GAT-B Physics

Sample Paper – 1

Duration: 23 Minutes **Maximum Marks: 15**

Instructions

- This paper contains **15 Multiple Choice Questions** (Single Correct Answer), modelled on the Physics portion of **GAT-B** Section A.
- Each correct answer carries **+1 mark**. There is a deduction of **0.5 mark** for each wrong answer. Unattempted questions carry zero marks.
- Only **one** option is correct per question.
- Syllabus level: **Class 11 & 12 (NCERT) Physics** — Mechanics, Thermodynamics, Waves, Optics, Electricity & Magnetism, Modern Physics.
- Personal calculators, mobile phones, and other electronic gadgets are strictly prohibited. A simple on-screen calculator is provided in the CBT interface.

Q1. The physical quantity $\varepsilon_0 E^2$, where ε_0 is the permittivity of free space and E is the electric field intensity, has the same dimensional formula as:

(A) Energy $\times$ Area

(B) Force $\times$ Length^{-1}

(C) Power $\times$ Time $\times$ Length^{-2}

(D) Pressure (energy per unit volume)

Q2. A ball is launched horizontally from the top of a cliff of height $h = 80\,\mathrm{m}$ with a speed of $u = 20\,\mathrm{m\,s^{-1}}$. Neglecting air resistance and taking $g = 10\,\mathrm{m\,s^{-2}}$, the horizontal distance covered before the ball strikes the ground is:

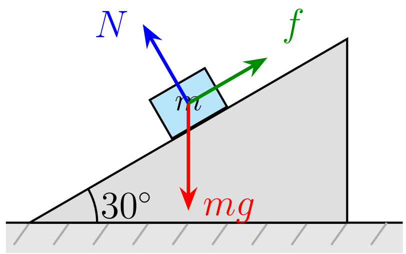
(A) $60\,\mathrm{m}$

(B) $80\,\mathrm{m}$

(C) $100\,\mathrm{m}$

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

Q3. A block of mass $m = 5\,\mathrm{kg}$ rests on a rough inclined plane of angle $\theta = 30°$. The coefficient of static friction is $\mu_s = \dfrac{1}{\sqrt{3}}$. The minimum force F applied *up* the incline (parallel to it) needed to prevent the block from sliding down is ($g = 10\,\mathrm{m\,s^{-2}}$):



(A) $0\,\mathrm{N}$

(B) $12.5\,\mathrm{N}$

(C) $25\,\mathrm{N}$

(D) $50\,\mathrm{N}$

Q4. A ball of mass m moving with speed v undergoes a perfectly elastic head-on collision with a stationary ball of mass $2m$. The velocity of the first ball immediately after the collision is:

(A) $+\dfrac{v}{3}$

(B) $-\dfrac{v}{2}$

(C) $-\dfrac{v}{3}$

(D) $+\dfrac{2v}{3}$

Q5. A stone tied to a string is whirled in a horizontal circle of radius $r = 1.5\,\mathrm{m}$ with constant angular speed $\omega = 4\,\mathrm{rad\,s^{-1}}$. The magnitude of the centripetal acceleration of the stone is:

(A) $6\,\mathrm{m\,s^{-2}}$

(B) $24\,\mathrm{m\,s^{-2}}$

(C) $12\,\mathrm{m\,s^{-2}}$

(D) $48\,\mathrm{m\,s^{-2}}$

Q6. A satellite moves in a circular orbit at height $h = R/2$ above Earth's surface (R = radius of Earth). The ratio of the satellite's orbital speed v_o to the escape speed v_e from Earth's surface is:

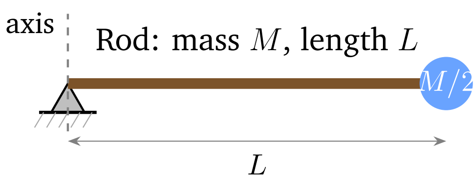
(A) $\frac{1}{2}$

(B) $\frac{1}{\sqrt{2}}$

(C) $\sqrt{\frac{2}{3}}$

(D) $\frac{1}{\sqrt{3}}$

Q7. A uniform thin rod of mass M and length L is pivoted at one end. A particle of mass $M/2$ is fixed at the free end. The moment of inertia of the system about the pivot axis perpendicular to the rod is:



