AME CET Physics

Sample Paper – 5

Duration: 20 Minutes **Maximum Marks: 80**

Instructions

- This paper contains **20** Multiple Choice Questions (Single Correct Answer), modelled on the Physics section of **AME CET** entrance.
- Each correct answer carries **+4 marks**. Each wrong answer carries -1 **mark**. Unattempted questions carry **0 marks**.
- Only **one** option is correct per question. Choose carefully.
- Syllabus level: **Class 11 and 12 NCERT Physics** (Units & Measurement to Communication Systems).
- Use of mobile phones, calculators, or any electronic gadget is strictly prohibited.

Q1. A 24 V battery is connected to a series combination of $6\,\Omega$ and $2\,\Omega$ resistors. The voltage across the $6\,\Omega$ resistor is:

(A) 18 V

(B) 12 V

(C) 6 V

(D) 24 V

Q2. A conductor has free-electron density $n = 5 \times 10^{28}\,\text{m}^{-3}$, cross-sectional area $A = 2\times10^{-6}\,\text{m}^2$, and carries a current of 2 A. Taking $e = 1.6\times10^{-19}$ C, the drift velocity of the electrons is:

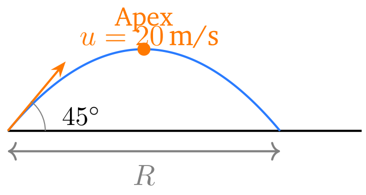
(A) 2.5×10^{-4} m/s

(B) 1.0×10^{-4} m/s

(C) 1.25×10^{-4} m/s

(D) 5×10^{-5} m/s

Q3. A ball is projected at 45° to the horizontal with initial speed $u = 20\,\text{m/s}$. Taking $g = 10\,\text{m/s}^2$, the maximum horizontal range is:



(A) $10\,\text{m}$

(B) $20\,\text{m}$

(C) $30\,\text{m}$

(D) $40\,\text{m}$

Q4. A car starts from rest and accelerates uniformly to $60\,\text{m/s}$ in $20\,\text{s}$. The distance covered during this time is:

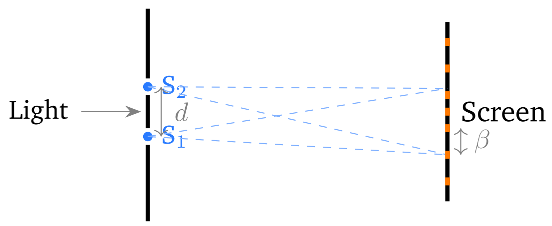
(A) $300\,\text{m}$

(B) $600\,\text{m}$

(C) $1200\,\text{m}$

(D) $150\,\text{m}$

Q5. In Young's double-slit experiment, the slit separation is $d = 0.5\,\text{mm}$, the screen distance is $D = 1\,\text{m}$, and the observed fringe width is $\beta = 1\,\text{mm}$. The wavelength of light used is:



(A) $250\,\text{nm}$

(B) $400\,\text{nm}$

(C) $500\,\text{nm}$

(D) 600 nm

Q6. A ray of light passes from air into a medium. The angle of incidence is 45° and the angle of refraction is 30°. The refractive index of the medium is:
$(\sin 45^\circ = 1/\sqrt{2},\ \sin 30^\circ = 0.5)$

(A) $\sqrt{2}$

(B) $\sqrt{3}$

(C) 2

(D) $1/\sqrt{2}$

Q7. An inductor of inductance $L = 4$ H carries a steady current of 5 A. The energy stored in its magnetic field is:

(A) 20 J

(B) 25 J

(C) 100 J

(D) 50 J

Q8. In a series LCR circuit operating at resonance, the power factor is:

(A) 0

(B) 1

(C) 0.5

(D) Depends on the value of R

Q9. A constant force of 10 N acts on a body of mass 2 kg for 5 s. The change in velocity of the body is:

(A) 25 m/s

(B) 100 m/s

(C) 10 m/s

(D) 50 m/s

Q10. A body of mass 4 kg has kinetic energy 50 J. Its momentum is:

