AIPMT PRE- EXAMINATION PAPER 2012
Code-A

PHYSICS

Time : - 3 Hours **Date : 01/04/12**

Important Instructions:

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on side-1 and side-2 carefully with blue/black ball point pen only.

2. The test is of 3 hours duration and Test Booklet contains 200 questions. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 800.

3. Use Blue/Black Ball Point Pen only for writing particulars on this pagel marking responses.

4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.

5. On completion of the test, the candidate must handover the Answer Sheet to the invigilator in the Room/Hall. The candidates are allowed to take away this Test Booklet with them.

6. The CODE for this Booklet is A. Make sure that the CODE printed on Side-2 of the Answer Sheet is the same as that on this Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of-both the Test Booklets and the Answer Sheets.

7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet- Do not write your roll no. anywhere else except in the specified space in the Test Booklet/ Answer Sheet.

8. Use of white fluid for correction is NOT permissible on the Answer Sheet.

9. Each candidate must show on demand his/her Admission Card to the Invigilator.

10. No candidate, without special permission of the Superintendent or Invigilator, would leave his/her seat.

11. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign the Attendance Sheet twice. Cases where a candidate has not signed the Attendance Sheet the second time will be deemed not to have handed over Answer Sheet and dealt with as an unfair means case.

12. Use of Electronic/Manual Calculator is prohibited.

13. The candidates are governed by all Rules and regulation of the Board with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of the Board.

14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet/ Answer Sheet in the Attendance Sheet.

PART B — PHYSICS

1. The damping force on a oscillator is directly proportional to the velocity. The Unit of the constant of proportionality are

(1) kgs^{-1} (2) kgs

(3) $kgms^{-1}$ (4) $kgms^{-2}$

Ans.[1]

Sol. **F= Kv**

$K = \frac{F}{v}$

Unit of $K = \frac{kg\ ms^{-2}}{kgs^{-1}\ ms^{-1}} =$

2. The motion of a particle along a straight line is described by equation $x = 8 + 12t - t^3$

where x is in metre and t in second. The retardation of the particle when its velocity becomes zero is

(1) $6\ ms^{-2}$ (2) $12\ ms^{-2}$

(3) $24ms^{-2}$ (4) zero

Ans.[2]

Sol. $x = 8 + 12t - t^3$

$v = \frac{dx}{dt} = 12 - 3t^2$

$a = \frac{dv}{dt} = -6t$

putting v = 0 $3t^2$

= 12

t = 2 sec

$\therefore$ $a = -6 \times 2 = -12\ ms^{-2}$

$\therefore$ retardation = $12\ ms^{-2}$

3. The horizontal range and the maximum height of a projectile are equal . The angle of projection of the projectile is:

(1) θ = tan–1 (2) (2) $\theta = 45°$

(3) $\theta = \tan^{-1}\frac{1}{4}$ (4) $\theta = \tan^{-1}$ (4)

Ans.[4]

Sol. $\tan\theta = \frac{4H}{R}$

given H = R

$\therefore \theta = \tan^{-1}(4)$

4. A particle has initial velocity $2\hat{i} + 3\hat{j}$ and acceleration $0.3\hat{i} + 0.2\hat{j}$. The magnitude of velocity after 10 seconds will be

(1) 5 units (2) 9 units

(3) $9\sqrt{2}$ units (4) $5\sqrt{2}$ units

Ans.[4]

Sol. $\vec{v} = \vec{u} + \vec{a}t$

$\vec{v} = (2\hat{i} + 3\hat{j}) + (0.3\hat{i} + 0.2\hat{j}) \times 10$

$\Rightarrow \vec{v} = 5\hat{i} + 5\hat{j}$

$v = 5\sqrt{2}$ units

5. A car of mass 1000 kg negotiates a banked curve of radius 90m on a frictionless road. If the banking angle is 45º, the speed of the car is