(A) $\frac{5ML^2}{6}$

(B) $\frac{ML^2}{3}$

(C) $\frac{2ML^2}{3}$

(D) $\frac{ML^2}{2}$

Q8. A Carnot engine operates between a heat source at $T_H = 500\,\mathrm{K}$ and a heat sink at $T_L = 300\,\mathrm{K}$. In each cycle it absorbs $Q_H = 600\,\mathrm{J}$ from the source. The work done by the engine per cycle is:

(A) $180\,\mathrm{J}$

(B) $200\,\mathrm{J}$

(C) $240\,\mathrm{J}$

(D) $360\,\mathrm{J}$

Q9. A particle of mass $m = 0.5\,\mathrm{kg}$ undergoes simple harmonic motion with amplitude $A = 0.1\,\mathrm{m}$. The maximum restoring force acting on it is $F_{\mathrm{max}} = 2\,\mathrm{N}$. The period of oscillation is:

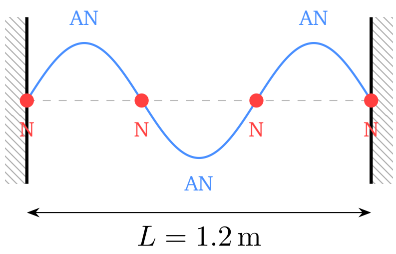
(A) $\frac{\pi}{5}\,\mathrm{s}$

(B) $\frac{\pi}{\sqrt{10}}\,\mathrm{s}$

(C) $\frac{\pi}{2}\,\mathrm{s}$

(D) $\frac{2\pi}{\sqrt{10}}\,\mathrm{s}$

Q10. A string of length $L = 1.2\,\mathrm{m}$ is clamped at both ends. The speed of transverse waves in the string is $v = 60\,\mathrm{m\,s^{-1}}$. The standing-wave pattern below shows the third harmonic ($n = 3$). The frequency of this harmonic is:



(A) $25\,\mathrm{Hz}$

(B) $50\,\mathrm{Hz}$

(C) $62.5\,\mathrm{Hz}$

(D) $75\,\mathrm{Hz}$

Q11. In a Wheatstone bridge the four arms carry resistances $P = 10\,\Omega$, $Q = 20\,\Omega$, $R = 30\,\Omega$, and $S = x\,\Omega$. For the galvanometer to read zero (bridge balanced), the value of x is:

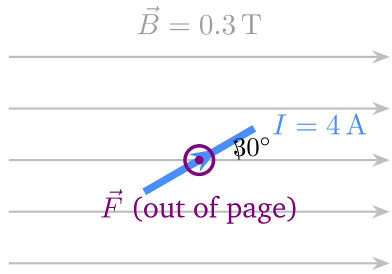
(A) $60\,\Omega$

(B) $45\,\Omega$

(C) $15\,\Omega$

(D) $30\,\Omega$

Q12. A straight wire of length $L = 0.5\,\text{m}$ carries a current $I = 4\,\text{A}$ and is placed in a uniform magnetic field $B = 0.3\,\text{T}$. The wire makes an angle of $30°$ with the field direction. The magnitude of the force on the wire is:



(A) $0.6\,\text{N}$

(B) $0.52\,\text{N}$

(C) $0.3\,\text{N}$

(D) $0.15\,\text{N}$

Q13. An object is placed $30\,\text{cm}$ in front of a concave mirror of focal length $15\,\text{cm}$. The image formed is:

(A) Virtual, erect, and magnified; $15\,\text{cm}$ behind the mirror

(B) Real, inverted, and of the same size; $30\,\text{cm}$ in front of the mirror

(C) Real, inverted, and magnified; $60\,\text{cm}$ in front of the mirror

(D) Virtual, erect, and diminished; $10\,\text{cm}$ behind the mirror

Q14. Light of frequency $f = 6 \times 10^{14}\,\text{Hz}$ is incident on a metal surface of work function $\phi = 1.5\,\text{eV}$. The maximum kinetic energy of the emitted photoelectrons is:

(Use $h = 6.6 \times 10^{-34}\,\mathrm{J\,s}$; $\quad 1\,\mathrm{eV} = 1.6 \times 10^{-19}\,\mathrm{J}$)

(A) $1.5\,\mathrm{eV}$

(B) $0.75\,\mathrm{eV}$

(C) $2.0\,\mathrm{eV}$

(D) $0.975\,\mathrm{eV}$

Q15. A radioactive sample initially contains $N_0 = 8 \times 10^{24}$ atoms. After exactly **three half-lives** the number of undecayed atoms remaining is:

(A) 1×10^{24}

(B) 2×10^{24}

(C) 4×10^{24}

(D) 0.5×10^{24}

Detailed Solutions

Q1.

