PHYSICS

AIPMT 2008 Examination Paper Solutions

1. Which two of the following five physical parameters have the same dimensions?
(a) energy density
(b) refractive index
(c) dielectric constant
(d) Young's modulus
(e) magnetic field

(1) (a) and (e)
(2) (b) and (d)
(3) (c) and (e)
(4) (a) and (d)

Sol. Answer (4)
Energy density and Young's modulus have same dimensional formula.

2. If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be
(1) 2%
(2) 4%
(3) 6%
(4) 8%

Sol. Answer (3)
$\frac{\Delta V}{V} = \frac{3\Delta R}{R}$

3. The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3}\ \text{ms}^{-2}$, in the third second is
(1) $\frac{19}{3}\text{m}$
(2) 6 m
(3) 4 m
(4) $\frac{10}{3}\text{m}$

Sol. Answer (4)
$S_{n\ th} = u + \frac{a}{2}(2n-1)$

4. A particle moves in a straight line with a constant acceleration. It changes its velocity from 10 ms^{-1} to 20 ms^{-1} while passing through a distance 135 m in t second. The value of t is

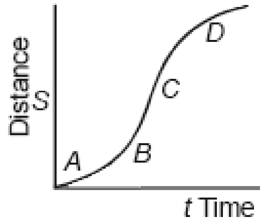
(1) 9
(2) 10
(3) 1.8
(4) 12

Sol. Answer (1)

$a = \frac{V_f^2 - V_i^2}{2S}$, $t = \frac{V_f - V_i}{a}$

or $S = \frac{1}{2}(u + v)t$

5. A particle shows distance-time curve as given in this figure. The maximum instantaneous velocity of the particle is around the point



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

Sol. Answer (3)
Maximum slope is at C.

6. A particle of mass m is projected with velocity *v* making an angle of 45^o with the horizontal. When the particle lands on the level ground the magnitude of the change in its momentum will be
(1) zero
(2) 2 m*v*
(3) $mv/\sqrt{2}$
(4) $mv\sqrt{2}$

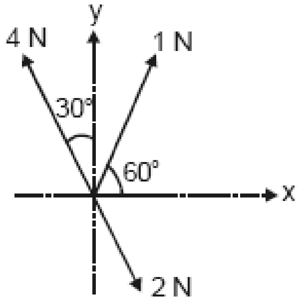
Sol. Answer (4)
Momentum change = 2mv sinθ

7. Sand is being dropped on a conveyor belt at the rate of M kg/s. The force necessary to keep the belt moving with a constant velocity of *v* m/s will be
(1) Zero
(2) M*v* newton
(3) 2 M*v* newton
(4) $\frac{Mv}{2}$ newton

Sol. Answer (2)

Force = $v\frac{du}{dt} = Mv$

8. Three forces acting on a body are shown in the figure. To have the resultant force only along the y-direction, the magnitude of the minimum additional force needed is



(1) $\sqrt{3}$ N
(2) 0.5 N
(3) 1.5 N
(4) $\frac{\sqrt{3}}{4}$N

Sol. Answer (2)

Net force along x-axis zero.

Let the unknown force be F along x-axis

$\therefore\ F + 1\sin 30° + 2\sin 30° - 4\sin 30° = 0$

$\therefore\ |F| = 0.5\ N$

9. Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional forces are 10% of energy. How much power is generated by the turbine? (g = 10 m/s^2)
(1) 7.0 kW
(2) 8.1 kW
(3) 10.2 kW
(4) 12.3 kW

Sol. Answer (2)

$P = 0.9\ gH\ \frac{dm}{dt}$

10. A shell of mass 200 gm is ejected from a gun of mass 4 kg by an explosion that generates 1.05 kJ of energy. The initial velocity of the shell is
(1) 120 ms^{-1}
(2) 100 ms^{-1}
(3) 80 ms^{-1}
(4) 40 ms^{-1}

Sol. Answer (2)

Let the initial velocity of the shell be v, then velocity of gun is $\left(\frac{0.2v}{4}\right)$. (from conservation of linar moment)

Now $1.05 \times 10^3 = \frac{1}{2}(0.2)v^2 + \frac{1}{2}(4)\left(\frac{0.2v}{4}\right)^2 \Rightarrow v = 100$ m/s

11. The ratio of the radii of gyration of a circular disc to that of a circular ring, each of same mass and radius, around their respective axes is