(1) 5 ms^{-1} (2) 10 ms^{-1}

(3) 20 ms^{-1} (4) 30 ms^{-1}

Ans.[4]

Sol. $v = \sqrt{rg \tan\theta}$

$\Rightarrow v = \sqrt{90 \times 10 \times \tan 45^\circ}$

$= 30$ m/s

6. A solid cylinder of mass 3 kg is rolling on a horizontal surface with velocity 4 ms^{-1}. It collides with a horizontal spring of force constant 200 Nm^{-1} . The maximum compression produced in the spring will be

(1) 0.7 m (2) 0.2 m

(3) 0.5 m (4) 0.6 m

Ans.[4]

Sol. $\frac{1}{2}mv^2\left(1 + \frac{K^2}{R^2}\right) = \frac{1}{2}kx_{max}^2$

Putting m = 3kg, v = 4 m/s, $\frac{K^2}{R^2}$ = 1/2 (For solid cylinder), k = 200 Nm^{-1} we get

$x_{max} = 0.6$ m

7. The potential energy of a particle in a force field is : $U = \frac{A}{r^2} - \frac{B}{r}$, where A and B are positive constants and r is the distance of particle from the centre of the field. For stable equilibrium, the distance of the particle is

(1) A/B
(2) B/A
(3) B/2A
(4) 2A/B

Ans.[4]

Sol. For Stable equilibrium, $F = -\frac{dU}{dr} = 0$

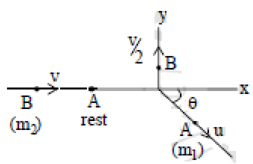
we get r = 2A/B

8. Two spheres A and B of masses m_1 and m_2 respectively collide. A is at rest initially and B is moving with velocity v along x-axis. After collision B has a velocity $\frac{v}{2}$ in a direction perpendicular to the original direction. The mass A moves after collision in the direction.

(1) $\theta = \tan^{-1}(1/2)$ to the x-axis
(2) $\theta = \tan^{-1}(-1/2)$ to the x-axis
(3) same as that of B
(4) opposite to the of B

Ans.[2]

Sol.



Applying the law of conservation of momentum we have

in y-direction, $m_1 u \sin\theta = m_2 v/2$ .....(i)

In x-direction, $m_1 u \cos\theta = m_2 v$ .....(ii)

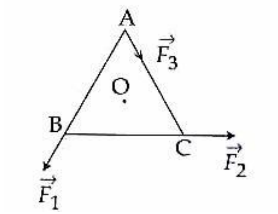
9. Two persons of masses 55 kg and 65kg respectively, are at the opposite ends of a boat. The length of the boat is 30. m and weighs 100 kg. The 55 kg man walks up to the 65 kg man and sits with him. If the boat is in still water the center of mass of the system shift by:

(1) zero
(2) 0.75 m
(3) 3.0 m
(4) 2.3 m

Ans.[1]

Sol. Since net external force on the system is zero hence C.O.M. remains unchanged.

10. ABC is an equilateral triangle with O as its centre $\vec{F_1}$, $\vec{F_2}$ and $\vec{F_3}$ represent three forces acting along the sides AB, BC and AC respectively. If the torque about O is zero then the magnitude of $\vec{F_3}$ is



(1) $\frac{F_1 + F_2}{2}$ (2) $2(F_1 + F_2)$

(3) $F_1 + F_2$ (4) $F_1 - F_2$

Ans.[3]

Sol. Taking anticlockwise torque

$F_1d + F_2d - F_3d = 0$ (where d = perpendicular distance of the centre O from each side)

$\therefore$ $F_3 = F_1 + F_2$

11. When a mass is rotating in a plane about a fixed point, its angular momentum is directed along

(1) the radius (2) the tangent to the orbit

(3) a line perpendicular to the plane of rotation (4) the line making an angle of 45º to the plane of rotation.

