law), which is exactly what makes induction braking work.

Final Answer: Magnetic braking of trains $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q19

Q20.

Solution

Concept — AC through a pure resistor: For a purely resistive load the current is in phase with the voltage and there is no reactance, so Ohm's law applies directly to the root-mean-square (rms) values: $I_{rms} = \frac{V_{rms}}{R}$. The rms voltage is related to the peak by $V_{rms} = \frac{V_0}{\sqrt{2}}$, so for a peak of 311 V the rms value is about 220 V (the value to use here).

Given: Peak voltage $V_0 = 311$ V, so $V_{rms} \approx 220$ V; resistance $R = 44\ \Omega$.

Step 1 — Choose the right voltage: Currents and voltages quoted as "rms" must be combined with each other, so use $V_{rms} = 220$ V, not the peak.

Step 2 — Apply Ohm's law and substitute: $I_{rms} = \frac{V_{rms}}{R} = \frac{220\ \text{V}}{44\ \Omega}$.

Step 3 — Evaluate: $I_{rms} = 5$ A (since $\text{V}/\Omega = \text{A}$).

Why each other option is wrong:

- (A) 7.07 A divides the *peak* voltage 311 V by 44 Ω, mixing peak with rms.

- (B) 14.1 A is roughly twice that, e.g. using V_0 and forgetting a $\sqrt{2}$.
- (C) 44 A ignores the voltage and just reads off the resistance value.

Key point: Pair rms with rms (and peak with peak); for a resistor $I_{rms} = V_{rms}/R$ straight from Ohm's law.

Final Answer: $I_{rms} = 5$ A $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept — Image in a convex mirror: A convex mirror has its reflecting surface bulging towards the object, so it is a *diverging* mirror with a virtual focus behind it. For a real object placed anywhere in front of it, the reflected rays spread out (diverge); when extended backward they appear to meet behind the mirror, forming a virtual image. Using the mirror formula $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ with $f > 0$ (convex) and $u < 0$ always gives a positive v (image behind the mirror) and a magnification $0 < m < 1$.

Step 1 — Location of the image: Because the rays only appear to meet behind the mirror, the image is virtual.

Step 2 — Orientation: The positive magnification means the image is erect (the same way up as the object).

Step 3 — Size: Since $|m| < 1$ for all object positions, the image is diminished (smaller than the object).

Why each other option is wrong:

- (B) "real, inverted and magnified" describes a concave mirror with the object beyond its focus, not a convex mirror.
- (C) "real, erect and the same size" is impossible for a convex mirror, which never forms a real image of a real object.
- (D) "virtual, inverted and magnified" is wrong on orientation and size; a convex-mirror image is erect and diminished.

Key point: A convex mirror *always* gives a virtual, erect, diminished image for a real object, which is why it is used as a wide-view rear and side mirror.

Final Answer: Virtual, erect and diminished $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — Apparent shift through a glass slab: When an object is viewed normally through a parallel-sided slab of thickness t and refractive index μ, refraction makes it appear nearer to the observer. The apparent (normal) shift towards the observer is $s = t\left(1 - \frac{1}{\mu}\right)$, where t is the slab thickness and μ its refractive index. Note this shift is different from the apparent thickness t/μ.

Given: Slab thickness $t = 6$ cm; refractive index $\mu = 1.5$.

Step 1 — Write the formula and substitute: $s = t\left(1 - \frac{1}{\mu}\right) = 6\text{ cm}\left(1 - \frac{1}{1.5}\right)$.

Step 2 — Simplify the bracket: $\frac{1}{1.5} = \frac{2}{3}$, so $1 - \frac{2}{3} = \frac{1}{3}$.

Step 3 — Evaluate: $s = 6\text{ cm} \times \frac{1}{3} = 2$ cm.

