

AME CET Physics

Sample Paper – 4

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 cell of EMF 10 V and internal resistance $r = 1 \Omega$ is connected to a load resistance $R = 4 \Omega$. What is the power delivered to the load?

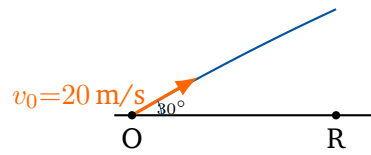
- (A) 20 W
- (B) 4 W
- (C) 40 W
- (D) 16 W

Q2. A potentiometer wire of length 100 cm and resistance 10Ω is connected to a 2 V battery (negligible internal resistance). What is the potential gradient along the wire?

- (A) 0.01 V/cm
- (B) 0.02 V/cm
- (C) 0.1 V/cm
- (D) 0.2 V/cm



Q3. A ball is kicked from ground level with a speed of 20 m/s at an angle of 30° to the horizontal (take $g = 10 \text{ m/s}^2$). Refer to the diagram below. What is the total time of flight?

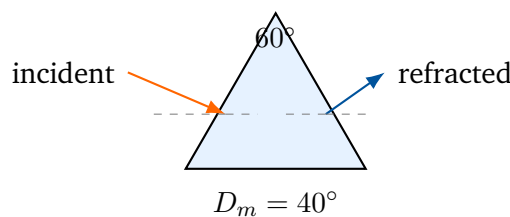


- (A) 1 s
- (B) 0.5 s
- (C) 2 s
- (D) 4 s

Q4. A car moves in a circle of radius $r = 40 \text{ m}$ at a speed of $v = 20 \text{ m/s}$. What is the centripetal acceleration?

- (A) 10 m/s^2
- (B) 2 m/s^2
- (C) 0.5 m/s^2
- (D) 20 m/s^2

Q5. A ray of light passes through an equilateral glass prism (apex angle $A = 60^\circ$) at minimum deviation. The angle of minimum deviation is $D_m = 40^\circ$. (Given: $\sin 50^\circ \approx 0.766$, $\sin 30^\circ = 0.5$.) Find the refractive index of the glass.



- (A) 1.2
- (B) 1.53



- (C) 1.73
- (D) 2.0

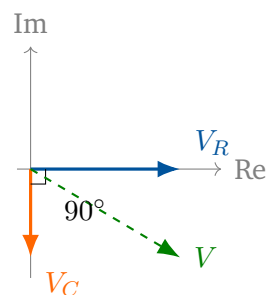
Q6. A magnifying glass has a focal length of $f = 5$ cm. An object is placed so that its virtual image forms at the near point (25 cm). What is the magnification?

- (A) 4
- (B) 5
- (C) 6
- (D) 25

Q7. A transformer has $N_P = 200$ turns in the primary and $N_S = 1000$ turns in the secondary. If the primary voltage is 220 V, what is the secondary voltage?

- (A) 44 V
- (B) 220 V
- (C) 440 V
- (D) 1100 V

Q8. In a series RC circuit connected to an AC source, V_R is in phase with the current I , and V_C lags I by 90° . The phasor diagram is shown below. What is the phase difference between V_R and V_C ?



- (A) 90°
- (B) 0°



- (C) 45°
- (D) 180°

- Q9.** A block of mass $m = 10 \text{ kg}$ rests on a horizontal surface with coefficient of static friction $\mu_s = 0.5$ (take $g = 10 \text{ m/s}^2$). What is the minimum horizontal force required to just start moving the block?
- (A) 10 N
 - (B) 50 N
 - (C) 100 N
 - (D) 5 N
- Q10.** A machine lifts a load of 500 N through a height of 6 m in 10 s. What is the power developed by the machine?
- (A) 5000 W
 - (B) 50 W
 - (C) 3000 W
 - (D) 300 W
- Q11.** A capacitor of capacitance $C = 4 \mu\text{F}$ is filled completely with a dielectric of dielectric constant $K = 3$. What is the new capacitance?
- (A) $\frac{4}{3} \mu\text{F}$
 - (B) $4 \mu\text{F}$
 - (C) $12 \mu\text{F}$
 - (D) $16 \mu\text{F}$
- Q12.** An electron ($m = 9 \times 10^{-31} \text{ kg}$, $q = 1.6 \times 10^{-19} \text{ C}$) moves with velocity $v = 2 \times 10^6 \text{ m/s}$ perpendicular to a magnetic field $B = 0.5 \text{ T}$. What is the radius of the circular orbit?
- (A) $2.25 \times 10^{-5} \text{ m}$