Ans.[3]

Sol. $\vec{L} = \vec{r} \times m\vec{v}$

12. A spherical planet has a mass M_P and diameter D_P. A particle of mass m falling freely near the surface of this planet will experience an acceleration due to gravity, equal to

(1) GM_P / D_P^2 (2) $4GM_P m / D_P^2$

(3) $4GM_P / D_P^2$ (4) $GM_P m / D_P^2$

Ans.[3]

Sol. $g = \frac{GM_p}{R_p^2}$ where $R_p = D_p/2$

13. A geostationary satellite is orbiting the earth at a height of 5R above that surface of the earth, R being the radius of the earth. The time period of another satellite of the earth. The time period of another satellite in hours at a height of 2R from the surface of the earth is

(1) $6\sqrt{2}$ (2) $\frac{6}{\sqrt{2}}$

(3) 5 (4) 10

Ans.[1]

Sol. According to Kepler's third law, $T^2 \propto r^3$

$$\frac{T_2}{T_1} = \left(\frac{r_2}{r_1}\right)^{3/2}$$

Given $T_1 = 24$ h

$r_1 = R + h_1 = R + 5R = 6R$

$r_2 = R + h_2 = R + 2R = 3R$

On solving we get

$T_2 = 6\sqrt{2}$ h

14. The height at which the weight of a body becomes $1/16^{th}$, its weight on the surface of earth (radius R), is

(1) 3R (2) 4R

(3) 5R (4) 15 R

Ans. [1]

Sol. $$\frac{W_h}{W} = \frac{mg_h}{mg} = \left(\frac{R}{R+h}\right)^2 = \frac{1}{16}$$

$\therefore$ h = 3R

15. Two sources of sound placed close to each other, are emitting progressive waves given by $y_1 = 4 \sin 600 \pi t$ and $y_2 = 5 \sin 608 \pi t$:

An observer located near these two sources of sound will hear

(1) 8 beats per second with intensity ratio 81 : 1 between waxing and waning

(2) 4 beats per second with intensity ratio 81 : 1 between waxing and waning

(3) 4 beats per second with intensity ratio 25 : 16 between waxing and waning

(4) 8 beats per second with intensity ratio 25 : 16 between waxing and waning

Ans.[2]

Sol. Comparing with $y_1 = a_1 \sin 2\pi f_1 t$ and $y_2 = a_2 \sin 2\pi f_2 t$ we get f1 = 300 Hz, f_2 = 304 Hz Number of beats = $f_2 - f_1 = 4s^{-1}$

$$\frac{I_{max}}{I_{min}} = \left(\frac{a_1 + a_2}{a_1 - a_2}\right)^2 = \frac{I_{max}}{I_{min}} = \left(\frac{4+5}{4-5}\right)^2 = \frac{81}{1}$$

16. When a string is divided into three segments of length l_1, l_2 and l_3, the fundamental frequencies of these three segments are v_1, v_2 and v_3 respectively. The original functamental frequency (v) of the string is :

(1) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$

(2) $\frac{1}{\sqrt{v}} = \frac{1}{\sqrt{v_1}} + \frac{1}{\sqrt{v_2}} + \frac{1}{\sqrt{v_3}}$

(3) $\sqrt{v} = \sqrt{v_1} + \sqrt{v_2} + \sqrt{v_3}$

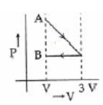
(4) $v = v_1 + v_2 + v_3$

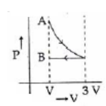
Ans.[1]

Sol. Length of the string $l = l_1 + l_2 + l_3$

Also $\upsilon \propto \frac{1}{l}$

17. One mole of an ideal gas goes from an initial state A to final state B via two processes : It first undergoes isothermal expansion from volume V to 3V and then its volume is reduced from 3V to V at constant pressure. The correct P-V diagram representing the two processes is:

(1)


(2)


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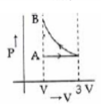

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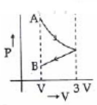
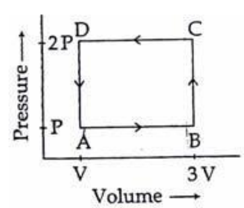