(A) 200 kg m/s

(B) 400 kg m/s

(C) 20 kg m/s

(D) 10 kg m/s

Q11. A capacitor of capacitance $C = 10\,\mu$F is charged to a potential difference of 200 V. The energy stored in it is:

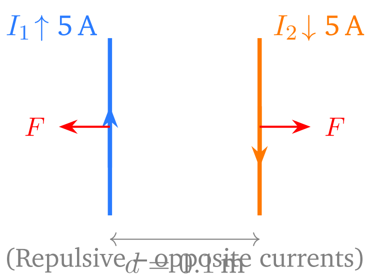
(A) 0.1 J

(B) 0.2 J

(C) 0.4 J

(D) 2.0 J

Q12. Two parallel wires, each 1 m long, carry currents of 5 A in *opposite* directions and are separated by 0.1 m. The magnitude of the magnetic force between them is
($\mu_0 = 4\pi \times 10^{-7}$ T m/A):



(A) 5×10^{-4} N

(B) 1×10^{-4} N

(C) 2.5×10^{-5} N

(D) 5×10^{-5} N

Q13. An electron moving at 10^6 m/s has a de Broglie wavelength equal to that of a proton. The speed of the proton is approximately:
$(m_p/m_e \approx 1836)$

(A) 545 m/s

(B) 1836 m/s

(C) 5.45×10^5 m/s

(D) 1.84×10^9 m/s

Q14. A radioactive element has a half-life of 40 min. Its decay constant λ is:

(A) 27.7 min^{-1}

(B) 1.73×10^{-2} min^{-1}

(C) 0.5 min^{-1}

(D) 40 min^{-1}

Q15. One mole of an ideal gas at $27°$C expands isothermally from 1 L to 4 L. The work done by the gas is:
$(R = 8.31\,\text{J mol}^{-1}\,\text{K}^{-1},\ \ln 4 \approx 1.386)$

(A) 1200 J

(B) 2493 J

(C) 2000 J

(D) 3455 J

Q16. A tuning fork vibrates at 256 Hz. If the speed of sound in air is 340 m/s, the wavelength of the sound wave is:

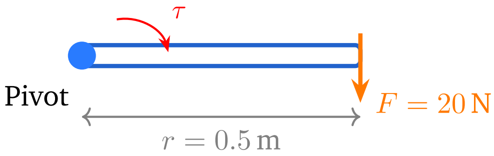
(A) 0.75 m

(B) 2.0 m

(C) 1.33 m

(D) 0.53 m

Q17. A force of 20 N is applied perpendicularly at the free end of a wrench of length 0.5 m. The torque produced about the pivot is:



(A) 10 N m

(B) 40 N m

(C) 20 N m

(D) 0.5 N m

Q18. A Light Emitting Diode (LED) emits light when it is:

(A) Reverse biased

(B) Under breakdown condition

(C) Unbiased

(D) Forward biased

Q19. A spring extends by 2 mm when a load of 4 N is applied. What extension is produced by a load of 10 N (within the elastic limit)?

(A) 8 mm

(B) 5 mm

(C) 20 mm

(D) 2.5 mm

Q20. At what distance r from the centre of the Earth does the acceleration due to gravity equal $g/4$? (R = radius of the Earth)

(A) $R/4$

(B) $R/2$

(C) $2R$

(D) $4R$

Detailed Solutions

Q1.

Solution

Concept — Voltage Divider in a Series Circuit: In a series circuit the current is the same everywhere; the voltage across each resistor is proportional to its resistance.

