

AIPMT 2010 Prelims — Physics Question Paper with Solutions

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

AIPMT 2010 Prelims · Q1

1. The dimension of $(1/2)\epsilon_0 E^2$, where ϵ_0 is permittivity of free space and E is electric field, is

- (A) MLT^{-1}
- (B) ML^2T^{-2}
- (C) $ML^{-1}T^{-2}$
- (D) ML^2T^{-1}

AIPMT 2010 Prelims · Q2

2. A particle moves a distance x in time t according to equation $x = (t + 5)^{-1}$. The acceleration of particle is proportional to

- (A) $(\text{Velocity})^{2/3}$
- (B) $(\text{Velocity})^{3/2}$
- (C) $(\text{Distance})^2$
- (D) $(\text{Distance})^{-2}$

AIPMT 2010 Prelims · Q4

3. A particle has initial velocity $(3\hat{i} + 4\hat{j})$ and has acceleration $(0.4\hat{i} + 0.3\hat{j})$. Its speed after 10 s is

- (A) 10 units
- (B) 7 units
- (C) $7\sqrt{2}$ units
- (D) 8.5 units

AIPMT 2010 Prelims · Q6

4. A man of 50 kg mass is standing in a gravity free space at a height of 10 m above the floor. He throws a stone of 0.5 kg mass downwards with a speed 2 m/s. When the stone reaches the floor, the distance of the man above the floor will be

- (A) 20 m
- (B) 9.9 m
- (C) 10.1 m
- (D) 10 m

AIPMT 2010 Prelims · Q8

5. A ball moving with velocity 2 m/s collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5 then their velocities (in m/s) after collision will be

- (A) 0, 2
- (B) 0, 1
- (C) 1, 1
- (D) 1, 0.5

AIPMT 2010 Prelims · Q9

6. A gramophone record is revolving with an angular velocity ω . A coin is placed at a distance r from the centre of the record. The static coefficient of friction is μ . The coin will revolve with the record if

- (A) $r \geq \mu g / \omega^2$
- (B) $r = \mu g \omega^2$
- (C) $r < \omega^2 / (\mu g)$
- (D) $r \leq \mu g / \omega^2$

AIPMT 2010 Prelims · Q11

7. Two particles which are initially at rest, move towards each other under the action of their internal attraction. If their speeds are v and $2v$ at any instant, then the speed of centre of mass of the system will be

- (A) v
- (B) $2v$
- (C) Zero
- (D) $1.5 v$

AIPMT 2010 Prelims · Q12

8. The radii of circular orbits of two satellites A and B of the earth, are $4R$ and R , respectively. If the speed of satellite A is $3V$, then the speed of satellite B will be

- (A) $3V/2$
- (B) $3V/4$
- (C) $6V$
- (D) $12V$

AIPMT 2010 Prelims · Q13

9. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a . The gravitational potential at a point situated at $a/2$ distance from the centre, will be

- (A) $-4GM/a$
- (B) $-3GM/a$
- (C) $-2GM/a$
- (D) $-GM/a$

AIPMT 2010 Prelims · Q14

10. A ball is dropped from a high rise platform at $t = 0$ starting from rest. After 6 seconds another ball is thrown downwards from the same platform with a speed v . The two balls meet at $t = 18$ s. What is the value of v ? (Take $g = 10 \text{ m/s}^2$)

- (A) 60 m/s
- (B) 75 m/s
- (C) 55 m/s
- (D) 40 m/s

AIPMT 2010 Prelims · Q15

11. A cylindrical metallic rod in thermal contact with two reservoirs of heat at its two ends conducts an amount of heat Q in time t . The metallic rod is melted and the material is formed into a rod of half the radius of the original rod. What is the amount of heat conducted by the new rod, when placed in thermal contact with the two reservoirs in time t ?