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

(2) $\sqrt{3}:\sqrt{2}$

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

(4) $\sqrt{2}:1$

Sol. Answer (3)

$$\frac{I_{disc}}{I_{ring}} = \frac{MR^2/2}{MR^2} = \frac{MK_{disc}^2}{MK_{ring}^2}$$

$$\Rightarrow \frac{K_{disc}}{K_{ring}} = \frac{1}{\sqrt{2}}$$

12. A thin rod of length L and mass M is bent at its midpoint into two halves so that the angle between them is 90^o. The moment of inertia of the bent rod about an axis passing through the bending point and perpendicular to the plane defined by the two halves of the rod is

(1) $\frac{\sqrt{2}ML^2}{24}$

(2) $\frac{ML^2}{24}$

(3) $\frac{ML^2}{12}$

(4) $\frac{ML^2}{6}$

Sol. Answer (3)

Distribution of masses about axis of rotation remain unchanged whether it is straight or bend.

$$I = \frac{ML^2}{12}$$

13. A roller coaster is designed such that riders experience "weightlessness" as they go round the top of a hill whose radius of curvature is 20 m. The speed of the car at the top of the hill is between

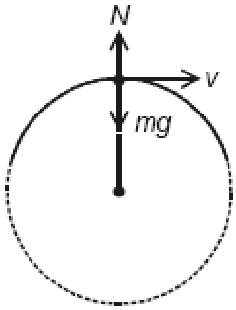
(1) 13 m/s and 14 m/s

(2) 14 m/s and 15 m/s

(3) 15 ms/ and 16 m/s

(4) 16 m/s and 17 m/s

Sol. Answer (2)



Actually, $mg - N = \frac{mv^2}{r}$

For weightlessness, $N = 0$

$\therefore \quad mg = \frac{mv^2}{r}$

$v = \sqrt{gr}$

$= \sqrt{10 \times 20}\ ms^{-1} = 14.14\ \text{ms}^{-1}$

14. If Q, E and W denote respectively the heat added, change in internal energy and the work done in a closed cycle process, then
(1) Q = 0
(2) W = 0
(3) Q = W = 0
(4) E = 0

Sol. Answer (4)
From the 1st law of thermodynamics,
Q = E + W
For cyclic process, $E = 0$, $\therefore\ Q = W \neq 0$

15. On a new scale of temperature (which is linear) and called the W scale, the freezing and boiling points of water are 39^o W and 239^o W respectively. What will be the temperature on the new scale, corresponding to a temperature of 39^o C on the Celsius scale?
(1) 139^o W
(2) 78^o W
(3) 117^o W
(4) 200^o W

Sol. Answer (3)
$\frac{39 - 0}{100 - 0} = \frac{x - 39}{239 - 39}$

$\Rightarrow \quad x = 117°\ W$

16. At 10^oC the value of the density of a fixed mass of an ideal gas divided by its pressure is x. At 110^oC this ratio is

(1) $\frac{283}{383}x$
(2) x
(3) $\frac{383}{283}x$
(4) $\frac{10}{110}x$

Sol. Answer (1)

$PV = nRT$

$$\Rightarrow \quad P.\frac{m}{\rho} = \frac{m}{M}RT$$

$$\Rightarrow \quad \frac{\left(\frac{\rho}{P}\right)_f}{\left(\frac{\rho}{P}\right)_i} = \frac{T_i}{T_f} = \frac{10+273}{110+273} = \frac{283}{383}$$

$$\Rightarrow \quad \frac{\left(\frac{\rho}{P}\right)_f}{x} = \frac{283}{383}$$

$$\therefore \quad \left(\frac{\rho}{P}\right)_f = \frac{283}{383}x$$

17. Two Simple Harmonic Motions of angular frequency 100 and 1000 rad s^{-1} have the same displacement amplitude. The ratio of their maximum accelerations is
(1) $1 : 10^4$
(2) 1 : 10
(3) $1 : 10^2$
(4) $1 : 10^3$

Sol. Answer (3)

$$\frac{(a_{max})_1}{(a_{max})_2} = \frac{\omega_1^2 A}{\omega_2^2 A} = \left(\frac{100}{1000}\right)^2 = \frac{1}{10^2}$$

18. The wave described by $y = 0.25\sin(10\pi x - 2\pi t)$, where x and y are in meters and t in seconds, is a wave travelling along the
(1) -ve x direction with amplitude 0.25 m and wavelength λ= 0.2 m
(2) -ve x direction with frequency 1 Hz
(3) +ve x direction with frequency π Hz and wavelength λ= 0.2 m
(4) +ve x direction with frequency 1 Hz and wavelength λ= 0.2 m

Sol. Answer (4)

Give, $y = 0.25 \sin(10\pi x - 2\pi t)$

Comparing with $y = A \sin\left(\frac{2\pi}{\lambda}.x - 2\pi nt\right)$, we get,

$\lambda = 0.2$ m

$n = 1$ Hz, –ve sign indicates, the x direction.