Step 1 — Find total resistance:

$$R_{\text{total}} = 6 + 2 = 8\,\Omega$$

Step 2 — Find current from battery:

$$I = \frac{V}{R_{\text{total}}} = \frac{24}{8} = 3\,\text{A}$$

Step 3 — Voltage across $6\,\Omega$:

$$V_6 = I \times 6 = 3 \times 6 = 18\,\text{V}$$

Why other options are wrong:

- Option B (12 V): Would require the resistor to be exactly half the total, i.e. $6\,\Omega$ out of $12\,\Omega$ total, not $8\,\Omega$.
- Option C (6 V): This is the voltage across the $2\,\Omega$ resistor ($3 \times 2 = 6\,\text{V}$), not the $6\,\Omega$ one.
- Option D (24 V): This is the battery EMF, not the partial voltage.

Final Answer: $V_6 = 18\,\text{V} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — Drift Velocity: Current and drift velocity are related by $I = nAev_d$, so $v_d = I/(nAe)$.

Step 1 — Write the formula:

$$v_d = \frac{I}{nAe}$$

Step 2 — Substitute:

$$v_d = \frac{2}{(5 \times 10^{28}) \times (2 \times 10^{-6}) \times (1.6 \times 10^{-19})}$$

Step 3 — Compute denominator step by step:

$$5 \times 10^{28} \times 2 \times 10^{-6} = 10^{23}$$

$$10^{23} \times 1.6 \times 10^{-19} = 1.6 \times 10^{4}$$

Step 4 — Divide:

$$v_d = \frac{2}{1.6 \times 10^{4}} = 1.25 \times 10^{-4}\,\text{m/s}$$

Why other options are wrong:

- Option A (2.5×10^{-4} m/s): Doubles the answer – likely used $A = 1 \times 10^{-6}\,\text{m}^2$ (half the actual area).
- Option B (1.0×10^{-4} m/s): Arises from rounding the denominator incorrectly to 2×10^4.
- Option D (5×10^{-5} m/s): One quarter of the correct answer – likely used $I = 0.5\,\text{A}$.

Final Answer: $v_d = 1.25 \times 10^{-4}\,\text{m/s} \Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q2**

Q3.

Solution

Concept — Range of a Projectile: For a projectile launched at angle θ with speed u, the horizontal range is $R = u^2 \sin 2\theta \,/\, g$.

Step 1 — Identify quantities:

$$u = 20\,\text{m/s}, \quad \theta = 45^\circ, \quad g = 10\,\text{m/s}^2$$

Step 2 — Evaluate $\sin 2\theta$:

$$\sin 2(45^\circ) = \sin 90^\circ = 1$$

Step 3 — Calculate range:

$$R = \frac{u^2 \sin 2\theta}{g} = \frac{(20)^2 \times 1}{10} = \frac{400}{10} = 40\,\text{m}$$

Note: 45° is the angle that gives the *maximum* range for a given u.

Why other options are wrong:

- Option A (10 m): Arises from using $u = 10\,\text{m/s}$ instead of $20\,\text{m/s}$.
- Option B (20 m): Uses $g = 20\,\text{m/s}^2$ erroneously.
- Option C (30 m): Has no consistent physical derivation from the given values.

Final Answer: $R = 40\,\text{m} \Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q3**

Q4.

Solution

Concept — Kinematics under Uniform Acceleration: When acceleration is constant the distance is $s = \frac{1}{2}(u + v)t$ (area under v-t graph).

Step 1 — Identify:

$$u = 0, \quad v = 60\,\text{m/s}, \quad t = 20\,\text{s}$$

Step 2 — Average velocity:

$$\bar{v} = \frac{u+v}{2} = \frac{0+60}{2} = 30\,\text{m/s}$$

Step 3 — Distance:

$$s = \bar{v} \times t = 30 \times 20 = 600\,\text{m}$$

Why other options are wrong:

- Option A (300 m): Uses $s = vt/4$ or forgets to halve the average correctly.
- Option C (1200 m): Uses $s = vt = 60 \times 20$, forgetting the factor of $\frac{1}{2}$.
- Option D (150 m): Uses $s = vt/8$, an incorrect formula.

Final Answer: $s = 600\,\text{m} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q4

Q5.

Solution

Concept — Young's Double-Slit Experiment: The fringe width is $\beta = \lambda D/d$, so the wavelength is $\lambda = \beta d/D$.