Solution

Concept — Dimensional Analysis: Find the dimensions of $\varepsilon_0 E^2$ from the known SI dimensions of each factor.

Step 1 — Dimensions of ε_0 and E:

$$[\varepsilon_0] = \mathrm{M^{-1}L^{-3}T^4A^2}, \qquad [E] = \mathrm{MLT^{-3}A^{-1}}, \qquad [E^2] = \mathrm{M^2L^2T^{-6}A^{-2}}$$

Step 2 — Product $[\varepsilon_0 E^2]$:

$$[\varepsilon_0 E^2] = \mathrm{M^{-1}L^{-3}T^4A^2} \times \mathrm{M^2L^2T^{-6}A^{-2}} = \mathrm{ML^{-1}T^{-2}}$$

This is exactly the dimensional formula of **pressure** ($=$ F/A $= \mathrm{MLT^{-2}/L^2} = \mathrm{ML^{-1}T^{-2}}$), equivalently energy density ($\mathrm{J\,m^{-3}}$). Physically, $\frac{1}{2}\varepsilon_0 E^2$ is the electric energy density stored in a field.

Why other options are wrong:

- Option A (Energy $\times$ Area): $[\mathrm{ML^2T^{-2}}][\mathrm{L^2}] = \mathrm{ML^4T^{-2}}$ — not the same.
- Option B (Force $\times$ Length^{-1}): $[\mathrm{MLT^{-2}}][\mathrm{L^{-1}}] = \mathrm{MT^{-2}}$ — not the same.
- Option C (Power $\times$ Time $\times$ Length^{-2}): $[\mathrm{ML^2T^{-3}}][\mathrm{T}][\mathrm{L^{-2}}] = \mathrm{MT^{-2}}$ — not the same.

Final Answer: $[\varepsilon_0 E^2] = \mathrm{ML^{-1}T^{-2}}$, same as pressure $\Rightarrow \boxed{\mathrm{D}}$

Answer: (D) **Go Back to Q 1**

Q2.

Solution

Concept — Horizontal Projectile: A ball launched horizontally has zero initial vertical velocity; horizontal and vertical motions are independent.

Step 1 — Time of flight (vertical free-fall from height h):

$$h = \tfrac{1}{2}gt^2 \implies t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2\times 80}{10}} = \sqrt{16} = 4\,\mathrm{s}$$

Step 2 — Horizontal range:

$$x = u \cdot t = 20 \times 4 = 80\,\text{m}$$

Why other options are wrong:

- Option A (60 m): Corresponds to $t = 3\,\text{s}$, which requires $h = 45\,\text{m}$.
- Option C (100 m): Corresponds to $t = 5\,\text{s}$, which requires $h = 125\,\text{m}$.
- Option D (40 m): Corresponds to $t = 2\,\text{s}$, which requires $h = 20\,\text{m}$.

Final Answer: $x = 80\,\text{m} \Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q 2**

Q3.

Solution

Concept — Static Friction on an Incline: Before applying any external force, check whether friction alone can hold the block in equilibrium.

Step 1 — Component of gravity along the incline (down the slope):

$$F_{\parallel} = mg\sin 30^\circ = 5 \times 10 \times 0.5 = 25\,\text{N}$$

Step 2 — Normal force and maximum static friction:

$$N = mg\cos 30^\circ = 5 \times 10 \times \frac{\sqrt{3}}{2} = 25\sqrt{3}\,\text{N}$$

$$f_{\max} = \mu_s N = \frac{1}{\sqrt{3}} \times 25\sqrt{3} = 25\,\text{N} \quad \text{(up the slope)}$$

Step 3 — Equilibrium check:

Since $f_{\max} = 25\,\text{N} = F_{\parallel}$, friction alone exactly balances the downward gravitational component. Note that $\mu_s = \frac{1}{\sqrt{3}} = \tan 30^\circ$, meaning the block is precisely at the limit of static equilibrium with *no* external force. Hence $F = 0\,\text{N}$.

Why other options are wrong:

- Options B, C, D: An upward applied force $F > 0$ would be needed only if $\mu_s < \tan\theta$. Here $\mu_s = \tan 30^\circ$, so no external force is required.

Final Answer: $F = 0\,\text{N} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 3

Q4.