Ans.[2]

Sol. For isothermal expansion P-V curve is rectangular hyperbola (clockwise curve)

18. A thermodynamics system is taken trough the cycle ABCD as shown in figure. Heat rejected by the gas during the cycle is:



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

(2) PV

(3) 2PV

(4) 4PV

Ans.[3]

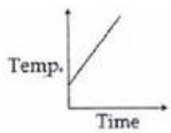
Sol. For given cyclic process, $\Delta U = 0$

$\therefore$ Q = W (From first law of thermodynamic $Q = \Delta U + W$)

Also W = – area enclosed by the curve = – P × 2V

$\therefore$ Heat rejected = 2PV

19. Liquid oxygen at 50 K is heated to 300 K at constant pressure of 1 atm. The rate of heating is constant. Which one of the following graphs represents the variation of temperature with time ?

(1)


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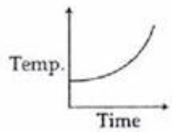

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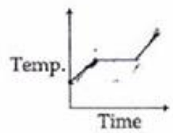
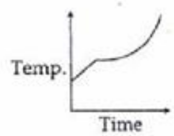


(4)


Ans.[3]

Sol. At first temperature will increase then there will be state change from liquid to gas.

20 If the radius of a star is R and it acts as a black body, what would be the temperature of the star, in which the rate of energy production is Q ?

(1) $(4\pi R^2 Q/\sigma)^{1/4}$ (2) $(Q/4\pi R^2\sigma)^{1/4}$

(3) $Q/4\pi R^2\sigma$ (4) $(Q/4\pi R^2\sigma)^{-1/2}$

(σ stands for Stefan's constant)

Ans.[2]

Sol. Using Stefan's law, the rate of energy production is $Q = E \times A = \sigma T^4 \times 4\pi R^2$

21. A coil of resistance 400Ω is placed in a magnetic filed. if the magnetic flux φ (wb) linked with the coil varies with times t(sec) as

$\varphi = 50\,t^2 + 4.$

The current is the coil at t = 2 sec is

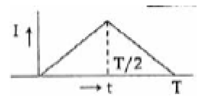
(1) 2A (2) 1A

(3) 0.5A (4) 0.1 A

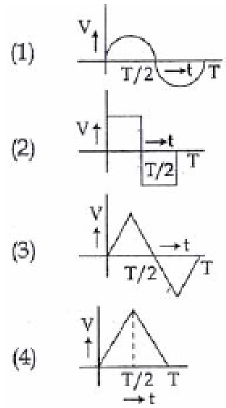
Ans.[3]

Sol. $|i| = \frac{\varepsilon}{R} = \frac{d\phi/dt}{R} = 0.5$ A

22. The current (I) in the inductance is varying with time according to the plot shown in figure.



Which one of the following is the correct variation of voltage with time in the coil ?



Ans.[2]

Sol. $|V| = \left| -L\frac{di}{dt} \right|$ therefore answer will be best represented by graph -2

23. In an electrical circuit R, L, C and an a.c. voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and the current in the ciruit is π/3 . If instead, C is removed from the circuit, the phase difference is again π/3 . The power factor of the circuit is

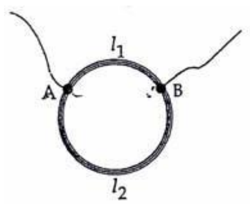
(1) 1 (2) $\frac{\sqrt{3}}{2}$

(3) $\frac{1}{2}$ (4) $\frac{1}{\sqrt{2}}$

Ans.[1]

Sol. It is the condition of resonance therefore phase difference between voltage and current is zero and power factor cos φ = 1

24. A ring is made of a wire having a resistance $R_0 = 12\Omega$. Find the points A and B, as shown in the figure, at which a current carrying conductor should be connected so that the resistance R of the sub circuit between these points is equal to $\frac{8}{3}\Omega$:



(1) $\frac{l_1}{l_2} = \frac{3}{8}$ (2) $\frac{l_1}{l_2} = \frac{1}{2}$

(3) $\frac{l_1}{l_2} = \frac{5}{8}$ (4) $\frac{l_1}{l_2} = \frac{1}{3}$

Ans.[2]

Sol. **Since** $R \propto l$.