Step 1 — Convert to SI units:

$$\beta = 1\,\text{mm} = 1 \times 10^{-3}\,\text{m}, \quad d = 0.5\,\text{mm} = 5 \times 10^{-4}\,\text{m}, \quad D = 1\,\text{m}$$

Step 2 — Apply formula:

$$\lambda = \frac{\beta\, d}{D} = \frac{(1 \times 10^{-3}) \times (5 \times 10^{-4})}{1}$$

Step 3 — Compute:

$$\lambda = 5 \times 10^{-7}\,\text{m} = 500\,\text{nm}$$

Why other options are wrong:

- Option A (250 nm): Corresponds to $\beta = 0.5\,\text{mm}$, not 1 mm.
- Option B (400 nm): Would require $\beta = 0.8\,\text{mm}$.
- Option D (600 nm): Needs $\beta = 1.2\,\text{mm}$, larger than the given 1 mm.

Final Answer: $\lambda = 500\,\text{nm} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q5

Q6.

Solution

Concept — Snell's Law: At an interface between two media, $n_1 \sin\theta_1 = n_2 \sin\theta_2$.

Step 1 — Set up:

$$n_1 = 1 \text{ (air)}, \quad \theta_1 = 45^\circ, \quad \theta_2 = 30^\circ$$

Step 2 — Solve for n_2:

$$n_2 = \frac{n_1 \sin\theta_1}{\sin\theta_2} = \frac{1 \times \sin 45^\circ}{\sin 30^\circ}$$

Step 3 — Substitute values:

$$n_2 = \frac{1/\sqrt{2}}{0.5} = \frac{1}{0.5\sqrt{2}} = \frac{2}{\sqrt{2}} = \sqrt{2} \approx 1.41$$

Why other options are wrong:

- Option B ($\sqrt{3} \approx 1.73$): Arises from using $\sin 30^\circ = 1/\sqrt{3}$, which is incorrect.
- Option C (2): Would require $\sin\theta_2 = \sin 45^\circ/2 \approx 0.354$, i.e. $\theta_2 \approx 20.7^\circ$, not 30°.
- Option D ($1/\sqrt{2} < 1$): Physically impossible; a denser medium has $n > 1$.

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

Answer: (A) Go Back to Q6

Q7.

Solution

Concept — Energy Stored in an Inductor: $U = \frac{1}{2}LI^2$.

Step 1 — Identify:

$$L = 4\,\text{H}, \quad I = 5\,\text{A}$$

Step 2 — Square the current:

$$I^2 = 25\,\text{A}^2$$

Step 3 — Compute energy:

$$U = \frac{1}{2} \times 4 \times 25 = 2 \times 25 = 50\,\text{J}$$

Why other options are wrong:

- Option A (20 J): Uses $U = LI = 4 \times 5 = 20$; omits both the square and the $\frac{1}{2}$ factor.
- Option B (25 J): Computes $I^2/2 = 12.5$ and multiplies by L incorrectly to get 25 J.
- Option C (100 J): Drops the $\frac{1}{2}$; $LI^2 = 4 \times 25 = 100\,\text{J}$.

Final Answer: $U = 50\,\text{J} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q7

Q8.

Solution

Concept — Power Factor at Resonance: At resonance $X_L = X_C$; net reactance is zero; impedance $Z = R$.

Step 1 — Condition at resonance:

$$X_L = \omega_0 L = \frac{1}{\omega_0 C} = X_C \quad \Rightarrow \quad X_L - X_C = 0$$

Step 2 — Impedance:

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{R^2} = R$$

Step 3 — Power factor:

$$\cos\phi = \frac{R}{Z} = \frac{R}{R} = 1$$

Why other options are wrong:

- Option A (0): Zero power factor belongs to a purely reactive (resistanceless) circuit.
- Option C (0.5): Corresponds to $\phi = 60^\circ$, which occurs only at specific off-resonance frequencies.
- Option D (depends on R): At resonance the power factor is *always* 1, regardless of R.