Solution

Concept — Elastic Collision (Head-On): In a perfectly elastic collision, both momentum and kinetic energy are conserved. The standard result for the post-collision velocity of mass m_1 is:

$$v_1' = \frac{m_1 - m_2}{m_1 + m_2} v_1$$

Step 1 — Substitute $m_1 = m$, $m_2 = 2m$, $v_1 = v$, $v_2 = 0$:

$$v_1' = \frac{m - 2m}{m + 2m} v = \frac{-m}{3m} v = -\frac{v}{3}$$

The negative sign means the first ball reverses direction after impact.

Why other options are wrong:

- Option A ($+v/3$): Correct magnitude but wrong sign; the ball must rebound for kinetic energy to be conserved when $m_1 < m_2$.
- Option B ($-v/2$): Applies to an inelastic collision or a different mass ratio.
- Option D ($+2v/3$): This is the velocity of the *second* ball ($v_2' = 2m_1v_1/(m_1 + m_2) = 2v/3$), not the first.

Final Answer: $v_1' = -v/3 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 4

Q5.

Solution

Concept — Centripetal Acceleration: For uniform circular motion with angular speed ω and radius r:

$$a_c = \omega^2 r$$

Step 1 — Substitute values:

$$a_c = (4\,\mathrm{rad\,s^{-1}})^2 \times 1.5\,\mathrm{m} = 16 \times 1.5 = 24\,\mathrm{m\,s^{-2}}$$

Why other options are wrong:

- Option A ($6\,\mathrm{m\,s^{-2}}$): Uses $a_c = \omega r$ (omits squaring ω).
- Option C ($12\,\mathrm{m\,s^{-2}}$): Uses only half the radius or half the ω^2.
- Option D ($48\,\mathrm{m\,s^{-2}}$): Doubles the radius; uses $r = 3\,\mathrm{m}$ instead of $1.5\,\mathrm{m}$.

Final Answer: $a_c = 24\,\mathrm{m\,s^{-2}} \Rightarrow \boxed{\mathrm{B}}$

Answer: (B) **Go Back to Q 5**

Q6.

Solution

Concept — Orbital and Escape Speeds:

$$v_o = \sqrt{\frac{GM}{r}} \quad \text{(orbital at radius } r\text{)}, \qquad v_e = \sqrt{\frac{2GM}{R}} \quad \text{(escape from surface)}$$

Step 1 — Orbital radius:

$$r = R + h = R + \frac{R}{2} = \frac{3R}{2}$$

Step 2 — Compute the ratio:

$$\frac{v_o}{v_e} = \frac{\sqrt{GM/r}}{\sqrt{2GM/R}} = \sqrt{\frac{GM}{r} \cdot \frac{R}{2GM}} = \sqrt{\frac{R}{2r}} = \sqrt{\frac{R}{2 \cdot \frac{3R}{2}}} = \sqrt{\frac{R}{3R}} = \sqrt{\frac{1}{3}} = \frac{1}{\sqrt{3}}$$

Why other options are wrong:

- Option A ($1/2$): Neglects the factor of 2 in the escape-speed formula.
- Option B ($1/\sqrt{2}$): Corresponds to a satellite orbiting at the surface ($r = R$).
- Option C ($\sqrt{2/3}$): Incorrect algebra; arises from omitting the factor of 2 in v_e.

Final Answer: $v_o/v_e = 1/\sqrt{3} \Rightarrow \boxed{\mathrm{D}}$

Answer: (D) **Go Back to Q 6**

Q7.

Solution

Concept — Moment of Inertia (Superposition): The total moment of inertia about an axis equals the sum of the contributions of each part.

Step 1 — Moment of inertia of the uniform rod about the pivot (one end):

$$I_{\text{rod}} = \frac{ML^2}{3}$$

Step 2 — Moment of inertia of the point mass at the free end (distance L from pivot):

$$I_{\text{mass}} = \frac{M}{2} \cdot L^2 = \frac{ML^2}{2}$$

Step 3 — Total:

$$I = I_{\text{rod}} + I_{\text{mass}} = \frac{ML^2}{3} + \frac{ML^2}{2} = \frac{2ML^2}{6} + \frac{3ML^2}{6} = \frac{5ML^2}{6}$$

Why other options are wrong:

- Option B ($ML^2/3$): Accounts only for the rod; ignores the point mass.
- Option C ($2ML^2/3$): Treats the point mass as having mass M rather than $M/2$.
- Option D ($ML^2/2$): Accounts only for the point mass; ignores the rod.