According to problem $R_1 + R_2 = 12\Omega$ and $\frac{R_1 \times R_2}{R_1 + R_2} = \frac{8}{3}\Omega$

On solving this we get $R_1 = 4\Omega$ and $R_2 = 8\Omega$ therefore the ratio $\frac{l_1}{l_2} = \frac{1}{2}$

25. If voltage across a bulb rated 220 Volts.- 100 Watt drops by 2.5% of its rated value the percentage of the rated value by which the power would decrease is

(1) 5% (2) 10%

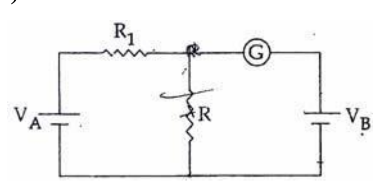
(3) 20% (4)2.5%

Ans.[1]

Sol. Power $P = \frac{V^2}{R}$.

For small variation, $\frac{\Delta P}{P} \times 100\% = \frac{2 \times \Delta V}{V} \times 100\%$ therefore power would decrease by 5%

26. In the circuit shown the cells A and B have negligible resistance. For $V_A = 12V$, $R_1 = 500\Omega$ and $R = 100\ \Omega$ the galvanometer (G) shows no deflection. The value of V_B is



(1) 12V (2) 6V

(3) 4V (4) 2V

Ans.[4]

Sol. By using kirchoff voltage law the potential difference across R is 2 volt.

27. The electric field associated with an e. m. wave in vacuum is given by $\vec{E} = \hat{i}\ 40 \cos(kz - 6 \times 10^8 t)$, where E, z and t are in volt/m, meter and seconds respectively. The value of wave vector k is :

(1) $6\ m^{-1}$ (2) $3\ m^{-1}$

(3) $2\ m^{-1}$ (4) $0.5\ m^{-1}$

Ans.[3]

Sol. Equation of Electromagnetic wave is $E = E_0 \cos(kz - \omega t)$ and speed of EM wave $V = \frac{\omega}{k}$

By comparing $k = \omega/v = \frac{6 \times 10^8}{3 \times 10^8} = 2\ m^{-1}$ is the wave vector.

28. What is the flux through a cube of side 'a' if a point charge of q is at one of its corner.

(1) $\frac{q}{\epsilon_0}$ (2) $\frac{q}{2\epsilon_0} 6a^2$

(3) $\frac{2q}{\epsilon_0}$ (4) $\frac{q}{8\epsilon_0}$

Ans.[4]

Sol. flux $\phi = \frac{q}{8\epsilon_0}$

29 An electric dipole of moment 'p' is placed in an electric field of intensity 'E'. The dipole acquires a position such that the axis of the dipole makes an angle θ with the direction of the field. Assuming that the potential energy of the dipole to be zero when $\theta = 90°$, the torque and the potential energy of the dipole will respectively be

(1) $pE \sin\theta,\ 2pE \cos\theta$ (2) $pE \cos\theta,\ -pE \sin\theta$

(3) $pE \sin\theta,\ -pE \cos\theta$ (4) $pE \sin\theta,\ -2pE \cos\theta$

Ans.[3]

Sol. Toque $\tau = PE \sin\theta$ and Potential energy $U = -PE \cos\theta$

30. Four point charge –Q, –q, 2q and 2Q are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is

(1) $Q = q$ (2) $Q = \frac{1}{q}$

(3) $Q = -q$ (4) $Q = -\frac{1}{q}$

Ans.[3]

Sol. Potential V at centre of the square = $\frac{-kQ}{r} - \frac{kq}{r} + \frac{k2Q}{r} + \frac{k2q}{r} = 0$

So $Q = -q$

31. A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole. It.

(1) Will stay in north-south direction only

(2) Will stay in east-west direction only

(3) Will becomes rigid showing no movement

(4) Will stay in any position

Ans.[4]

Sol. Will remain in any position at geomagnetic north and south pole.