Why each other option is wrong:

- (A) 4 cm is the apparent thickness $t/\mu = 6/1.5$, not the shift.
- (C) 9 cm multiplies by μ (6×1.5) instead of using the shift formula.
- (D) 3 cm uses a wrong factor of $\frac{1}{2}$ rather than $\frac{1}{3}$.

Key point: The shift is $t(1 - 1/\mu)$; do not confuse it with the apparent depth/thickness t/μ.

Final Answer: $s = 2\text{ cm} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q22

Q23.

Solution

Concept — Fringe width in Young's double-slit experiment: The spacing between consecutive bright (or dark) fringes is $\beta = \frac{\lambda D}{d}$, where λ is the wavelength of light, D the slit-to-screen distance and d the separation between the two slits. With λ and D fixed, the fringe width is *inversely* proportional to the slit separation, $\beta \propto \frac{1}{d}$.

Given: Original fringe width β; the slit separation is doubled, $d \to 2d$, with λ and D unchanged.

Step 1 — Write the proportionality: $\beta \propto \frac{1}{d}$, so $\frac{\beta_{new}}{\beta} = \frac{d}{d_{new}}$.

Step 2 — Substitute $d_{new} = 2d$: $\frac{\beta_{new}}{\beta} = \frac{d}{2d} = \frac{1}{2}$.

Step 3 — Result: $\beta_{new} = \frac{\beta}{2}$; doubling the slit separation halves the fringe width.

Why each other option is wrong:

- (A) 2β assumes $\beta \propto d$, the opposite of the true inverse relation.
- (B) 4β assumes $\beta \propto d^2$, doubly wrong.
- (D) β ignores the change in d altogether.

Key point: Since $\beta \propto 1/d$, increasing the slit separation *narrows* the fringes; bring the slits closer to spread the pattern out.

Final Answer: $\frac{\beta}{2} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q23

Q24.

Solution

Concept — Saturation photocurrent: In the photoelectric effect, once the frequency exceeds the threshold, every absorbed photon can eject one electron. The saturation photocurrent is reached when *all* emitted electrons are collected. Its size is therefore set by how many electrons are emitted per second, which equals the number of photons arriving per second. Since the intensity of light measures the photon arrival rate (energy per unit area per unit time), the saturation current is proportional to the intensity.

Step 1 — Relate photons to current: Number of photoelectrons per second $\propto$ number of incident photons per second $\propto$ intensity of the light.

Step 2 — Relate to saturation current: More electrons per second means a larger collected current at saturation, so $I_{sat} \propto$ intensity.

Step 3 — Conclusion: With the frequency held above threshold, the saturation photocurrent depends mainly on the intensity of the incident light.

Why each other option is wrong:

- (A) the work function only decides *whether* emission occurs (the threshold), not the magnitude of the saturated current.
- (B) the stopping potential is fixed by the maximum kinetic energy of the electrons, not by how many are emitted.

- (C) the frequency (above threshold) sets the electrons' maximum energy, not the number emitted, so it controls stopping potential rather than saturation current.

Key point: Intensity $\rightarrow$ number of electrons $\rightarrow$ saturation current; frequency $\rightarrow$ energy of electrons $\rightarrow$ stopping potential. Keep these two chains separate.

Final Answer: Intensity of the light $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — Number of spectral lines: An electron excited to level n can return to lower levels by many different routes, each transition between two distinct levels giving one spectral line. The total number of distinct lines is the number of ways to choose 2 levels out of n, namely $\dfrac{n(n-1)}{2}$. Here n is the principal quantum number of the highest occupied level.

Given: The atom is excited to $n = 4$ and de-excites to the ground state ($n = 1$).

Step 1 — Write the formula and substitute $n = 4$: Number of lines $= \dfrac{n(n-1)}{2} = \dfrac{4(4-1)}{2}$.

Step 2 — Simplify the bracket: $4(4-1) = 4 \times 3 = 12$.