Final Answer: $I = 5ML^2/6 \Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q 7**

Q8.

Solution

Concept — Carnot Efficiency: The thermal efficiency of a Carnot engine is:

$$\eta = 1 - \frac{T_L}{T_H}$$

and the work done per cycle is $W = \eta Q_H$.

Step 1 — Efficiency:

$$\eta = 1 - \frac{300}{500} = 1 - 0.6 = 0.4 \quad (40\%)$$

Step 2 — Work done per cycle:

$$W = \eta Q_H = 0.4 \times 600 = 240\,\mathrm{J}$$

Why other options are wrong:

- Option A ($180\,\mathrm{J}$): Corresponds to $\eta = 0.30$, which would need $T_L/T_H = 0.70$ (e.g. 350 K/500 K).
- Option B ($200\,\mathrm{J}$): Corresponds to $\eta = 1/3$; not applicable to these temperatures.
- Option D ($360\,\mathrm{J}$): This is $Q_L = Q_H - W = 600 - 240 = 360\,\mathrm{J}$, the heat rejected to the sink, not the work.

Final Answer: $W = 240\,\mathrm{J} \Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q 8**

Q9.

Solution

Concept — SHM: Spring Constant and Period: In SHM the restoring force is $F = kx$, so the maximum force is $F_{\max} = kA$. The period is $T = 2\pi\sqrt{m/k}$.

Step 1 — Find the effective spring constant:

$$k = \frac{F_{\max}}{A} = \frac{2}{0.1} = 20\,\mathrm{N\,m^{-1}}$$

Step 2 — Angular frequency:

$$\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{20}{0.5}} = \sqrt{40} = 2\sqrt{10}\,\mathrm{rad\,s^{-1}}$$

Step 3 — Period:

$$T = \frac{2\pi}{\omega} = \frac{2\pi}{2\sqrt{10}} = \frac{\pi}{\sqrt{10}}\,\mathrm{s} \approx 0.99\,\mathrm{s}$$

Why other options are wrong:

- Option A ($\pi/5\,\mathrm{s}$): Arises from setting $\omega = 5$ (i.e. forgetting to take the square root of k/m).
- Option C ($\pi/2\,\mathrm{s}$): Corresponds to $\omega = 2$, which would require $k = 2\,\mathrm{N\,m^{-1}}$.
- Option D ($2\pi/\sqrt{10}\,\mathrm{s}$): Twice the correct period; confuses T with $2T$.

Final Answer: $T = \pi/\sqrt{10}\,\text{s} \Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q 9**

Q10.

Solution

Concept — Standing Waves (String Fixed at Both Ends): For a string of length L with wave speed v, the n-th harmonic frequency is:

$$f_n = \frac{n\,v}{2L}$$

Step 1 — Fundamental frequency ($n = 1$):

$$f_1 = \frac{v}{2L} = \frac{60}{2 \times 1.2} = \frac{60}{2.4} = 25\,\text{Hz}$$

Step 2 — Third harmonic ($n = 3$):

$$f_3 = 3\,f_1 = 3 \times 25 = 75\,\text{Hz}$$

The pattern has 3 loops (antinodes) and 4 nodes (including the fixed ends), as shown in the diagram.

Why other options are wrong:

- Option A ($25\,\text{Hz}$): This is the *fundamental* ($n = 1$), not the third harmonic.
- Option B ($50\,\text{Hz}$): This is the *second harmonic* ($n = 2$).
- Option C ($62.5\,\text{Hz}$): Does not correspond to any integer harmonic of this string.

Final Answer: $f_3 = 75\,\text{Hz} \Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q 10**

Q11.

Solution

Concept — Wheatstone Bridge Balance: The bridge is balanced (no galvanometer current) when:

$$\frac{P}{Q} = \frac{R}{S}$$

Step 1 — Substitute known values:

$$\frac{10}{20} = \frac{30}{x} \implies \frac{1}{2} = \frac{30}{x} \implies x = 30 \times 2 = 60\,\Omega$$

Why other options are wrong:

- Option B ($45\,\Omega$): Does not satisfy $P/Q = R/S$; gives $10/20 \neq 30/45$.
- Option C ($15\,\Omega$): Inverts the ratio: $30/15 = 2 \neq P/Q = 0.5$.
- Option D ($30\,\Omega$): Gives $P/Q = R/S$ only if $P = Q$, which is not the case here.