- (B) $4.5 \times 10^{-5} \text{ m}$
- (C) $1.125 \times 10^{-5} \text{ m}$
- (D) $9 \times 10^{-5} \text{ m}$

Q13. A photon has wavelength $\lambda = 0.1 \text{ nm}$. Given $h = 6.6 \times 10^{-34} \text{ J}\cdot\text{s}$ and $c = 3 \times 10^8 \text{ m/s}$, what is the energy of the photon?

- (A) $6.6 \times 10^{-24} \text{ J}$
- (B) $1.98 \times 10^{-24} \text{ J}$
- (C) $6.6 \times 10^{-16} \text{ J}$
- (D) $1.98 \times 10^{-15} \text{ J}$

Q14. In the hydrogen atom, the ground state energy is -13.6 eV . How much energy is required to ionize a hydrogen atom from the $n = 2$ state?

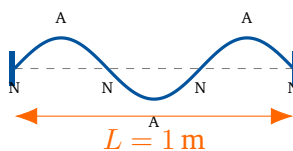
- (A) 13.6 eV
- (B) 3.4 eV
- (C) 6.8 eV
- (D) 1.51 eV

Q15. An ideal gas occupies 2 L at 27°C . At constant pressure, what volume will it occupy at 127°C ?

- (A) 1.5 L
- (B) 4 L
- (C) $\frac{8}{3} \text{ L}$
- (D) 3 L

Q16. A string of length $L = 1 \text{ m}$ is fixed at both ends. The speed of transverse waves on the string is $v = 60 \text{ m/s}$. The diagram below shows the 3rd harmonic (second overtone). What is its frequency?





- (A) 90 Hz
- (B) 30 Hz
- (C) 60 Hz
- (D) 120 Hz
- Q17.** A spinning skater has moment of inertia $I_1 = 4 \text{ kg}\cdot\text{m}^2$ and angular velocity $\omega_1 = 2 \text{ rad/s}$. She pulls her arms in, reducing her moment of inertia to $I_2 = 1 \text{ kg}\cdot\text{m}^2$. What is her new angular velocity ω_2 ?
- (A) 0.5 rad/s
- (B) 8 rad/s
- (C) 4 rad/s
- (D) 2 rad/s
- Q18.** An NPN transistor is connected in common-emitter configuration. The current gain $\beta = 100$ and the base current $I_B = 20 \mu\text{A}$. What is the collector current I_C ?
- (A) 0.2 mA
- (B) 100 mA
- (C) 2 mA
- (D) 20 mA
- Q19.** A solid is subjected to a uniform pressure $P = 2 \times 10^7 \text{ Pa}$. The bulk modulus of the material is $B = 4 \times 10^{10} \text{ Pa}$. What is the volumetric strain $\Delta V/V$?
- (A) 5×10^{-3}
- (B) 2×10^{-3}



(C) 1×10^{-4}

(D) 5×10^{-4}

Q20. The acceleration due to gravity at the surface of the Earth is g . At a height $h = R/2$ above the surface (where R is Earth's radius), what is the acceleration due to gravity?

(A) $\frac{4g}{9}$

(B) $\frac{g}{2}$

(C) $\frac{g}{4}$

(D) $\frac{2g}{3}$



Detailed Solutions

Q1.

Solution

Concept — Power to Load Resistance: When a cell with EMF \mathcal{E} and internal resistance r drives a load R , the current in the circuit is $I = \mathcal{E}/(R + r)$, and the power delivered to the load is $P = I^2 R$.

Step 1 — Find current in circuit:

$$I = \frac{\mathcal{E}}{R + r} = \frac{10}{4 + 1} = \frac{10}{5} = 2 \text{ A}$$

Step 2 — Power delivered to load resistance R :

$$P_{\text{load}} = I^2 R = (2)^2 \times 4 = 4 \times 4 = 16 \text{ W}$$

Why other options are wrong:

- Option A (20 W): Uses $P = \mathcal{E} \times I = 10 \times 2$ — gives total power of source, not just load.
- Option B (4 W): Uses $P = I^2 r = 4 \times 1$ — gives power lost in internal resistance, not load.
- Option C (40 W): Applies $P = \mathcal{E}^2/R = 100/4$ without accounting for internal resistance drop.