Final Answer: Power factor $= 1 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q8

Q9.

Solution

Concept — Impulse–Momentum Theorem: $J = F\Delta t = m\Delta v$, so $\Delta v = F\Delta t/m$.

Step 1 — Compute impulse:

$$J = F \times t = 10 \times 5 = 50\,\text{N s}$$

Step 2 — Apply impulse-momentum:

$$\Delta v = \frac{J}{m} = \frac{50}{2} = 25\,\text{m/s}$$

Why other options are wrong:

- Option B (100 m/s): Multiplies instead of divides ($J \times m = 50 \times 2 = 100$).
- Option C (10 m/s): Uses only the force value and ignores both time and mass.
- Option D (50 m/s): Equals the impulse J in numbers but never divides by mass.

Final Answer: $\Delta v = 25\,\text{m/s} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Kinetic Energy and Momentum: $KE = p^2/(2m)$, so $p = \sqrt{2m \cdot KE}$.

Step 1 — Identify:

$$m = 4\,\text{kg}, \quad KE = 50\,\text{J}$$

Step 2 — Compute $2mKE$:

$$2 \times 4 \times 50 = 400$$

Step 3 — Take square root:

$$p = \sqrt{400} = 20\,\text{kg m/s}$$

Why other options are wrong:

- Option A (200 kg m/s): Computes $m \times KE/1 = 4 \times 50 = 200$ without the factor of 2 or the square root.
- Option B (400 kg m/s): Takes $2mKE = 400$ without taking the square root.
- Option D (10 kg m/s): Halves the correct answer; perhaps uses $m = 1\,\text{kg}$.

Final Answer: $p = 20\,\text{kg m/s} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q10

Q11.

Solution

Concept — Energy Stored in a Capacitor: $U = \frac{1}{2}CV^2$.

Step 1 — Identify:

$$C = 10\,\mu\text{F} = 10 \times 10^{-6}\,\text{F}, \quad V = 200\,\text{V}$$

Step 2 — Square voltage:

$$V^2 = (200)^2 = 40\,000\,\text{V}^2$$

Step 3 — Compute energy:

$$U = \frac{1}{2} \times 10 \times 10^{-6} \times 40\,000 = \frac{1}{2} \times 0.4 = 0.2\,\text{J}$$

Why other options are wrong:

- Option A (0.1 J): Applies the $\frac{1}{2}$ factor twice, halving the result unnecessarily.
- Option C (0.4 J): Omits the $\frac{1}{2}$ factor; $CV^2 = 0.4\,\text{J}$.
- Option D (2.0 J): Uses $C = 100\,\mu\text{F}$ instead of $10\,\mu\text{F}$.

Final Answer: $U = 0.2\,\text{J} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q11

Q12.

Solution

Concept — Force Between Parallel Current-Carrying Wires:

$$F = \frac{\mu_0 I_1 I_2 L}{2\pi d}$$

Step 1 — Identify:

$$\mu_0 = 4\pi \times 10^{-7}\,\text{T m/A}, \quad I_1 = I_2 = 5\,\text{A}, \quad L = 1\,\text{m}, \quad d = 0.1\,\text{m}$$

Step 2 — Substitute:

$$F = \frac{4\pi \times 10^{-7} \times 5 \times 5 \times 1}{2\pi \times 0.1}$$

Step 3 — Cancel π:

$$F = \frac{4 \times 25 \times 10^{-7}}{2 \times 0.1} = \frac{100 \times 10^{-7}}{0.2}$$

Step 4 — Divide:

$$F = 500 \times 10^{-7} = 5 \times 10^{-5}\,\text{N}$$

Since the currents are in opposite directions, the force is *repulsive*.

Why other options are wrong:

- Option A (5×10^{-4} N): Uses $d = 0.01\,\text{m}$, ten times smaller.
- Option B (1×10^{-4} N): Off by a factor of 2 – perhaps halved $I_1 I_2$.
- Option C (2.5×10^{-5} N): Halves the correct answer; may have used $I = 5/\sqrt{2}$.

