

# AIPMT 2005 Prelims — Physics Question Paper with Solutions

40 Physics questions as set in the paper · answers checked by RankUp

AIPMT 2005 Prelims · Q1

**1. A coil in the shape of an equilateral triangle of side  $l$  is suspended between the pole pieces of a permanent magnet such that  $B$  is in plane of the coil. If due to a current  $i$  in the triangle a torque  $\tau$  acts on it, the side  $l$  of the triangle is :**

- (A)  $(2/\sqrt{3}) (\tau/Bi)^{1/2}$
- (B)  $(2/\sqrt{3}) (\tau/Bi)$
- (C)  $2 (\tau/(\sqrt{3} Bi))^{1/2}$
- (D)  $(1/\sqrt{3}) (\tau/Bi)$

AIPMT 2005 Prelims · Q3

**2. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at distance of 2m and 3m respectively from the source. The ratio of the intensities of the waves at P and Q is :**

- (A) 9 : 4
- (B) 2 : 9
- (C) 9 : 2
- (D) 4 : 9

AIPMT 2005 Prelims · Q4

**3. A bomb of mass 30 kg at rest explodes into two pieces of masses 18 kg and 12 kg. The velocity of 18 kg mass is  $6 \text{ m s}^{-1}$ . The kinetic energy of the other mass is :**

- (A) 243 J
- (B) 486 J
- (C) 564 J
- (D) 388 J

AIPMT 2005 Prelims · Q5

**4. A drum of radius  $R$  and mass  $M$ , rolls down without slipping along an inclined plane of angle  $\theta$ . The frictional force :**

- (A) converts translational energy to rotational energy
- (B) dissipates energy as heat
- (C) decreases the rotational motion
- (D) decreases the rotational and translational motion

AIPMT 2005 Prelims · Q6

**5. Imagine a new planet having the same density as that of earth but it is 3 times bigger than the earth in size. If the acceleration due to gravity on the surface of earth is  $g$  and that on the surface of the new planet is  $g'$ , then :**

- (A)  $g' = 3g$
- (B)  $g' = g/9$
- (C)  $g' = 9g$
- (D)  $g' = g/3$

AIPMT 2005 Prelims · Q8

**6. Which of the following circular rods, (given radius  $r$  and length  $l$ ) each made of the same material and whose ends are maintained at the same temperature will conduct most heat ?**

- (A)  $r = 2r_0; l = 2l_0$
- (B)  $r = 2r_0; l = l_0$
- (C)  $r = r_0; l = l_0$
- (D)  $r = r_0; l = 2l_0$

**7. In the reaction  ${}^2_1\text{H} + {}^3_1\text{H} \rightarrow {}^4_2\text{He} + {}^1_0\text{n}$ , if the binding energies of  ${}^2_1\text{H}$ ,  ${}^3_1\text{H}$  and  ${}^4_2\text{He}$  are respectively a, b and c (in MeV), then the energy (in MeV) released in this reaction is :**

- (A)  $c + a - b$
- (B)  $c - a - b$
- (C)  $a + b + c$
- (D)  $a + b - c$

**8. Energy levels A, B and C of a certain atom correspond to increasing values of energy i.e.,  $E_A < E_B < E_C$ . If  $\lambda_1$ ,  $\lambda_2$  and  $\lambda_3$  are wavelengths of radiations corresponding to transitions C to B, B to A and C to A respectively, which of the following relations is correct ?**

- (A)  $\lambda_3 = \lambda_1 + \lambda_2$
- (B)  $\lambda_3 = \lambda_1\lambda_2/(\lambda_1 + \lambda_2)$
- (C)  $\lambda_1 + \lambda_2 + \lambda_3 = 0$
- (D)  $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

**9. The work functions for metals A, B and C are respectively 1.92 eV, 2.0 eV and 5 eV. According to Einstein's equation, the metals which will emit photoelectrons for a radiation of wavelength 4100 Å is/are :**