Final Answer: $P_{\text{load}} = 16 \text{ W} \Rightarrow \boxed{\text{D}}$

Answer: (D) [Go Back to Q1](#)

Q2.

Solution

Concept — Potentiometer Potential Gradient: The potential gradient k is the potential drop per unit length along the potentiometer wire.

Step 1 — Total potential difference across the wire equals the battery voltage (negligible internal resistance):

$$V_{\text{wire}} = 2 \text{ V}$$



Step 2 — Potential gradient:

$$k = \frac{V_{\text{wire}}}{L} = \frac{2\text{ V}}{100\text{ cm}} = 0.02\text{ V/cm}$$

Why other options are wrong:

- Option A (0.01 V/cm): Halves the correct value; arises from using $V = 1\text{ V}$ or $L = 200\text{ cm}$.
- Option C (0.1 V/cm): Uses $V = 10\text{ V}$ (EMF of a different circuit element).
- Option D (0.2 V/cm): Uses $V = 20\text{ V}$; a factor-of-10 error.

Final Answer: $k = 0.02\text{ V/cm} \Rightarrow$ B

Answer: (B) [Go Back to Q2](#)

Q3.

Solution

Concept — Projectile Time of Flight: The time of flight depends only on the vertical component of the initial velocity and gravity. $T = 2u_y/g$.

Step 1 — Vertical component of initial velocity:

$$u_y = v_0 \sin \theta = 20 \times \sin 30^\circ = 20 \times 0.5 = 10\text{ m/s}$$

Step 2 — Time to reach maximum height (vertical velocity = 0):

$$t_{\text{up}} = \frac{u_y}{g} = \frac{10}{10} = 1\text{ s}$$

Step 3 — Total time of flight (projectile returns to same level):

$$T = 2t_{\text{up}} = 2 \times 1 = 2\text{ s}$$

Why other options are wrong:

- Option A (1 s): Only the time to reach maximum height, not the full flight.
- Option B (0.5 s): Divides t_{up} by 2 — no physical basis.
- Option D (4 s): Would require $u_y = 20\text{ m/s}$ (i.e. $\theta = 90^\circ$, straight up).

Final Answer: $T = 2\text{ s} \Rightarrow$ C

Answer: (C) [Go Back to Q3](#)



Q4.

Solution

Concept — Centripetal Acceleration: For circular motion at constant speed v and radius r , the centripetal (centre-directed) acceleration is $a_c = v^2/r$.

Step 1 — Apply centripetal acceleration formula:

$$a_c = \frac{v^2}{r}$$

Step 2 — Substitute values:

$$a_c = \frac{(20)^2}{40} = \frac{400}{40} = 10 \text{ m/s}^2$$

Why other options are wrong:

- Option B (2 m/s^2): Uses $a_c = v/r = 20/40$ (dimensional error, divides speed instead of speed squared).
- Option C (0.5 m/s^2): Uses $a_c = r/v^2$, an inverted formula.
- Option D (20 m/s^2): Uses $a_c = v^2/(2r) \times 2$ or forgets to divide by r .

Final Answer: $a_c = 10 \text{ m/s}^2 \Rightarrow \boxed{\text{A}}$

Answer: (A) [Go Back to Q4](#)

Q5.

Solution

Concept — Prism Refractive Index at Minimum Deviation: At minimum deviation, the ray passes symmetrically through the prism. The refractive index is:

$$\mu = \frac{\sin\left(\frac{A + D_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

Step 1 — Compute the arguments:

$$\frac{A + D_m}{2} = \frac{60 + 40}{2} = 50^\circ, \quad \frac{A}{2} = 30^\circ$$



Step 2 — Substitute:

$$\mu = \frac{\sin 50^\circ}{\sin 30^\circ} = \frac{0.766}{0.5}$$

Step 3 — Evaluate:

$$\mu = 1.532 \approx 1.53$$

Why other options are wrong:

- Option A (1.2): Far too low; no common glass has $\mu = 1.2$.
- Option C (1.73): Uses $\sin 60^\circ / \sin 30^\circ = 0.866/0.5$; applies the wrong angle argument.
- Option D (2.0): Uses $\sin 90^\circ / \sin 30^\circ = 1/0.5$; an error in the numerator angle.