Step 3 — Divide by 2: $\dfrac{12}{2} = 6$ distinct spectral lines (the transitions $4 \rightarrow 3, 4 \rightarrow 2, 4 \rightarrow 1, 3 \rightarrow 2, 3 \rightarrow 1, 2 \rightarrow 1$).

Why each other option is wrong:

- (B) 4 counts only the direct transitions, or wrongly uses n itself.
- (C) 3 is $n-1$, the number of lines reaching the ground state only, not all lines.
- (D) 10 comes from using $n = 5$, i.e. $\frac{5\times4}{2}$.

Key point: Use $\frac{n(n-1)}{2}$ for the maximum number of lines; listing the transitions explicitly is a good cross-check.

Final Answer: 6 spectral lines $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q25

Q26.

Solution

Concept — Half-life and decay constant: Radioactive decay follows $N = N_0 e^{-\lambda t}$, where λ is the decay constant. The half-life $T_{1/2}$ is the time for N to fall to $N_0/2$; setting $e^{-\lambda T_{1/2}} = \frac{1}{2}$ gives $\lambda T_{1/2} = \ln 2$, hence $T_{1/2} = \dfrac{\ln 2}{\lambda} = \dfrac{0.693}{\lambda}$. Here λ is in s^{-1} and $T_{1/2}$ comes out in seconds.

Given: Decay constant $\lambda = 0.0693\ s^{-1}$.

Step 1 — Write the formula and substitute: $T_{1/2} = \dfrac{0.693}{\lambda} = \dfrac{0.693}{0.0693\ s^{-1}}$.

Step 2 — Divide: $\dfrac{0.693}{0.0693} = 10$, and dividing by s^{-1} gives seconds.

Step 3 — State the result: $T_{1/2} = 10$ s.

Why each other option is wrong:

- (A) 0.693 s ignores the extra factor of 10 from the decimal in λ (treats λ as $1\ s^{-1}$).
- (C) 5 s uses a wrong numerator (e.g. 0.3465) or halves the answer incorrectly.
- (D) 100 s is off by a power of ten, dividing by 0.00693 instead of 0.0693.

Key point: Remember $T_{1/2} = 0.693/\lambda$ (with $0.693 = \ln 2$); a quick check is that $\lambda T_{1/2}$ should equal about 0.693.

Final Answer: $T_{1/2} = 10\ s \Rightarrow \boxed{B}$

Answer: (B) Go Back to Q26

Q27.

Solution

Concept — Total energy in SHM: For a body of mass m executing simple harmonic motion with angular frequency ω and amplitude A, the total mechanical energy (kinetic plus potential) is constant and equals $E = \frac{1}{2}m\omega^2 A^2$. With the mass m and frequency (hence ω) fixed, the total energy is proportional to the *square* of the amplitude, $E \propto A^2$.

Given: The amplitude is doubled from A to $2A$, with the same mass and frequency.

Step 1 — Form the ratio: $\dfrac{E_2}{E_1} = \dfrac{\frac{1}{2}m\omega^2(2A)^2}{\frac{1}{2}m\omega^2 A^2} = \dfrac{(2A)^2}{A^2}$.

Step 2 — Square the amplitude factor: $\dfrac{(2A)^2}{A^2} = \dfrac{4A^2}{A^2} = 4$.

Step 3 — Conclusion: $E_2 = 4E_1$, so the total mechanical energy becomes 4 times as large.

Why each other option is wrong:

- (A) "2 times" wrongly assumes $E \propto A$ instead of A^2.
- (B) "half" would need the amplitude to decrease, contradicting the doubling.
- (D) "unchanged" ignores the amplitude dependence entirely.

Key point: Energy in SHM goes as the square of the amplitude, so doubling A quadruples the energy.

Final Answer: 4 times $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q27

Q28.