- (A) none
- (B) A only
- (C) A and B only
- (D) all the three metals

**10. The nuclei of which one of the following pairs of nuclei are isotones ?**

- (A)  ${}^{74}_{34}\text{Se}$ ,  ${}^{71}_{31}\text{Ga}$
- (B)  ${}^{92}_{42}\text{Mo}$ ,  ${}^{92}_{40}\text{Zr}$
- (C)  ${}^{84}_{38}\text{Sr}$ ,  ${}^{86}_{38}\text{Sr}$
- (D)  ${}^{40}_{20}\text{Ca}$ ,  ${}^{32}_{16}\text{S}$

**11. The circular motion of a particle with constant speed is :**

- (A) simple harmonic but not periodic
- (B) periodic and simple harmonic
- (C) neither periodic nor simple harmonic
- (D) periodic but not simple harmonic

**12. A particle executing simple harmonic motion of amplitude 5 cm has maximum speed of 31.4 cm/s. The frequency of its oscillation is :**

- (A) 2 Hz
- (B) 1.5 Hz
- (C) 0.5 Hz
- (D) 1 Hz

**13. The ratio of the dimensions of Planck's constant and that of the moment of inertia is the dimension of :**

- (A) frequency
- (B) velocity
- (C) angular momentum
- (D) time

**14. Which of the following processes is reversible ?**

- (A) Transfer of heat by radiation
- (B) Electrical heating of a nichrome wire
- (C) Transfer of heat by conduction
- (D) Isothermal compression

**15. The temperature of inversion of a thermocouple is  $620^{\circ}\text{C}$  and the neutral temperature is  $300^{\circ}\text{C}$ . what is the temperature of cold junction ?**

- (A)  $20^{\circ}\text{C}$
- (B)  $120^{\circ}\text{C}$
- (C)  $-20^{\circ}\text{C}$
- (D)  $-120^{\circ}\text{C}$

**16. A photosensitive metallic surface has work function,  $h\nu_0$ . If photons of energy  $2h\nu_0$  fall on this surface, the electrons come out with a maximum velocity of  $4 \times 10^6$  m/s. When the photon energy is increased to  $5h\nu_0$ , then maximum velocity of photoelectrons will be :**

- (A)  $16 \times 10^6$  m/s
- (B)  $8 \times 10^7$  m/s
- (C)  $4 \times 10^5$  m/s
- (D)  $8 \times 10^6$  m/s

**17. Fission of nuclei is possible because the binding energy per nucleon in them :**

- (A) increases with mass number at high mass numbers
- (B) decreases with mass number at high mass numbers
- (C) increases with mass number at low mass numbers
- (D) decreases with mass number at low mass numbers

**18. The displacement  $x$  of a particle varies with time  $t$  as  $x = ae^{(-\alpha t)} + be^{(\beta t)}$ , where  $a$ ,  $b$ ,  $\alpha$  and  $\beta$  are positive constants. The velocity of the particle will :**

- (A) go on decreasing with time
- (B) be independent of  $\alpha$  and  $\beta$
- (C) drop to zero when  $\alpha = \beta$
- (D) go on increasing with time

**19. In any fission process the ratio (mass of fission products/mass of parent nucleus) is :**

- (A) less than 1
- (B) greater than 1
- (C) equal to 1
- (D) depends on the mass of parent nucleus

**20. An ideal gas heat engine operates in Carnot cycle between  $227^{\circ}\text{C}$  and  $127^{\circ}\text{C}$ . It absorbs  $6 \times 10^4$  cal of heat at higher temperature. Amount of heat converted to work is :**

- (A)  $2.4 \times 10^4$  cal
- (B)  $3.6 \times 10^4$  cal
- (C)  $1.2 \times 10^4$  cal
- (D)  $6.4 \times 10^4$  cal

**21. If a vector  $2\hat{i} + 3\hat{j} + 8\hat{k}$  is perpendicular to the vector  $4\hat{j} - 4\hat{i} + \alpha\hat{k}$ , then the value of  $\alpha$  is :**

- (A)  $-2$
- (B)  $1/2$
- (C)  $-1/2$
- (D)  $2$

**22. Zener diode is used for :**

- (A) producing oscillations in an oscillator
- (B) amplification
- (C) stabilisation
- (D) rectification