Final Answer: $\mu = 1.53 \Rightarrow$ B

Answer: (B) [Go Back to Q5](#)

Q6.

Solution

Concept — Magnifying Glass (Image at Near Point): When the virtual image is at the near point D , the magnification is $m = 1 + D/f$.

Step 1 — Identify given values:

$$f = 5 \text{ cm}, \quad D = 25 \text{ cm}$$

Step 2 — Apply magnification formula:

$$m = 1 + \frac{D}{f} = 1 + \frac{25}{5} = 1 + 5$$

Step 3 — Evaluate:

$$m = 6$$

Why other options are wrong:

- Option A (4): Uses $m = D/f - 1 = 5 - 1 = 4$ — incorrect formula variant.
- Option B (5): Uses $m = D/f = 25/5$ — omits the +1 term (applies when image is at infinity).
- Option D (25): Confuses D (in cm) with magnification directly.



Final Answer: $m = 6 \Rightarrow$ C

Answer: (C) [Go Back to Q6](#)

Q7.

Solution

Concept — Transformer Voltage Ratio: An ideal transformer obeys $V_S/V_P = N_S/N_P$.

Step 1 — Apply transformer voltage ratio:

$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

Step 2 — Solve for secondary voltage V_S :

$$V_S = V_P \times \frac{N_S}{N_P} = 220 \times \frac{1000}{200} = 220 \times 5$$

Step 3 — Evaluate:

$$V_S = 1100 \text{ V}$$

Why other options are wrong:

- Option A (44 V): Inverts the ratio; uses $V_S = V_P \times N_P/N_S = 220/5$.
- Option B (220 V): Ignores the turns ratio (gives $V_S = V_P$, which is only true for a 1:1 transformer).
- Option C (440 V): Uses turns ratio = 2 instead of 5.

Final Answer: $V_S = 1100 \text{ V} \Rightarrow$ D

Answer: (D) [Go Back to Q7](#)

Q8.

Solution

Concept — AC Phasor Phase Relationship in RC Circuit: In a series RC circuit, V_R is in phase with current I (reference phasor), while V_C lags I by 90° (i.e. V_C is at -90° relative to I).

Step 1 — Phase of V_R relative to current I :

$$\phi_{V_R} = 0^\circ \quad (\text{in phase with } I)$$



Step 2 — Phase of V_C relative to current I :

$$\phi_{V_C} = -90^\circ \quad (V_C \text{ lags } I \text{ by } 90^\circ)$$

Step 3 — Phase difference between V_R and V_C :

$$\Delta\phi = \phi_{V_R} - \phi_{V_C} = 0^\circ - (-90^\circ) = 90^\circ$$

As the phasor diagram shows: V_R along $+x$ axis and V_C along $-y$ axis, confirming a 90° angle.

Why other options are wrong:

- Option B (0°): Would mean V_R and V_C are in phase — impossible in an RC circuit.
- Option C (45°): No physical basis from the given phase relationships.
- Option D (180°): Applies to the phase between V_L and V_C in an LCR circuit.

Final Answer: Phase difference = $90^\circ \Rightarrow$

Answer: (A) [Go Back to Q8](#)

Q9.

Solution

Concept — Static Friction: The maximum static friction force is $f_s = \mu_s N$, where N is the normal force. This is the minimum force required to initiate motion.

Step 1 — Normal force on the block (horizontal surface):

$$N = mg = 10 \times 10 = 100 \text{ N}$$

Step 2 — Maximum static friction:

$$f_s = \mu_s N = 0.5 \times 100 = 50 \text{ N}$$

A force just greater than f_s is required to start motion, so the minimum force is 50 N.

Why other options are wrong:

- Option A (10 N): Uses $f_s = \mu_s \times m = 0.5 \times 10$ — forgets g in computing N .
- Option C (100 N): This is the normal force N itself, not the friction force.



- Option D (5 N): Uses $f_s = \mu_s \times g = 0.5 \times 10$ — missing the mass factor.

Final Answer: Minimum force = 50 N \Rightarrow

Answer: (B) [Go Back to Q9](#)

Q10.

Solution

Concept — Power: Power is the rate of doing work: $P = W/t$. Work done against gravity is $W = Fh$.