Solution

Concept — Doppler effect (receding source): When a sound source moves relative to a stationary observer, the observed frequency differs from the emitted one. For a source receding at speed v_s from a stationary observer, $f' = f\dfrac{v}{v+v_s}$, where v is the speed of sound, f the emitted frequency and f' the heard frequency. Because v_s adds to the denominator, the factor $\dfrac{v}{v+v_s}$ is less than 1, so $f' < f$.

Step 1 — Apply the receding-source formula: The source moving away makes the denominator $v + v_s$ larger than v.

Step 2 — Compare with f: Since $\dfrac{v}{v+v_s} < 1$, the heard frequency $f' = f\dfrac{v}{v+v_s}$ is smaller than f.

Step 3 — Conclusion: The observer hears a lower frequency (lower pitch) than the source emits.

Why each other option is wrong:

- (A) "higher" is the case for a source *approaching* the observer, the opposite situation.
- (B) "unchanged" would require no relative motion between source and observer.
- (C) "first higher then lower" describes a source passing by; here it only recedes at constant speed, so the pitch is steadily lower.

Key point: Receding source $\Rightarrow$ longer wavelength $\Rightarrow$ lower frequency; the every-day clue is the dropping pitch of a siren as a vehicle moves away.

Final Answer: Lower frequency ⇒ D

Answer: (D) Go Back to Q28

Q29.

Solution

Concept — Carriers in a p-type semiconductor: A p-type semiconductor is made by doping a pure (intrinsic) semiconductor such as silicon with a trivalent impurity (e.g. boron or aluminium). Each trivalent atom has one electron too few to complete the covalent bonds, creating a "hole". These holes are abundant and become the *majority* carriers. A small number of free electrons still appear from thermal generation of electron–hole pairs; being far fewer, they are the *minority* carriers.

Step 1 — Identify the majority carriers: The trivalent dopant produces many holes, so holes are the majority carriers in p-type material.

Step 2 — Identify the minority carriers: The few thermally generated free electrons are greatly outnumbered by the holes, so electrons are the minority carriers.

Step 3 — Conclusion: In a p-type semiconductor the minority charge carriers are electrons.

Why each other option is wrong:

- (B) holes are the *majority* carriers in p-type material, not the minority.
- (C) protons are bound in nuclei and are not mobile charge carriers in a solid.
- (D) negative ions are not the mobile carriers in a doped semiconductor; conduction is by electrons and holes.

Key point: p-type: holes are majority, electrons are minority (and the reverse holds for n-type). Only electrons and holes carry charge in a semiconductor.

Final Answer: Electrons ⇒ A

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — OR logic gate: A two-input OR gate performs logical addition, $Y = A + B$ (Boolean OR). Its output is 1 (HIGH) whenever *at least one* input is 1, and is 0 (LOW) only in the single case where both inputs are 0. In Boolean algebra $0 + 0 = 0$, $0 + 1 = 1$, $1 + 0 = 1$ and $1 + 1 = 1$. Logic outputs are restricted to the two values 0 and 1.

Given: Inputs $A = 0$ and $B = 1$ applied to an OR gate.

Step 1 — Check the inputs: At least one input (B) is 1, which is the condition for the OR gate to output 1.

Step 2 — Apply the OR rule: $Y = A + B = 0 + 1$.

Step 3 — Evaluate: $Y = 1$.

Why each other option is wrong:

- (A) 0 would require *both* inputs to be 0; here $B = 1$.
- (B) "undefined" is wrong because the OR truth table gives a definite output for every input combination.
- (C) 2 is not a valid logic level; Boolean outputs can only be 0 or 1, not the arithmetic sum.

Key point: For an OR gate, output is 1 unless every input is 0; treat $A + B$ as a logical OR, not ordinary arithmetic addition.

Final Answer: $Y = 1 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q30

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	D	3	C	4	B	5	A
6	B	7	C	8	D	9	A	10	B
11	C	12	D	13	A	14	B	15	C
16	C	17	A	18	B	19	C	20	D
21	A	22	B	23	C	24	D	25	A
26	B	27	C	28	D	29	A	30	D