Final Answer: $F = 5 \times 10^{-5}\,\text{N} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — de Broglie Wavelength: $\lambda = h/(mv)$. If $\lambda_e = \lambda_p$ then $m_e v_e = m_p v_p$.

Step 1 — Equal wavelengths condition:

$$\frac{h}{m_e v_e} = \frac{h}{m_p v_p}$$

Step 2 — Cancel h:

$$m_e v_e = m_p v_p$$

Step 3 — Solve for v_p:

$$v_p = \frac{m_e}{m_p} v_e = \frac{1}{1836} \times 10^6$$

Step 4 — Evaluate:

$$v_p = \frac{10^6}{1836} \approx 544.7 \approx 545\,\text{m/s}$$

Why other options are wrong:

- Option B (1836 m/s): Inverts the mass ratio; gives $v_p = (m_p/m_e)v_e$, which would be enormous.
- Option C (5.45×10^5 m/s): Off by a factor of 1000 – a decimal place error.
- Option D (1.84×10^9 m/s): Multiplies v_e by m_p/m_e instead of dividing; exceeds the speed of light.

Final Answer: $v_p \approx 545\,\text{m/s} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Radioactive Decay Constant: $\lambda = \ln 2 \,/\, T_{1/2}$.

Step 1 — Identify:

$$T_{1/2} = 40\,\text{min}, \quad \ln 2 = 0.693$$

Step 2 — Compute:

$$\lambda = \frac{0.693}{40} = 0.017325\,\text{min}^{-1}$$

Step 3 — Express in scientific notation:

$$\lambda \approx 1.73 \times 10^{-2}\,\text{min}^{-1}$$

Why other options are wrong:

- Option A (27.7 min^{-1}): This is $T_{1/2}/\ln 2 = 40/0.693$, the inverse of λ.
- Option C (0.5 min^{-1}): Uses $\lambda = 1/(2 \times T_{1/2}) = 1/80$; wrong formula.
- Option D (40 min^{-1}): Confuses λ with the half-life value itself.

Final Answer: $\lambda = 1.73 \times 10^{-2}\,\text{min}^{-1} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Isothermal Work Done by an Ideal Gas: $W = nRT\ln(V_2/V_1)$.

Step 1 — Convert temperature:

$$T = 27 + 273 = 300\,\text{K}$$

Step 2 — Volume ratio:

$$\frac{V_2}{V_1} = \frac{4}{1} = 4, \quad \ln 4 \approx 1.386$$

Step 3 — Apply formula:

$$W = nRT\ln\frac{V_2}{V_1} = 1 \times 8.31 \times 300 \times 1.386$$

Step 4 — Compute step by step:

$$8.31 \times 300 = 2493$$

$$2493 \times 1.386 \approx 3455\,\text{J}$$

Why other options are wrong:

- Option A (1200 J): Ignores the logarithmic factor; uses a rough approximation.

- Option B (2493 J): This is nRT alone, without the $\ln 4$ factor.
- Option C (2000 J): A rounded guess with no rigorous derivation.

Final Answer: $W \approx 3455\,\text{J} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q15

Q16.

Solution

Concept — Wave Speed Relation: $v = f\lambda$, so $\lambda = v/f$.

Step 1 — Identify:

$$v = 340\,\text{m/s}, \quad f = 256\,\text{Hz}$$

Step 2 — Compute wavelength:

$$\lambda = \frac{v}{f} = \frac{340}{256}$$

Step 3 — Divide:

$$\lambda = 1.3281\ldots \approx 1.33\,\text{m}$$

Why other options are wrong:

- Option A (0.75 m): Corresponds to $f = 340/0.75 \approx 453\,\text{Hz}$, not 256 Hz.
- Option B (2.0 m): Gives $f = 340/2 = 170\,\text{Hz}$, not 256 Hz.
- Option D (0.53 m): Corresponds to $f = 340/0.53 \approx 640\,\text{Hz}$, not 256 Hz.