32. A milli voltmeter of 25 milli volt range is to be converted into an ammeter of 25 ampere rage. The value (in ohm) of necessary shunt will be

(1) 1 (2) 0.05

(3) 0.001 (4) 0.01

Ans.[3]

Sol. If the resistance of the meter is G then the full scale deflection current $i_g = \frac{25mV}{G}$ ampere

The Value of shunt required for converting it into ammeter of range 25 ampere is $S = \frac{i_g G}{i - i_g}$

So $\approx \frac{25mV}{25} = 0.001\ \Omega$

33. Two similar coils of radius R are lying concentrically with their planes at right angles to each other. The currents flowing in them are I and 2I, respectively. The resultant magnetic field induction at the centre will be

(1) $\frac{\mu_0 I}{2R}$ (2) $\frac{\mu_0 I}{R}$

(3) $\frac{\sqrt{5}\mu_0 I}{2R}$ (4) $\frac{3\mu_0 I}{2R}$

Ans.[3]

Sol. Magnetic field at the centre of circular current carrying coil of radius R and current I is = $\frac{\mu_0 I}{2R} = B$

Magnetic field at the centre of circular current carrying coil of radius R and current 2I is = $\frac{\mu_0 2I}{2R} = 2B$

The resulting magnetic field will be = $\sqrt{B^2 + 4B^2} = \sqrt{5}B$

34. An alternating electric field, of frequency v, is applied across the dees (radius = R) of a cyclotron that is being used to accelerated protons (mass = m). The operating magnetic field (B) used in the cyclotron and the kinetic energy (K) of the proton beam, produced by it, are given by

(1) $B = \frac{2\pi mv}{e}$ and $K = 2m\pi^2 v^2 R^2$

(2) $B = \frac{mv}{e}$ and $K = m^2 \pi v R^2$

(3) $B = \frac{mv}{e}$ and $K = 2m\pi^2 v^2 R$

(4) $B = \frac{2\pi m v}{e}$ and $K = m^2 \pi v R^2$

Ans.[1]

Sol. Frequency $\upsilon = \frac{eB}{2\pi m}$ so $B = \frac{2\pi mv}{e}$

Kinetic energy $K = \frac{1}{2} mv^2$

radius $R = \frac{mv}{eB}$

35. The magnifying power of a teloscope is 9. When it is adjusted for parallel rays the distance between the objective and eyepiece is 20 cm. The focal length of lenses are

(1) 18 cm, 2 cm
(2) 11 cm, 9 cm
(3) 10 cm, 10 cm
(4) 15 cm, 5 cm

Ans.[1]

Sol. $L = f_o + f_e = 20$cm and $M = \frac{f_0}{f_e} = 9$

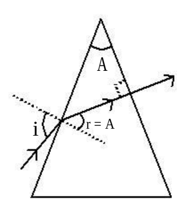
On solving, $f_o = 18$cm $f_e = 2$ cm

36. A ray of light is incident at an angle of incidence, i, on one face of a prism of angle A (assumed to be small) and emerges normally from the opposite face. It the refractive index of the prism is μ, the angle of incidence i, is nearly equal to

(1) A/ μ
(2)A/ 2μ
(3) μ A
(4)$\frac{\mu A}{2}$

Ans.[3]

Sol. $\mu = \sin\frac{\sin i}{\sin r} = \frac{\sin i}{\sin A} = \frac{i}{A}$ (for small angle)