Final Answer: $x = 60\,\Omega \Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q 11**

Q12.

Solution

Concept — Force on a Current-Carrying Conductor:

$$F = BIL\sin\theta$$

where θ is the angle between the current direction and $\vec{B}$.

Step 1 — Substitute values:

$$F = 0.3 \times 4 \times 0.5 \times \sin 30^\circ = 0.3 \times 4 \times 0.5 \times 0.5 = 0.3\,\text{N}$$

The direction (by the right-hand rule, or $\vec{F} = I\vec{L} \times \vec{B}$) is out of the page, as shown in the diagram.

Why other options are wrong:

- Option A ($0.6\,\text{N}$): Uses $\sin 90^\circ = 1$ (wire perpendicular to field).
- Option B ($0.52\,\text{N}$): Uses $\sin 60^\circ \approx 0.866$ (wrong angle: complement of 30°).
- Option D ($0.15\,\text{N}$): Halves the wire length ($L = 0.25\,\text{m}$ instead of $0.5\,\text{m}$).

Final Answer: $F = 0.3\,\text{N} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 12

Q13.

Solution

Concept — Concave Mirror (Mirror Formula):

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

Sign convention (new Cartesian): distances in front of the mirror are negative.

Step 1 — Known values:

$$u = -30\,\text{cm}, \quad f = -15\,\text{cm} \quad (\text{concave mirror})$$

Step 2 — Image distance:

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-15} - \frac{1}{-30} = -\frac{2}{30} + \frac{1}{30} = -\frac{1}{30} \implies v = -30\,\text{cm}$$

Negative v means the image is in front of the mirror $\Rightarrow$ **real**.

Step 3 — Magnification:

$$m = -\frac{v}{u} = -\frac{(-30)}{(-30)} = -1$$

$|m| = 1$ (same size as object); $m < 0$ (inverted). Image is real, inverted, same size, $30\,\text{cm}$ in front.

Why other options are wrong:

- Option A: Object at $u = -30\,\text{cm}$ with $f = -15\,\text{cm}$ always gives a real image for a concave mirror; no virtual image is formed.
- Option C: A magnified real image ($|m| > 1$) requires the object between f and $2f$; here $u = 2f$ gives $|m| = 1$.
- Option D: Virtual images form only when the object is inside the focal length ($|u| < |f| = 15\,\text{cm}$).

Final Answer: Real, inverted, same size, $30\,\text{cm}$ in front $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 13

Q14.

Solution

Concept — Einstein's Photoelectric Equation:

$$KE_{\max} = hf - \phi$$

Step 1 — Energy of the incident photon:

$$E = hf = 6.6 \times 10^{-34} \times 6 \times 10^{14} = 39.6 \times 10^{-20}\ \text{J}$$

Converting to eV:

$$E = \frac{39.6 \times 10^{-20}}{1.6 \times 10^{-19}} = \frac{3.96}{1.6} = 2.475\,\text{eV}$$

Step 2 — Maximum kinetic energy:

$$KE_{\max} = 2.475 - 1.5 = 0.975\,\text{eV}$$

Why other options are wrong:

- Option A ($1.5\,\text{eV}$): This is the work function ϕ, not the kinetic energy.
- Option B ($0.75\,\text{eV}$): Under-estimates hf (uses $h \approx 6.0 \times 10^{-34}$ giving $hf \approx 2.25\,\text{eV}$).
- Option C ($2.0\,\text{eV}$): Does not subtract the work function correctly from the photon energy.

Final Answer: $KE_{\max} = 0.975\,\text{eV} \Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q 14**

Q15.

Solution

Concept — Radioactive Decay Law: After n half-lives the number of undecayed atoms is:

$$N = \frac{N_0}{2^n}$$

Step 1 — Apply for $n = 3$:

$$N = \frac{8 \times 10^{24}}{2^3} = \frac{8 \times 10^{24}}{8} = 1 \times 10^{24}\ \text{atoms}$$

Each half-life halves the sample: $8 \to 4 \to 2 \to 1$ (in units of 10^{24}).

Why other options are wrong:

- Option B (2×10^{24}): Result after only *two* half-lives ($N_0/4$).
- Option C (4×10^{24}): Result after only *one* half-life ($N_0/2$).
- Option D (0.5×10^{24}): Result after *four* half-lives ($N_0/16$).

Final Answer: $N = 1 \times 10^{24}$ atoms $\Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q 15**

Answer Key

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