Step 1 — Work done lifting the load:

$$W = F \times h = 500 \times 6 = 3000 \text{ J}$$

Step 2 — Power developed:

$$P = \frac{W}{t} = \frac{3000}{10}$$

Step 3 — Evaluate:

$$P = 300 \text{ W}$$

Why other options are wrong:

- Option A (5000 W): Uses $P = F \times v$ but with wrong speed ($v = 10$ m/s instead of 0.6 m/s).
- Option B (50 W): Uses $P = F/t = 500/10$ (dimensional error — divides force by time, not work by time).
- Option C (3000 W): This is the total work done, not the power — forgets to divide by $t = 10$ s.

Final Answer: $P = 300 \text{ W} \Rightarrow$

Answer: (D) [Go Back to Q10](#)



Q11.

Solution

Concept — Capacitor with Dielectric: Inserting a dielectric of constant K increases the capacitance by factor K : $C_{\text{new}} = KC_0$.

Step 1 — Identify given values:

$$C_0 = 4 \mu\text{F}, \quad K = 3$$

Step 2 — New capacitance:

$$C_{\text{new}} = KC_0 = 3 \times 4$$

Step 3 — Evaluate:

$$C_{\text{new}} = 12 \mu\text{F}$$

Why other options are wrong:

- Option A ($4/3 \mu\text{F}$): Divides by K instead of multiplying — wrong direction of change.
- Option B ($4 \mu\text{F}$): No change; forgets that the dielectric increases capacitance.
- Option D ($16 \mu\text{F}$): Uses $C = C_0 + K \times C_0 = 4 + 12$ — incorrect additive formula.

Final Answer: $C_{\text{new}} = 12 \mu\text{F} \Rightarrow \boxed{\text{C}}$

Answer: (C) [Go Back to Q11](#)

Q12.

Solution

Concept — Radius of Circular Motion in Magnetic Field: For a charged particle moving perpendicular to a uniform magnetic field, the magnetic force provides centripetal acceleration: $qvB = mv^2/r$, giving $r = mv/(qB)$.

Step 1 — Compute numerator mv :

$$mv = 9 \times 10^{-31} \times 2 \times 10^6 = 18 \times 10^{-25} = 1.8 \times 10^{-24} \text{ kg}\cdot\text{m/s}$$



Step 2 — Compute denominator qB :

$$qB = 1.6 \times 10^{-19} \times 0.5 = 0.8 \times 10^{-19} = 8 \times 10^{-20} \text{ C}\cdot\text{T}$$

Step 3 — Radius:

$$r = \frac{mv}{qB} = \frac{1.8 \times 10^{-24}}{8 \times 10^{-20}} = 0.225 \times 10^{-4} = 2.25 \times 10^{-5} \text{ m}$$

Why other options are wrong:

- Option B ($4.5 \times 10^{-5} \text{ m}$): Doubles the correct radius; uses $v = 4 \times 10^6 \text{ m/s}$.
- Option C ($1.125 \times 10^{-5} \text{ m}$): Halves the correct radius; uses $v = 10^6 \text{ m/s}$.
- Option D ($9 \times 10^{-5} \text{ m}$): Quadruples the correct value; an arithmetic error.

Final Answer: $r = 2.25 \times 10^{-5} \text{ m} \Rightarrow$ A

Answer: (A) [Go Back to Q12](#)

Q13.

Solution

Concept — Photon Energy: $E = hc/\lambda$, where h is Planck's constant, c is the speed of light, and λ is the wavelength.

Step 1 — Convert wavelength:

$$\lambda = 0.1 \text{ nm} = 0.1 \times 10^{-9} \text{ m} = 10^{-10} \text{ m}$$

Step 2 — Compute hc :

$$hc = 6.6 \times 10^{-34} \times 3 \times 10^8 = 19.8 \times 10^{-26} = 1.98 \times 10^{-25} \text{ J}\cdot\text{m}$$

Step 3 — Divide by λ :

$$E = \frac{hc}{\lambda} = \frac{1.98 \times 10^{-25}}{10^{-10}} = 1.98 \times 10^{-25+10} = 1.98 \times 10^{-15} \text{ J}$$

Why other options are wrong:

- Option A ($6.6 \times 10^{-24} \text{ J}$): Uses $E = h/\lambda$ (omits factor of c).
- Option B ($1.98 \times 10^{-24} \text{ J}$): Uses $\lambda = 10^{-9} \text{ m}$ (100 nm), not 0.1 nm.