**23. A stone tied to the end of a string of 1 m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolutions in 44 s, what is the magnitude and direction of acceleration of the stone ?**

- (A)  $(\pi^2/4) \text{ m s}^{-2}$  and direction along the radius towards the centre
- (B)  $2\pi^2 \text{ m s}^{-2}$  and direction along the radius away from centre
- (C)  $\pi^2 \text{ m s}^{-2}$  and direction along the radius towards the centre
- (D)  $4\pi^2 \text{ m s}^{-2}$  and direction along the tangent to the circle

**24. If the magnetic dipole moment of an atom of diamagnetic material, paramagnetic material and ferromagnetic material are denoted by  $\mu_d$ ,  $\mu_p$  and  $\mu_f$  respectively, then :**

- (A)  $\mu_d \neq 0$  and  $\mu_f \neq 0$
- (B)  $\mu_p = 0$  and  $\mu_f \neq 0$
- (C)  $\mu_d = 0$  and  $\mu_p \neq 0$
- (D)  $\mu_d \neq 0$  and  $\mu_p = 0$

**25. In a circuit, L, C and R are connected in series with an alternating voltage source of frequency f. The current leads the voltage by  $45^\circ$ . The value of C is :**

- (A)  $1/[2\pi f(2\pi fL + R)]$
- (B)  $1/[\pi f(2\pi fL + R)]$
- (C)  $1/[2\pi f(2\pi fL - R)]$
- (D)  $1/[\pi f(2\pi fL - R)]$

**26. The angular resolution of a 10 cm diameter telescope at a wavelength of  $5000 \text{ \AA}$  is of the order of :**

- (A)  $10^6 \text{ rad}$
- (B)  $10^{-4} \text{ rad}$
- (C)  $10^4 \text{ rad}$
- (D)  $10^{-6} \text{ rad}$

**27. Two vibrating tuning forks produce progressive waves given by  $y_1 = 4 \sin 500\pi t$  and  $y_2 = 2 \sin 506\pi t$ . Number of beats produced per minute is :**

- (A) 360
- (B) 180
- (C) 120
- (D) 30

**28. When a wire of uniform cross-section  $a$ , length  $l$  and resistance  $R$  is bent into a complete circle, resistance between two of diametrically opposite points will be :**

- (A)  $R/4$
- (B)  $2R$
- (C)  $4R$
- (D)  $R/2$

**29. Carbon, silicon and germanium atoms have four valence electrons each. Their valence and conduction bands are separated by energy band gaps represented by  $(E_g)_C$ ,  $(E_g)_{Si}$  and  $(E_g)_{Ge}$  respectively. Which one of the following relationships is true in their case ?**

- (A)  $(E_g)_C > (E_g)_{Si}$
- (B)  $(E_g)_C = (E_g)_{Si}$
- (C)  $(E_g)_C < (E_g)_{Ge}$
- (D)  $(E_g)_C < (E_g)_{Si}$

**30. If  $\lambda_v$ ,  $\lambda_x$  and  $\lambda_m$  represent the wavelengths of visible light, X-rays and microwaves respectively, then :**

- (A)  $\lambda_m > \lambda_x > \lambda_v$
- (B)  $\lambda_v > \lambda_m > \lambda_x$
- (C)  $\lambda_m > \lambda_v > \lambda_x$
- (D)  $\lambda_v > \lambda_x > \lambda_m$

**31. Two boys are standing at the ends A and B of a ground, where  $AB = a$ . The boy at B starts running in a direction perpendicular to AB with velocity  $v_1$ . The boy at A starts running simultaneously with velocity  $v$  and catches the other boy in a time  $t$ , where  $t$  is :**

- (A)  $a/\sqrt{(v^2 + v_1^2)}$
- (B)  $\sqrt{(a^2/(v^2 - v_1^2))}$
- (C)  $a/(v - v_1)$
- (D)  $a/(v + v_1)$