- (A) $Q/2$
- (B) $Q/4$
- (C) $Q/16$
- (D) $2Q$

AIPMT 2010 Prelims · Q16

12. The total radiant energy per unit area, normal to the direction of incidence, received at a distance R from the centre of a star of radius r , whose outer surface radiates as a black body at a temperature T K is given by (where σ is Stefan's constant)

- (A) $4\pi\sigma r^2 T^4 / R^2$
- (B) $\sigma r^2 T^4 / R^2$
- (C) $\sigma r^2 T^4 / (4\pi r^2)$
- (D) $\sigma r^4 T^4 / r^4$

AIPMT 2010 Prelims · Q17

13. If ΔU and ΔW represent the increase in internal energy and work done by the system respectively in a thermodynamical process, which of the following is true?

- (A) $\Delta U = -\Delta W$, in an isothermal process
- (B) $\Delta U = -\Delta W$, in an adiabatic process
- (C) $\Delta U = \Delta W$, in an isothermal process
- (D) $\Delta U = \Delta W$, in an adiabatic process

AIPMT 2010 Prelims · Q18

14. The displacement of a particle along the x-axis is given by $x = a \sin^2 \omega t$. The motion of the particle corresponds to

- (A) Simple harmonic motion of frequency $\omega/(2\pi)$
- (B) Simple harmonic motion of frequency ω/π
- (C) Simple harmonic motion of frequency $3\omega/(2\pi)$
- (D) Non simple harmonic motion

AIPMT 2010 Prelims · Q19

15. The period of oscillation of a mass M suspended from a spring of negligible mass is T . If along with it another mass M is also suspended, the period of oscillation will now be

- (A) $\sqrt{2} T$
- (B) T
- (C) $T/\sqrt{2}$
- (D) $2T$

AIPMT 2010 Prelims · Q20

16. A transverse wave is represented by $y = A \sin(\omega t - kx)$. For what value of the wavelength is the wave velocity equal to the maximum particle velocity?

- (A) A
- (B) $\pi A/2$
- (C) πA
- (D) $2\pi A$

AIPMT 2010 Prelims · Q21

17. A tuning fork of frequency 512 Hz makes 4 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per sec when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was

- (A) 508 Hz
- (B) 510 Hz
- (C) 514 Hz
- (D) 516 Hz

AIPMT 2010 Prelims · Q22

18. Which of the following statement is false for the properties of electromagnetic waves?

- (A) These waves do not require any material medium for propagation
- (B) Both electric and magnetic field vectors attains the maxima and minima at the same place and same time
- (C) The energy in electromagnetic wave is divided equally between electric and magnetic vectors
- (D) Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of wave

19. A lens having focal length f and aperture of diameter d forms an image of intensity I . Aperture of diameter $d/2$ in central region of lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively

- (A) $f/2$ and $I/2$
- (B) f and $I/4$
- (C) $3f/4$ and $I/2$
- (D) f and $3I/4$

20. A ray of light travelling in a transparent medium of refractive index μ , falls on a surface separating the medium from air at an angle of incidence of 45° . For which of the following value of μ the ray can undergo total internal reflection?

- (A) $\mu = 1.25$
- (B) $\mu = 1.33$
- (C) $\mu = 1.40$
- (D) $\mu = 1.50$

21. Two positive ions, each carrying a charge q , are separated by a distance d . If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge on an electron)

- (A) $4\pi\epsilon_0 Fd^2/q^2$
- (B) $4\pi\epsilon_0 Fd^2/e^2$
- (C) $\sqrt{(4\pi\epsilon_0 Fd^2/e^2)}$
- (D) $\sqrt{(4\pi\epsilon_0 Fd^2/e^2)}$

22. A square surface of side L meter in the plane of the paper is placed in a uniform electric field E (volt/m) acting along the same plane at an angle θ with the horizontal side of the square. The electric flux linked to the surface, in units of volt-m, is

- (A) Zero
- (B) EL^2
- (C) $EL^2 \cos \theta$
- (D) $EL^2 \sin \theta$

23. A series combination of n_1 capacitors, each of value C_1 , is charged by a source of potential difference $4V$. When another parallel combination of n_2 capacitors, each of value C_2 , is charged by a source of potential difference V , it has the same (total) energy stored in it, as the first combination has. The value of C_2 , in terms of C_1 , is then