- Option C (6.6×10^{-16} J): Uses $E = hc/\lambda$ but with $\lambda = 3 \times 10^{-10}$ m.

Final Answer: $E = 1.98 \times 10^{-15}$ J \Rightarrow **D**

Answer: (D) [Go Back to Q13](#)

Q14.

Solution

Concept — Hydrogen Atom Energy Levels: $E_n = E_1/n^2$, where $E_1 = -13.6$ eV. Ionization energy from level n is $|E_n|$ (energy needed to bring the electron to $E = 0$).

Step 1 — Energy of the $n = 2$ level:

$$E_2 = \frac{E_1}{n^2} = \frac{-13.6}{2^2} = \frac{-13.6}{4} = -3.4 \text{ eV}$$

Step 2 — Ionization energy from $n = 2$:

$$E_{\text{ion}} = 0 - E_2 = 0 - (-3.4) = 3.4 \text{ eV}$$

Why other options are wrong:

- Option A (13.6 eV): This is the ionization energy from the ground state ($n = 1$).
- Option C (6.8 eV): Incorrect; $E_2/2 = 1.7$ eV has no physical meaning here.
- Option D (1.51 eV): This is $|E_3| = 13.6/9 = 1.51$ eV — ionization from $n = 3$, not $n = 2$.

Final Answer: Ionization energy from $n = 2 = 3.4$ eV \Rightarrow **B**

Answer: (B) [Go Back to Q14](#)

Q15.

Solution

Concept — Charles' Law (Constant Pressure): At constant pressure, $V \propto T$ (in Kelvin): $V_1/T_1 = V_2/T_2$.

Step 1 — Convert temperatures to Kelvin:

$$T_1 = 27 + 273 = 300 \text{ K}, \quad T_2 = 127 + 273 = 400 \text{ K}$$



Step 2 — Apply Charles' Law:

$$V_2 = V_1 \times \frac{T_2}{T_1} = 2 \times \frac{400}{300}$$

Step 3 — Simplify:

$$V_2 = 2 \times \frac{4}{3} = \frac{8}{3} \text{ L} \approx 2.67 \text{ L}$$

Why other options are wrong:

- Option A (1.5 L): Applies $V_2 = V_1 \times T_1/T_2$ (inverted ratio).
- Option B (4 L): Uses Celsius temperatures directly: $V_2 = 2 \times 127/27$ (incorrect; must use Kelvin).
- Option D (3 L): Uses $T_2/T_1 = 400/300$ then rounds $8/3$ up to 3; approximate error.

Final Answer: $V_2 = 8/3 \text{ L} \Rightarrow$ C

Answer: (C) [Go Back to Q15](#)

Q16.

Solution

Concept — Harmonics of a String Fixed at Both Ends: The n -th harmonic frequency is $f_n = nv/(2L)$. The 3rd harmonic has 3 loops (antinodes) and 4 nodes, fitting 1.5λ in length L .

Step 1 — Identify given values:

$$L = 1 \text{ m}, \quad v = 60 \text{ m/s}, \quad n = 3$$

Step 2 — Apply the harmonic frequency formula:

$$f_3 = \frac{nv}{2L} = \frac{3 \times 60}{2 \times 1} = \frac{180}{2}$$

Step 3 — Evaluate:

$$f_3 = 90 \text{ Hz}$$

Why other options are wrong:

- Option B (30 Hz): This is the fundamental frequency ($n = 1$): $f_1 = v/(2L) = 30 \text{ Hz}$.



- Option C (60 Hz): This is the 2nd harmonic ($n = 2$): $f_2 = 2 \times 30 = 60$ Hz.
- Option D (120 Hz): This is the 4th harmonic ($n = 4$): $f_4 = 4 \times 30 = 120$ Hz.

Final Answer: $f_3 = 90$ Hz \Rightarrow

Answer: (A) [Go Back to Q16](#)

Q17.

Solution

Concept — Conservation of Angular Momentum: When no external torque acts, $I_1\omega_1 = I_2\omega_2$. Reducing the moment of inertia increases angular velocity.