**32. A 5-A fuse wire can withstand a maximum power of 1 W in circuit. The resistance of the fuse wire is :**

- (A)  $0.02 \Omega$
- (B)  $0.2 \Omega$
- (C)  $0.4 \Omega$
- (D)  $0.04 \Omega$

**33. Two bodies have their moments of inertia  $I$  and  $2I$  respectively about their axis of rotation. If their kinetic energies of rotation are equal, their angular momenta will be in the ratio :**

- (A)  $1 : 4$
- (B)  $\sqrt{2} : 1$
- (C)  $4 : 1$
- (D)  $1 : \sqrt{2}$

**34. An electron moves in a circular orbit with a uniform speed  $v$ . It produces a magnetic field  $B$  at the centre of the circle. The radius of the circle is proportional to :**

- (A)  $B/v$
- (B)  $v/B$
- (C)  $\sqrt{v/B}$
- (D)  $\sqrt{B/v}$

**35. Choose the only false statement from the following :**

- (A) Substances with energy gap of the order of 10 eV are insulators
- (B) The conductivity of a semiconductor increases with increases in temperature
- (C) In conductors the valence and conduction bands may overlap
- (D) The resistivity of a semiconductor increases with increase in temperature

**36. If the angle between the vectors  $\vec{A}$  and  $\vec{B}$  is  $\theta$ , the value of the product  $(\vec{B} \times \vec{A}) \cdot \vec{A}$  is equal to :**

- (A)  $BA^2 \cos^2 \theta$
- (B)  $BA^2 \sin^2 \theta$
- (C)  $BA^2 \sin \theta \cos \theta$
- (D) zero

**37. The moment of inertia of a uniform circular disc of radius  $R$  and mass  $M$  about an axis passing from the edge of the disc and normal to the disc is :**

- (A)  $(5/2)MR^2$
- (B)  $MR^2$
- (C)  $(7/2)MR^2$
- (D)  $(3/2)MR^2$

**38. Copper has face-centered cubic (fcc) lattice with interatomic spacing equal to 2.54 Å. The value of lattice constant for this lattice is :**

- (A) 2.29 Å
- (B) 3.29 Å
- (C) 2.59 Å
- (D) 3.59 Å

**39. The total energy of an electron in the first excited state of hydrogen is about  $-3.4$  eV. Its kinetic energy in this state is :**

- (A)  $-3.4$  eV
- (B)  $-1.7$  eV
- (C)  $1.7$  eV
- (D)  $3.4$  eV

**40. A ball is thrown vertically upward. It has a speed of 10 m/s when it has reached one half of its maximum height. How high does the ball rise ? (Taking  $g = 10 \text{ m/s}^2$ )**

- (A) 6 m
- (B) 10 m
- (C) 14 m
- (D) 18 m

## Answer key and explanations

**1. Answer: (C)  $2(\tau/(\sqrt{3}Bi))^{1/2}$**

With B in the plane of the coil the torque is maximum:  $\tau = iAB$  with  $A = (\sqrt{3}/4)l^2$ . So  $l^2 = 4\tau/(\sqrt{3}Bi)$  and  $l = 2(\tau/(\sqrt{3}Bi))^{1/2}$ . The trap  $(2/\sqrt{3})(\tau/Bi)^{1/2}$  wrongly keeps  $\sqrt{3}$  outside the square root.

**2. Answer: (A) 9 : 4**

A point source spreads energy over a sphere, so  $I \propto 1/r^2$ .  $I_P/I_Q = (3/2)^2 = 9/4$ , i.e. 9 : 4. Writing 4 : 9 inverts the ratio by taking  $I \propto r^2$ .

**3. Answer: (B) 486 J**

Momentum conservation from rest:  $18 \times 6 = 12 \times v$ , so  $v = 9$  m/s.  $KE = \frac{1}{2} \times 12 \times 81 = 486$  J. 243 J is half the correct value.

**4. Answer: (A) converts translational energy to rotational energy**

In rolling without slipping the contact point is momentarily at rest, so static friction does no work and dissipates no heat. Its torque speeds up the rotation while it slows the translation, so it converts translational energy into rotational energy.