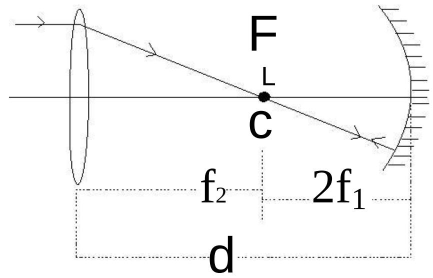
37. A concave mirror of focal length 'f_1' is placeed at a distance of 'd' from a convex lens of focal length 'f_2' A beam of light coming from infinity and falling on this convex lens- concave mirror combination returns to infinity. The dsitance 'd' must equal

(1) $2f_1 + f_2$ (2) $-2f_1 + f_2$

(3) $f_1 + f_2$ (4) $-f_1 + f_2$

Ans.[1]

Sol.



38. When a biconves lens of glass having refractive index 1.47 is dipped in a liqud, it acts as a plane sheet of glass. This implies that the liquid must have refractive index.

(1) greater than that of glass

(2) less than that of glass

(3) equal to that of glass

(4) less than one

Ans.[3]

Sol. $\frac{1}{f} = \left(\frac{\mu_2}{\mu_1} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

For power $= \frac{1}{f} = 0$, $\mu_2 = \mu_1$

39. An α-particle moves in a circular path of radius 0.83 cm in the presence of a magnetic field of 0.25 Wb/m^2. The de-Broglie wavelength associated with the particle will be

(1) 10Å (2) 0.01 Å

(3) 1 Å (4) 0.1 Å

Ans.[2]

Sol. radius $R = \frac{mv}{qB}$ and de- Broglie wavelength $\lambda = \frac{h}{mv}$ on solving we get $\lambda = 0.01$Å

40. Monochromatic radiation emitted when electron on hydrogen atom jumps from first excited to the ground state irradiates a photosensitive material. The stopping potential is measured to be 3.57 V. The threshold frequency of the material is

(1) 1.6×10^{15} Hz (2) 2.5×10^{15} Hz

(3) $4. \times 10^{15}$ Hz (4) 5×10^{15} Hz

Ans.[1]

Sol. Energy released from emmition of electron is E = (– 3.4) –(–13.6) = 10.2 eV.

From photo-electric equation, work function $\varphi = E - eV_0 = h\upsilon_0$

On Solving this $\upsilon_0 = 1.6 \times 10^{15}$ Hz

41. A 200 W sodium street lamp emits yellow light of wavelength 0.6 μm. Assuming it to be 25% efficient in converting electrical energy to light, the number of photons of yellow light it emits per second is .

(1) 62×10^{20} (2) 3×10^{19}

(3) 1.5×10^{20} (4) 6×10^{18}

Ans.[3]

Sol. Efficient power $P = \frac{N}{t} \times \frac{hc}{\lambda} = 200 \times 0.25$

' On Solving $\frac{N}{t} = 50 \times \frac{\lambda}{hc} = 1.5 \times 10^{20}$

42. Electron in hydrogen atom first jumps from third excited state to second excited state and then from second excited to the first excited state. The ratio of the wavelengths $\lambda_1 : \lambda_2$ emitted in the two cases is

(1) 27/5 (2) 20/7

(3) 7/5 (4) 27/20

Ans.[2]

Sol. Wavelength observed from transition of n_i to n_f is $\lambda = \frac{1}{\frac{1}{n_f^2} - \frac{1}{n_i^2}}$

For λ_1, $n_i = 4$, $n_f = 3$

For λ_2, $n_i = 3$, $n_f = 2$

We get

$\lambda_1 : \lambda_2 = 20 : 7$

43. An electron of a stationary hydrogen atom passes from the fifth energy level to the ground level. The velocity that the atom acquired as a result of photon emission will be

(1) $\frac{25m}{24h\,R}$ (2) $\frac{24m}{24h\,R}$

(3) $\frac{24m}{25h\,R}$ (4) $\frac{25m}{24h\,R}$

Ans.[3]

Sol. Wavelength observed from transition of n_i to n_f is $\lambda = \frac{1}{\frac{1}{n_f^2} - \frac{1}{n_i^2}}$

$n_i = 5$ $n_f = 1$

Also. $v = \frac{h}{\lambda m}$.