- (A) $16C_1/(n_1n_2)$
- (B) $2C_1/(n_1n_2)$
- (C) $16(n_2/n_1)C_1$
- (D) $2(n_2/n_1)C_1$

24. A galvanometer has a coil of resistance 100 ohm and gives a full scale deflection for 30 mA current. If it is to work as a voltmeter of 30 volt range, the resistance required to be added will be

- (A) 1000Ω
- (B) 900Ω
- (C) 1800Ω
- (D) 500Ω

25. Consider the following two statements:

(A) Kirchhoff's junction law follows from the conservation of charge.

(B) Kirchhoff's loop law follows from the conservation of energy.

Which of the following is correct?

- (A) Both (A) and (B) are correct
- (B) Both (A) and (B) are wrong
- (C) (A) is correct and (B) is wrong
- (D) (A) is wrong and (B) is correct

26. In producing chlorine by electrolysis 100 kW power at 125 V is being consumed.

How much chlorine per minute is liberated? (E.C.E. of chlorine is $0.367 \times 10^{-6} \text{ kg/C}$)

- (A) $3.67 \times 10^{-3} \text{ kg}$
- (B) $1.76 \times 10^{-3} \text{ kg}$
- (C) $9.67 \times 10^{-3} \text{ kg}$
- (D) $17.61 \times 10^{-3} \text{ kg}$

27. A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is F , the net force on the remaining three arms of the loop is

- (A) F
- (B) $3F$
- (C) $-F$
- (D) $-3F$

28. A thin ring of radius R meter has charge q coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of f revolutions/s. The value of magnetic induction in Wb/m^2 at the centre of the ring is

- (A) $\mu_0 q f / (2R)$
- (B) $\mu_0 q f / (2\pi R)$
- (C) $\mu_0 q / (2\pi f R)$
- (D) $\mu_0 q / (2f R)$

29. Electromagnets are made of soft iron because soft iron has

- (A) High retentivity and low coercive force
- (B) Low retentivity and high coercive force
- (C) High retentivity and high coercive force
- (D) Low retentivity and low coercive force

30. A vibration magnetometer placed in magnetic meridian has a small bar magnet. The magnet executes oscillations with a time period of 2 s in earth's horizontal magnetic field of 24 microtesla. When a horizontal field of 18 microtesla is produced opposite to the earth's field by placing a current carrying wire, the new time period of magnet will be

- (A) 4 s
- (B) 1 s
- (C) 2 s
- (D) 3 s

31. A conducting circular loop is placed in a uniform magnetic field, $B = 0.025 \text{ T}$ with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of 1 mm s^{-1} . The induced emf when the radius is 2 cm is

- (A) $2 \text{ } \mu\text{V}$
- (B) $2\pi \text{ } \mu\text{V}$
- (C) $\pi \text{ } \mu\text{V}$
- (D) $(\pi/2) \text{ } \mu\text{V}$

32. A 220 volt input is supplied to a transformer. The output circuit draws a current of 2.0 ampere at 440 volts. If the efficiency of the transformer is 80%, the current drawn by the primary windings of the transformer is

- (A) 5.0 ampere
- (B) 3.6 ampere
- (C) 2.8 ampere
- (D) 2.5 ampere

33. A source S_1 is producing 10^{15} photons per second of wavelength $5000 \text{ } \text{\AA}$. Another source S_2 is producing 1.02×10^{15} photons per second of wavelength $5100 \text{ } \text{\AA}$. Then (power of S_2)/(power of S_1) is equal to

- (A) 0.98
- (B) 1.00
- (C) 1.02
- (D) 1.04

34. A beam of cathode rays is subjected to crossed electric (E) and magnetic (B) fields. The fields are adjusted such that the beam is not deflected. The specific charge of the cathode rays is given by (where V is the potential difference between cathode and anode)