**5. Answer: (A)  $g' = 3g$**

$g = GM/R^2 = (4/3)\pi G\rho R$ , so at equal density  $g \propto R$ . A planet with 3 times the radius has  $g' = 3g$ .  $g/9$  would follow only if the mass stayed the same.

**6. Answer: (B)  $r = 2r_0$ ;  $l = l_0$**

Heat current  $H = k\Delta T/l \propto r^2/l$ . For  $r = 2r_0$ ,  $l = l_0$  this is  $4r_0^2/l_0$ , the largest;  $r = 2r_0$ ,  $l = 2l_0$  gives only  $2r_0^2/l_0$ .

**7. Answer: (B)  $c - a - b$**

Energy released = total binding energy of products – total binding energy of reactants =  $c - (a + b)$ . The free neutron has zero binding energy.  $a + b - c$  has the sign reversed.

**8. Answer: (B)  $\lambda_3 = \lambda_1\lambda_2/(\lambda_1 + \lambda_2)$**

Photon energies add:  $hc/\lambda_3 = hc/\lambda_1 + hc/\lambda_2$ , so  $1/\lambda_3 = 1/\lambda_1 + 1/\lambda_2$  and  $\lambda_3 = \lambda_1\lambda_2/(\lambda_1 + \lambda_2)$ . Adding the wavelengths directly is wrong because energy, not wavelength, is additive.

**9. Answer: (C) A and B only**

$E = 12400/4100 \approx 3.0$  eV. This exceeds the work functions of A (1.92 eV) and B (2.0 eV) but not C (5 eV), so only A and B emit. 'All three' ignores that  $5 \text{ eV} > 3 \text{ eV}$ .

**10. Answer: (A)  ${}^{74}_{34}\text{Se}$ ,  ${}^{71}_{31}\text{Ga}$**

Isotones have the same neutron number  $N = A - Z$ . Se:  $74 - 34 = 40$ ; Ga:  $71 - 31 = 40$ . The Sr pair are isotopes (same Z) and the Mo/Zr pair are isobars (same A).

**11. Answer: (D) periodic but not simple harmonic**

Uniform circular motion repeats after every revolution, so it is periodic. It is not SHM, because SHM is motion along a line under a restoring force  $\propto$  displacement; only the projection of circular motion is SHM.

**12. Answer: (D) 1 Hz**

$v_{\text{max}} = A\omega$ , so  $\omega = 31.4/5 = 6.28$  rad/s and  $f = \omega/2\pi = 1$  Hz. Taking 6.28 as the frequency or dividing wrongly gives 2 Hz or 0.5 Hz.

**13. Answer: (A) frequency**

$[h] = ML^2T^{-1}$  and  $[l] = ML^2$ , so  $[h/l] = T^{-1}$ , the dimension of frequency. Angular momentum has the dimensions of  $h$  itself, not  $h/l$ .

**14. Answer: (D) Isothermal compression**

A quasi-static isothermal compression can be retraced through the same equilibrium states, so it is reversible. Heat flow by conduction or radiation across a finite temperature difference and Joule heating are irreversible.

**15. Answer: (C)  $-20^\circ\text{C}$**

The neutral temperature is the mean of the cold-junction and inversion temperatures:  $300 = (\theta_c + 620)/2$ , so  $\theta_c = -20^\circ\text{C}$ . Taking the difference instead of the mean gives  $20^\circ\text{C}$ .

**16. Answer: (D)  $8 \times 10^6$  m/s**

$KE_{\text{max}} = E - h\nu_0$ . With  $2h\nu_0$  it is  $h\nu_0$ ; with  $5h\nu_0$  it is  $4h\nu_0$ . Since  $v \propto \sqrt{KE}$ , the speed doubles to  $8 \times 10^6$  m/s.  $16 \times 10^6$  m/s wrongly takes  $v \propto KE$ .

**17. Answer: (B) decreases with mass number at high mass numbers**

At high mass numbers the binding energy per nucleon falls as A increases, so splitting a heavy nucleus into medium nuclei raises the binding energy per nucleon and releases energy. Increase with A at low mass numbers explains fusion, not fission.