Final Answer: $\lambda \approx 1.33\,\text{m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q16

Q17.

Solution

Concept — Torque: $\tau = rF\sin\theta$. When force is perpendicular to the lever arm, $\theta = 90^\circ$ and $\sin 90^\circ = 1$.

Step 1 — Identify:

$$r = 0.5\,\text{m}, \quad F = 20\,\text{N}, \quad \theta = 90^\circ$$

Step 2 — Apply formula:

$$\tau = rF\sin 90^\circ = 0.5 \times 20 \times 1$$

Step 3 — Compute:

$$\tau = 10\,\text{N m}$$

Why other options are wrong:

- Option B (40 N m): Uses $r = 2\,\text{m}$ instead of 0.5 m.
- Option C (20 N m): Uses $r = 1\,\text{m}$; perhaps confuses r with F.
- Option D (0.5 N m): Equals only r, completely ignoring the force.

Final Answer: $\tau = 10\,\text{N m} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Light Emitting Diode (LED): An LED is a p-n junction diode; it emits light by electroluminescence when forward biased.

Step 1 — Forward bias reduces the depletion width: When a positive voltage is applied to the p-side and negative to the n-side, the potential barrier decreases.

Step 2 — Carrier recombination emits photons: Electrons from the n-region and holes from the p-region recombine at the junction, releasing energy as photons of light.

Why other options are wrong:

- Option A (Reverse biased): Reverse bias widens the depletion layer; negligible current flows and no light is emitted.
- Option B (Breakdown): Breakdown in an LED causes damage, not normal light emission.
- Option C (Unbiased): Without a bias voltage there is no net current and no recombination current.

Final Answer: Forward biased $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q18

Q19.

Solution

Concept — Hooke's Law: Within the elastic limit, extension is directly proportional to load: $F = kx$.

Step 1 — Find spring constant from first data point:

$$k = \frac{F_1}{x_1} = \frac{4\,\text{N}}{2\,\text{mm}} = 2\,\text{N/mm}$$

Step 2 — Apply to second load:

$$x_2 = \frac{F_2}{k} = \frac{10\,\text{N}}{2\,\text{N/mm}} = 5\,\text{mm}$$

Why other options are wrong:

- Option A (8 mm): Multiplies $x_1 \times F_2/F_1 = 2 \times 10/4 = 5\,\text{mm}$ is correct, but if someone uses $x_1 \times (F_2 - F_1)/something$ they get $8\,\text{mm}$.
- Option C (20 mm): Uses extension $\propto F^2$ or another incorrect non-linear rule.
- Option D (2.5 mm): Halves the correct answer; perhaps confuses load and extension values.

Final Answer: $x_2 = 5\,\text{mm} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q19

Q20.

Solution

Concept — Variation of g with Distance from Earth's Centre: For $r > R$, $g_r = g(R/r)^2$.

Step 1 — Set $g_r = g/4$:

$$g\left(\frac{R}{r}\right)^2 = \frac{g}{4}$$

Step 2 — Cancel g:

$$\left(\frac{R}{r}\right)^2 = \frac{1}{4}$$

Step 3 — Take square root:

$$\frac{R}{r} = \frac{1}{2}$$

Step 4 — Solve for r:

$$r = 2R$$

Why other options are wrong:

- Option A $(R/4)$: At $r = R/4$ (inside the Earth) the external formula does not apply; surface gravity would be modified differently.
- Option B $(R/2)$: At $r = R/2$ (inside Earth), surface formula gives $g_r = g(R/(R/2))^2 = 4g$, not $g/4$.
- Option D $(4R)$: At $r = 4R$, $g_r = g(R/4R)^2 = g/16$, not $g/4$.

Final Answer: $r = 2R \Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q20**

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	C	3	D	4	B	5	C
6	A	7	D	8	B	9	A	10	C
11	B	12	D	13	A	14	B	15	D
16	C	17	A	18	D	19	B	20	C