- (A) $E^2/(2VB^2)$
- (B) $B^2/(2VE^2)$
- (C) $2VB^2/E^2$
- (D) $2VE^2/B^2$

35. The activity of a radioactive sample is measured as N_0 counts per minute at $t = 0$ and N_0/e counts per minute at $t = 5$ minutes. The time (in minutes) at which the activity reduces to half its value is

- (A) $5 \log_e 2$
- (B) $\log_e(2/5)$
- (C) $5/\log_e 2$
- (D) $5 \log_{10} 5$

36. The energy of a hydrogen atom in the ground state is -13.6 eV . The energy of a He^+ ion in the first excited state will be

- (A) -6.8 eV
- (B) -13.6 eV
- (C) -27.2 eV
- (D) -54.4 eV

37. The mass of a ${}^7_3\text{Li}$ nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of ${}^7_3\text{Li}$ nucleus is nearly

- (A) 23 MeV
- (B) 46 MeV
- (C) 5.6 MeV
- (D) 3.9 MeV

38. A alpha nucleus of energy $(1/2)mv^2$ bombards a heavy nuclear target of charge Ze. Then the distance of closest approach for the alpha nucleus will be proportional to

- (A) $1/v^4$
- (B) $1/(Ze)$
- (C) v^2
- (D) $1/m$

39. A common emitter amplifier has a voltage gain of 50, an input impedance of 100 Ω and an output impedance of 200 Ω . The power gain of the amplifier is

- (A) 50
- (B) 500
- (C) 1000
- (D) 1250

40. Which one of the following bonds produces a solid that reflects light in the visible region and whose electrical conductivity decreases with temperature and has high melting point?

- (A) Covalent bonding
- (B) Metallic bonding
- (C) van der Waal's bonding
- (D) Ionic bonding

41. The device that can act as a complete electronic circuit is

- (A) Zener diode
- (B) Junction diode
- (C) Integrated circuit
- (D) Junction transistor

42. Which of the following statements is false?

- (A) The resistance of intrinsic semiconductor decreases with increase of temperature
- (B) Pure Si doped with trivalent impurities gives a p-type semiconductor
- (C) Majority carriers in an n-type semiconductor are holes
- (D) Minority carriers in a p-type semiconductor are electrons

Answer key and explanations

1. Answer: (C) $\text{ML}^{-1}\text{T}^{-2}$

$(1/2)\epsilon_0 E^2$ is the energy density of the electric field, i.e. energy per unit volume. Its dimensions are $\text{ML}^2\text{T}^{-2}/\text{L}^3 = \text{ML}^{-1}\text{T}^{-2}$. ML^2T^{-2} is the dimension of energy itself, which forgets the division by volume.

2. Answer: (B) (Velocity) $^{3/2}$

With $x = (t + 5)^{-1}$, $v = -(t + 5)^{-2}$ and $a = 2(t + 5)^{-3}$. Since $|v| = (t + 5)^{-2}$, $(t + 5)^{-3} = |v|^{3/2}$, so $a \propto (\text{velocity})^{3/2}$. In terms of distance $a = 2x^3$, so neither (distance) ^{2} nor (distance) $^{-2}$ fits.

3. Answer: (C) $7\sqrt{2}$ units

$v = u + at = (3 + 0.4 \times 10)\hat{i} + (4 + 0.3 \times 10)\hat{j} = 7\hat{i} + 7\hat{j}$. Speed = $\sqrt{49 + 49} = 7\sqrt{2} \approx 9.9$ units. Adding the initial speed 5 and the gain 5 to get 10 units wrongly adds magnitudes of non-parallel vectors.

4. Answer: (C) 10.1 m

With no external force, momentum is conserved: $0.5 \times 2 = 50 \times v$, so the man moves up at 0.02 m/s. The stone takes $10/2 = 5$ s to reach the floor, in which the man rises $0.02 \times 5 = 0.1$ m, so he is at 10.1 m. Answering 10 m ignores the recoil; 9.9 m takes the recoil in the wrong direction.