**18. Answer: (D) go on increasing with time**

$v = -\alpha e^{(-\alpha t)} + \beta e^{(\beta t)}$  and  $dv/dt = \alpha^2 e^{(-\alpha t)} + \beta^2 e^{(\beta t)} > 0$  for all  $t$ , so the velocity keeps increasing. It clearly depends on  $\alpha$  and  $\beta$ , and  $\alpha = \beta$  does not make it zero for all times.

**19. Answer: (A) less than 1**

Fission releases energy  $Q = \Delta m c^2$ , which comes from a loss of mass, so the products are lighter than the parent nucleus and the ratio is less than 1. 'Equal to 1' ignores the mass defect.

**20. Answer: (C)  $1.2 \times 10^4$  cal**

$\eta = 1 - T_2/T_1 = 1 - 400/500 = 0.2$  (temperatures in kelvin).  $W = 0.2 \times 6 \times 10^4 = 1.2 \times 10^4$  cal. Using Celsius temperatures or the rejected heat ( $4.8 \times 10^4$  cal) gives the wrong choices.

**21. Answer: (C)  $-1/2$**

Perpendicular vectors have zero dot product:  $2(-4) + 3(4) + 8\alpha = 0$ , so  $4 + 8\alpha = 0$  and  $\alpha = -1/2$ . Ignoring the sign of the  $\hat{i}$  component gives the wrong  $-2$  or  $2$ .

**22. Answer: (C) stabilisation**

In reverse breakdown a Zener diode keeps a nearly constant voltage across itself over a wide range of current, so it is used as a voltage regulator (stabiliser). Rectification uses ordinary p-n diodes.

**23. Answer: (C)  $\pi^2 \text{ m s}^{-2}$  and direction along the radius towards the centre**

$f = 22/44 = 0.5 \text{ rev/s}$ , so  $\omega = 2\pi f = \pi \text{ rad/s}$ .  $a = \omega^2 r = \pi^2 \times 1 = \pi^2 \text{ m s}^{-2}$ , directed along the radius towards the centre (centripetal). Acceleration of uniform circular motion is never tangential or outward.

**24. Answer: (C)  $\mu_d = 0$  and  $\mu_p \neq 0$**

Atoms of diamagnetic substances have no net permanent dipole moment, while atoms of paramagnetic and ferromagnetic substances do. So  $\mu_d = 0$  and  $\mu_p \neq 0$ ; any option with  $\mu_d \neq 0$  or  $\mu_p = 0$  is wrong.

**25. Answer: (A)  $1/[2\pi f(2\pi fL + R)]$**

Current leading the voltage means the circuit is net capacitive:  $\tan 45^\circ = (X_C - X_L)/R = 1$ , so  $X_C = X_L + R$ .  $1/(2\pi fC) = 2\pi fL + R$  gives  $C = 1/[2\pi f(2\pi fL + R)]$ . The form with  $(2\pi fL - R)$  would come from  $X_C = X_L - R$ , which makes the circuit inductive with current lagging.

**26. Answer: (D)  $10^{-6}$  rad**

Limit of resolution  $\theta \approx 1.22\lambda/D = 1.22 \times 5 \times 10^{-7}/0.1 \approx 6 \times 10^{-6}$  rad, i.e. of the order of  $10^{-6}$  rad.  $10^{-4}$  rad would need a 1 mm aperture.

**27. Answer: (B) 180**

$\omega_1 = 500\pi$  gives  $f_1 = 250 \text{ Hz}$  and  $\omega_2 = 506\pi$  gives  $f_2 = 253 \text{ Hz}$ . Beat frequency = 3 per second = 180 per minute. 360 per minute would double the true beat frequency of 3 Hz.

**28. Answer: (A)  $R/4$**

Each semicircle has resistance  $R/2$  and the two halves are in parallel between diametrically opposite points:  $(R/2 \times R/2)/(R/2 + R/2) = R/4$ .  $R/2$  is the resistance of only one half.