Step 1 — Initial angular momentum:

$$L = I_1\omega_1 = 4 \times 2 = 8 \text{ kg}\cdot\text{m}^2/\text{s}$$

Step 2 — Apply conservation of angular momentum:

$$I_2\omega_2 = L$$

Step 3 — Solve for ω_2 :

$$\omega_2 = \frac{L}{I_2} = \frac{8}{1} = 8 \text{ rad/s}$$

Why other options are wrong:

- Option A (0.5 rad/s): Inverts; computes $\omega_2 = I_2\omega_1/I_1 = 1 \times 2/4$ (wrong formula direction).
- Option C (4 rad/s): Uses $\omega_2 = \omega_1 \times (I_1/I_2)^{1/2} = 2 \times 2$ (incorrect square-root formula).
- Option D (2 rad/s): The initial angular velocity; forgets that I changed.

Final Answer: $\omega_2 = 8$ rad/s \Rightarrow

Answer: (B) [Go Back to Q17](#)



Q18.

Solution

Concept — NPN Transistor (Common-Emitter): The current gain $\beta = I_C/I_B$, so $I_C = \beta I_B$.

Step 1 — Identify given values:

$$\beta = 100, \quad I_B = 20 \mu\text{A} = 20 \times 10^{-6} \text{ A}$$

Step 2 — Collector current:

$$I_C = \beta \times I_B = 100 \times 20 \times 10^{-6} = 2000 \times 10^{-6} \text{ A}$$

Step 3 — Convert to mA:

$$I_C = 2000 \mu\text{A} = 2 \text{ mA}$$

Why other options are wrong:

- Option A (0.2 mA): Uses $I_C = \beta I_B$ with $I_B = 2 \mu\text{A}$ (a factor-10 error in I_B).
- Option B (100 mA): Sets $I_C = \beta$ in mA directly — dimensionally incorrect.
- Option D (20 mA): Uses $I_C = \beta I_B$ but gives I_B in mA instead of μA .

Final Answer: $I_C = 2 \text{ mA} \Rightarrow$ C

Answer: (C) [Go Back to Q18](#)

Q19.

Solution

Concept — Bulk Modulus: $B = -P/(\Delta V/V)$, so $\Delta V/V = P/B$ (magnitude for compressive pressure).

Step 1 — Write the relation:

$$\frac{\Delta V}{V} = \frac{P}{B}$$

Step 2 — Substitute values:

$$\frac{\Delta V}{V} = \frac{2 \times 10^7}{4 \times 10^{10}}$$



Step 3 — Compute coefficient:

$$\frac{2}{4} = 0.5$$

Step 4 — Compute power of 10:

$$10^{7-10} = 10^{-3}$$

Step 5 — Combine:

$$\frac{\Delta V}{V} = 0.5 \times 10^{-3} = 5 \times 10^{-4}$$

Why other options are wrong:

- Option A (5×10^{-3}): Off by factor 10; arises from $B = 4 \times 10^9$ Pa (wrong bulk modulus).
- Option B (2×10^{-3}): Uses $\Delta V/V = B/P$ (inverted formula).
- Option C (1×10^{-4}): Off by factor 5; arises from $P/B = 2 \times 10^7 / (2 \times 10^{11})$.

Final Answer: $\Delta V/V = 5 \times 10^{-4} \Rightarrow \boxed{\text{D}}$

Answer: (D) [Go Back to Q19](#)

Q20.

Solution

Concept — Variation of g with Height: $g_h = g(1 + h/R)^{-2} = gR^2/(R + h)^2$.

Step 1 — Substitute $h = R/2$:

$$\frac{h}{R} = \frac{R/2}{R} = \frac{1}{2}$$

Step 2 — Apply the formula:

$$g_h = \frac{g}{\left(1 + \frac{h}{R}\right)^2} = \frac{g}{\left(1 + \frac{1}{2}\right)^2} = \frac{g}{\left(\frac{3}{2}\right)^2}$$

Step 3 — Evaluate:

$$g_h = \frac{g}{9/4} = \frac{4g}{9}$$

Why other options are wrong:



- Option B ($g/2$): Uses the linear approximation $g_h \approx g(1 - 2h/R) = g(1 - 1) = 0$ or simplistic halving.
- Option C ($g/4$): Would result from $h = R$ (i.e. orbital altitude = one Earth radius), not $R/2$.
- Option D ($2g/3$): Arises from applying $g_h = g/(1 + h/R)$ without squaring the denominator.

Final Answer: $g_h = 4g/9 \Rightarrow$

[Go Back to Q20](#)



Answer Key

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