5. Answer: (B) 0, 1

Momentum: $m \times 2 = m v_1 + 2m v_2$, so $v_1 + 2v_2 = 2$. Restitution: $v_2 - v_1 = 0.5 \times 2 = 1$. Solving gives $v_2 = 1$ m/s and $v_1 = 0$, i.e. velocities 0 and 1 m/s. The pair 1 and 1 would need perfectly inelastic sticking, which conserves momentum only if $v = 2/3$.

6. Answer: (D) $r \leq \mu g/\omega^2$

Static friction supplies the centripetal force: $mr\omega^2 \leq \mu mg$, so the coin stays on if $r \leq \mu g/\omega^2$. The reversed inequality $r \geq \mu g/\omega^2$ describes when the coin slips off.

7. Answer: (C) Zero

Only internal forces act, so total momentum stays zero (it was zero initially). Hence the centre of mass stays at rest and its speed is zero, whatever the individual speeds v and $2v$ are.

8. Answer: (C) 6V

Orbital speed $v = \sqrt{GM/r}$, so $v \propto 1/\sqrt{r}$. $v_B/v_A = \sqrt{(4R/R)} = 2$, so $v_B = 2 \times 3V = 6V$. Using $v \propto 1/r$ would give 12V.

9. Answer: (B) $-3GM/a$

Inside the shell its potential is constant at $-GM/a$. The point mass at the centre contributes $-GM/(a/2) = -2GM/a$. Total $V = -2GM/a - GM/a = -3GM/a$. Forgetting the shell gives $-2GM/a$.

10. Answer: (B) 75 m/s

At $t = 18$ s the first ball has fallen $\frac{1}{2} \times 10 \times 18^2 = 1620$ m. The second ball moves for 12 s: $12v + \frac{1}{2} \times 10 \times 12^2 = 12v + 720$. Equating gives $12v = 900$, $v = 75$ m/s.

11. Answer: (C) $Q/16$

Volume is fixed: halving the radius makes the area $A/4$, so the length becomes $4L$. Heat flow $\propto A/L$, so it becomes $\frac{1}{4} \div 4 = 1/16$ of the original: $Q/16$. Taking only the area change gives $Q/4$.

12. Answer: (B) $\sigma r^2 T^4/R^2$

The star emits $\sigma T^4 \times 4\pi r^2$ in total. At distance R this spreads over a sphere of area $4\pi R^2$, so energy per unit area per second = $\sigma T^4 \cdot 4\pi r^2 / (4\pi R^2) = \sigma r^2 T^4 / R^2$. Keeping the 4π in the numerator forgets to divide by the full sphere area.

13. Answer: (B) $\Delta U = -\Delta W$, in an adiabatic process

First law: $Q = \Delta U + \Delta W$ with ΔW the work done by the system. In an adiabatic process $Q = 0$, so $\Delta U = -\Delta W$. In an isothermal process of an ideal gas $\Delta U = 0$, so neither isothermal relation holds.

14. Answer: (B) Simple harmonic motion of frequency ω/π

$x = a \sin^2 \omega t = (a/2)(1 - \cos 2\omega t)$. This is a cosine oscillation of amplitude $a/2$ about the shifted mean position $x = a/2$ with angular frequency 2ω , so $d^2(x - a/2)/dt^2 = -4\omega^2(x - a/2)$: it is SHM of frequency $2\omega/2\pi = \omega/\pi$. Calling it non-SHM ignores the shift of the mean position; $\omega/2\pi$ uses the wrong angular frequency.

15. Answer: (A) $\sqrt{2} T$

$T = 2\pi\sqrt{M/k}$, so $T \propto \sqrt{M}$. Doubling the mass gives $T' = \sqrt{2} T$. $2T$ would need four times the mass.

16. Answer: (D) $2\pi A$

Wave speed ω/k equals the maximum particle speed $A\omega$ when $1/k = A$, i.e. $\lambda/(2\pi) = A$, so $\lambda = 2\pi A$. Choosing πA drops the factor 2 in $k = 2\pi/\lambda$.