**29. Answer: (A)  $(E_g)_C > (E_g)_{Si}$**

Band gaps fall down group 14: carbon (diamond)  $\approx 5.5 \text{ eV}$ , Si  $\approx 1.1 \text{ eV}$ , Ge  $\approx 0.7 \text{ eV}$ . So  $(E_g)_C > (E_g)_{Si}$ ; diamond is an insulator, not a material with a smaller gap.

**30. Answer: (C)  $\lambda_m > \lambda_v > \lambda_x$**

In the EM spectrum microwaves (mm-cm) are longer than visible light (400–700 nm), which is longer than X-rays ( $\approx 0.01$ –10 nm). So  $\lambda_m > \lambda_v > \lambda_x$ .

**31. Answer: (B)  $\sqrt{(a^2/(v^2 - v_1^2))}$**

The catcher runs along the hypotenuse of a right triangle with legs  $a$  and  $v_1 t$ :  $(vt)^2 = a^2 + (v_1 t)^2$ , so  $t = \sqrt{(a^2/(v^2 - v_1^2))}$ .  $a/(v - v_1)$  would apply only if both ran along the same line.

**32. Answer: (D)  $0.04 \Omega$**

$P = I^2 R$ , so  $R = P/I^2 = 1/25 = 0.04 \Omega$ . Using  $P = IR$  gives  $0.2 \Omega$ .

**33. Answer: (D)  $1 : \sqrt{2}$**

$E = L^2/2I$ , so  $L = \sqrt{2IE}$ . For equal  $E$ ,  $L_1/L_2 = \sqrt{I_2/I_1} = 1 : \sqrt{2}$ . The body with the larger moment of inertia has the larger angular momentum, not the smaller.

**34. Answer: (C)  $\sqrt{(v/B)}$**

The orbiting electron is a current  $I = ev/(2\pi r)$ , giving  $B = \mu_0 I/(2r) = \mu_0 ev/(4\pi r^2)$ . So  $r^2 \propto v/B$  and  $r \propto \sqrt{(v/B)}$ .  $v/B$  would follow from  $B \propto v/r$ , which ignores that the current itself depends on  $r$ .

**35. Answer: (D) The resistivity of a semiconductor increases with increase in temperature**

In a semiconductor more electrons cross the band gap as temperature rises, so conductivity increases and resistivity decreases. The statement that resistivity increases with temperature is therefore the false one; the other three are true.

**36. Answer: (D) zero**

$\vec{B} \times \vec{A}$  is perpendicular to  $\vec{A}$ , so its dot product with  $\vec{A}$  is zero for any  $\theta$ . The  $\sin \theta$  and  $\cos \theta$  forms wrongly treat the product as non-zero.

**37. Answer: (D)  $(3/2)MR^2$**

About the central perpendicular axis  $I = MR^2/2$ . By the parallel-axis theorem, about a parallel axis through the edge  $I = MR^2/2 + MR^2 = (3/2)MR^2$ .  $(5/2)MR^2$  wrongly adds  $2MR^2$ .

**38. Answer: (D) 3.59 Å**

In an fcc lattice atoms touch along the face diagonal, so the nearest-neighbour distance  $d = a/\sqrt{2}$ .  $a = \sqrt{2} \times 2.54 \approx 3.59$  Å. Taking  $a = d$  or dividing by  $\sqrt{2}$  gives the smaller values.

**39. Answer: (D) 3.4 eV**

In a Bohr orbit  $KE = -E_{\text{total}}$ , so  $KE = +3.4$  eV. Kinetic energy can never be negative, which rules out  $-3.4$  eV and  $-1.7$  eV.

**40. Answer: (B) 10 m**

From  $H/2$  to the top the speed drops from 10 m/s to 0:  $10^2 = 2g(H/2) = gH$ , so  $H = 100/10 = 10$  m. 5 m would be just the upper half.

Questions as set in the AIPMT/NEET papers conducted by CBSE and NTA. Answers checked and explanations written by the RankUp team. RankUp is not affiliated with CBSE or NTA.