44. If the nuclear radius of ^{27}Al is 3.6 Fermi, the approximate nuclear radius of ^{64}Cu in Fermi is

(1) 4.8 (2) 3.6

(3) 2.4 (4) 1.2

Ans.[1]

Sol. Nuclear radius $R \propto A^{1/3}$ where A is mass number

45. A mixture consists of two radioactive materials A_1 and A_2 with half lives of 20 s and 10s respectively. Initially the mixture has 40 g of A_1 and 160 g of A_2. The amount of the two in the mixture will become equal after :

(1) 20 s (2) 40 s

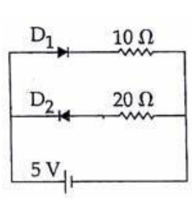
(3) 60 s (4) 80 s

Ans.[2]

Sol. For A, 40g $\xrightarrow{20s}$ 20g $\xrightarrow{20s}$ 10g

For B, 160g $\xrightarrow{10s}$ 80g $\xrightarrow{10s}$ 40g $\xrightarrow{10s}$ 20g $\xrightarrow{10s}$ 10g

46. Two ideal diodes are connected to a battery as shown in the circuit. The current supplied by the battery is



(1) 0.25 A (2) 0.5 A

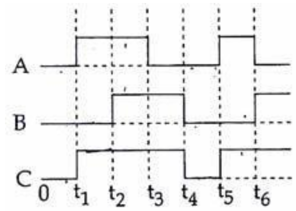
(3) 0. 75 A (4) Zero

Ans.[2]

Sol. Current will flow only in diode D_1 therefore current supplied by the battery is 0.5 A

Since D_1 is forward bias and D_2 is reverse bias.

47. The figure shown a logic circuit with two inputs A and B and the output C. The voltage wave farms across A, B and C are given. The logic circuit gate is



(1) AND gate (2) NAND gate

(3) OR gate (4) NOR gate

Ans.[3]

Sol. The Logic of the OR gate is if any of the input is one then output is one".

48. In a CE transistor amplifier, the audio singal voltage across the collector resistance of 2kΩ is 2V. If the v base resistance is 1 kΩ and the current amplification of the transistor is 100, the input signal voltage is

(1) 1 mV (2) 10 mV

(3) 0.1 V (4) 1.0 V

Ans.[2]

Sol. Voltage amplification $\frac{Vo}{Vi}$ = current gain × $\frac{Ro}{Ri}$.

49. C and Si both have same lattice structure, having 4 bonding electrons in each. However, C is insulator where as Si is intrinsic semiconductor. This is because.

(1) The four bonding electrons in the case of C lie in the second orbit, whereas in the case of Si they lie in the third.

(2) The four bonding electrons in the case of C lie in the third orbit, whereas for Si they lie in the fourth orbit.

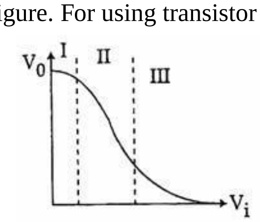
(3) In case of C the valence band is not completely filled at absolute zero temperature.

(4) In case of C the conduction bans is partly filled even at absolute zero temperature

Ans.[1]

Sol. The four bonding electrons in the case of C lie in the second orbit, whereas in the case of Si they lie in the third.

50. Transfer characteristics [output voltage (V_0) vs input voltage (V_i)] for a base biased transistor in CE configuration is as show in the figure. For using transistor as a switch, it is used.



(1) in region II (2) in region I

(3) in region III (4) both in region (I) and (III)

Ans.[4]

Sol. For using transistor as a switch, it is used in cut off state and saturation state only.