17. Answer: (A) 508 Hz

The string frequency is 512 ± 4 , i.e. 508 or 516 Hz. Increasing tension raises the string's frequency; the beats fall to 2, so the frequency moved towards 512, meaning it was below: 508 Hz. If it were 516 Hz, raising it would increase the beats to more than 4.

18. Answer: (D) Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of wave

In an electromagnetic wave E and B are perpendicular to each other and both perpendicular to the direction of propagation, so saying they are parallel to each other is false. The other statements (no medium needed, in-phase maxima, equal energy sharing) are true.

19. Answer: (D) f and $3I/4$

Covering part of a lens does not change its focal length, which depends only on curvature and refractive index. The light gathered is $\propto$ area: the covered central part has diameter $d/2$, i.e. $1/4$ of the area, so intensity becomes $I - I/4 = 3I/4$. $I/4$ would be the share of the covered part, not what remains.

20. Answer: (D) $\mu = 1.50$

TIR needs the incidence angle to exceed the critical angle: $\sin 45^\circ > 1/\mu$, so $\mu > \sqrt{2} \approx 1.414$. Only $\mu = 1.50$ exceeds this; 1.40 is just below.

21. Answer: (D) $\sqrt{(4\pi\epsilon_0 F d^2/e^2)}$

Each ion has charge $q = ne$. $F = (ne)^2/(4\pi\epsilon_0 d^2)$, so $n^2 = 4\pi\epsilon_0 F d^2/e^2$ and $n = \sqrt{(4\pi\epsilon_0 F d^2/e^2)}$. The same expression without the square root gives n^2 , not n .

22. Answer: (A) Zero

Flux = $E \cdot A \cos(\text{angle between } E \text{ and the area vector})$. The area vector is normal to the paper, while E lies in the plane of the paper, so the angle is 90° and the flux is zero for any θ . $EL^2 \cos \theta$ wrongly treats θ as the angle with the normal.

23. Answer: (A) $16C_1/(n_1 n_2)$

Series: $C_{eq} = C_1/n_1$, energy = $\frac{1}{2}(C_1/n_1)(4V)^2 = 8C_1V^2/n_1$. Parallel: $C_{eq} = n_2 C_2$, energy = $\frac{1}{2}n_2 C_2 V^2$. Equating gives $C_2 = 16C_1/(n_1 n_2)$.

24. Answer: (B) 900 Ω

Total resistance needed = $V/I_g = 30/0.030 = 1000 \Omega$. Series resistance = $1000 - 100 = 900 \Omega$. 1000 Ω forgets to subtract the coil's own resistance.

25. Answer: (A) Both (A) and (B) are correct

The junction rule says charge does not pile up at a node: conservation of charge. The loop rule says the net potential change round a closed loop is zero, i.e. work per unit charge round a loop is zero: conservation of energy. Both statements are correct.

26. Answer: (D) $17.61 \times 10^{-3} \text{ kg}$

$I = P/V = 100000/125 = 800 \text{ A}$. In one minute $m = ZIt = 0.367 \times 10^{-6} \times 800 \times 60 = 17.6 \times 10^{-3} \text{ kg}$. $3.67 \times 10^{-3} \text{ kg}$ would need a far smaller charge.

27. Answer: (C) $-F$

The net magnetic force on a closed current loop in a uniform field is zero. So the other three arms together must give $-F$, cancelling the force on the first arm.

28. Answer: (A) $\mu_0 qf/(2R)$

The rotating charge acts as a current $I = qf$. Field at the centre of a ring is $B = \mu_0 I/(2R) = \mu_0 qf/(2R)$. Putting $2\pi R$ in the denominator confuses it with the field of a long straight wire.

29. Answer: (D) Low retentivity and low coercive force

An electromagnet must lose its magnetism as soon as the current is switched off, so it needs low retentivity, and it must be easy to demagnetise, so low coercivity. High retentivity and high coercivity suit permanent magnets.

30. Answer: (A) 4 s

$T \propto 1/\sqrt{B}$. The opposing field reduces the net horizontal field to $24 - 18 = 6 \mu\text{T}$. $T' = 2 \times \sqrt{(24/6)} = 4 \text{ s}$. Adding the fields ($42 \mu\text{T}$) would give a shorter period.

31. Answer: (C) $\pi \mu\text{V}$

$\phi = B\pi r^2$, so $|\epsilon| = B\pi 2r \cdot (dr/dt) = 0.025 \times \pi \times 2 \times 0.02 \times 10^{-3} = \pi \times 10^{-6} \text{ V} = \pi \mu\text{V}$. Forgetting the factor 2 from $d(r^2)/dt$ gives $(\pi/2) \mu\text{V}$.

32. Answer: (A) 5.0 ampere

Output power = $440 \times 2 = 880 \text{ W}$. Input = $880/0.8 = 1100 \text{ W}$, so primary current = $1100/220 = 5.0 \text{ A}$. Multiplying by 0.8 instead of dividing gives 3.2 A; ignoring efficiency gives 4 A.

33. Answer: (B) 1.00

Power = $n \cdot hc/\lambda$. $P_2/P_1 = (n_2/n_1)(\lambda_1/\lambda_2) = 1.02 \times 5000/5100 = 1.00$. 1.02 counts only the photon numbers and ignores the lower energy of longer-wavelength photons.

34. Answer: (A) $E^2/(2VB^2)$

No deflection means $eE = evB$, so $v = E/B$. Accelerated through V : $eV = \frac{1}{2}mv^2$, so $e/m = v^2/(2V) = E^2/(2VB^2)$. The inverted forms come from writing $v = B/E$.

35. Answer: (A) $5 \log_e 2$

Activity falls to $1/e$ in 5 min, so $\lambda = 1/5$ per minute (mean life 5 min). $T_{1/2} = \ln 2/\lambda = 5 \log_e 2 \text{ min} \approx 3.47 \text{ min}$. $5/\log_e 2$ inverts the relation.

36. Answer: (B) -13.6 eV

$E_n = -13.6 Z^2/n^2 \text{ eV}$. For He^+ , $Z = 2$ and first excited state $n = 2$: $E = -13.6 \times 4/4 = -13.6 \text{ eV}$. -54.4 eV is the He^+ ground state.

37. Answer: (C) 5.6 MeV

Binding energy = $0.042 \times 931 \approx 39.1$ MeV. Per nucleon: $39.1/7 \approx 5.6$ MeV. 39 MeV would be the total, not per nucleon.

38. Answer: (D) $1/m$

At closest approach all kinetic energy becomes potential energy: $\frac{1}{2}mv^2 = (1/4\pi\epsilon_0)(Ze)(2e)/r_0$, so $r_0 = 4Ze^2/(4\pi\epsilon_0mv^2)$. Thus $r_0 \propto 1/m$, $\propto Ze$ and $\propto 1/v^2$, so $1/v^4$ and v^2 are wrong powers and $1/(Ze)$ has the wrong dependence.

39. Answer: (D) 1250

Voltage gain $A_V = \beta \times (R_{out}/R_{in})$, so $\beta = 50 \times 100/200 = 25$. Power gain = $A_V \times \beta = 50 \times 25 = 1250$. Taking the power gain equal to the voltage gain (50) ignores the current gain.

40. Answer: (B) Metallic bonding

Metallic solids reflect visible light (lustre), have high melting points and their conductivity falls as temperature rises because lattice vibrations scatter the free electrons. Covalent and ionic solids are poor conductors whose conductivity, if any, increases with temperature.

41. Answer: (C) Integrated circuit

An integrated circuit contains many transistors, diodes, resistors and capacitors on one chip, so it can work as a complete circuit. A diode or a single transistor is just one component.

42. Answer: (C) Majority carriers in an n-type semiconductor are holes

In n-type semiconductors the majority carriers are electrons, not holes, so that statement is false. Intrinsic resistance does fall with temperature, trivalent doping does give p-type, and electrons are minority carriers in p-type.

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.