19. A point performs simple harmonic oscillation of period T and the equation of motion is given by x = a sin(wt + π/6). After the elapse of what fraction of the time period the velocity of the point will be equal to half of its maximum velocity?

(1) $\frac{T}{12}$

(2) $\frac{T}{8}$

(3) $\frac{T}{6}$

(4) $\frac{T}{3}$

Sol. Answer (1)

$v = \omega a \cos\left(\omega t + \frac{\pi}{6}\right)$

$\Rightarrow \quad \frac{\omega a}{2} = \omega a \cos\left(\frac{2\pi}{T}t + \frac{\pi}{6}\right)$

$\Rightarrow \quad \frac{\pi}{3} = \frac{2\pi}{T}t + \frac{\pi}{6}$

$\Rightarrow \quad t = \frac{T}{12}$

20. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 sec and the velocity of the wave is 300 m/sec. What is the phase difference between the oscillations of two points?

(1) $\frac{\pi}{6}$

(2) $\frac{\pi}{3}$

(3) $\frac{2\pi}{3}$

(4) π

Sol. Answer (3)

Phase difference $\phi = \frac{2\pi}{\lambda} \times$ path difference

$= \frac{2\pi}{15} \times (15 - 10) \qquad \{\lambda = vT = 300 \times 0.05 \text{ m}\}$

$= \frac{2\pi}{5}$

21. The velocity of electromagnetic radiation in a medium of permittivity ϵ_0 and permeability μ_0 is given by

(1) $\sqrt{\frac{\mu_0}{\varepsilon_0}}$

(2) $\sqrt{\frac{\varepsilon_0}{\mu_0}}$

(3) $\sqrt{\mu_0 \varepsilon_0}$

(4) $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$

Sol. Answer (4)

$v = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$

22. Two periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is

(1) $2(I_1 + I_2)$

(2) $I_1 + I_2$

(3) $(\sqrt{I_1} + \sqrt{I_2})^2$

(4) $(\sqrt{I_1} - \sqrt{I_2})^2$

Sol. Answer (1)

$I_{max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$

$I_{min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2$

$\therefore \quad I_{max} + I_{min} = 2\,(I_1 + I_2)$

23. Two thin lenses of focal lengths f_1 and f_2 are in contact and coaxial. The power of the combinations is

(1) $\frac{f_1 + f_2}{f_1 f_2}$

(2) $\sqrt{\frac{f_1}{f_2}}$

(3) $\sqrt{\frac{f_2}{f_1}}$

(4) $\frac{f_1 + f_2}{2}$

Sol. Answer (1)

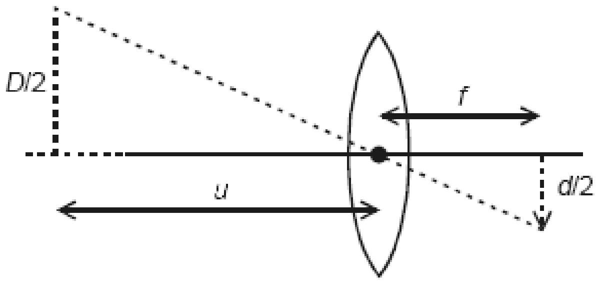
$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$\Rightarrow \quad P = \frac{f_1 + f_2}{f_1 f_2}$$

24. A boy is trying to start a fire by focusing Sunlight on a piece of paper using an equiconvex lens of focal length 10 cm. The diameter of the Sun is 1.39×10^9 m and its mean distance from the earth is 1.5×10^{11} m. What is the diameter of the Sun's image on the paper?

(1) 12.4×10^{-4} m
(2) 9.2×10^{-4} m
(3) 6.5×10^{-4} m
(4) 6.5×10^{-5} m

Sol. Answer (2)



Here, $\frac{D/2}{u} = \frac{d/2}{f}$

$$\Rightarrow \quad d = \frac{Df}{u}$$

$$= \frac{1.39 \times 10^9 \times 10 \times 10^{-2}}{1.5 \times 10^{11}} = 9.2 \times 10^{-4} \text{ m}$$

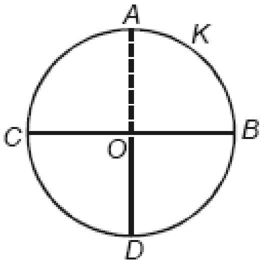
25. The energy required to charge a parallel plate condenser of plate separation d and plate area of cross-section A such that the uniform electric field between the plates is E, is

(1) $\frac{1}{2}\varepsilon_0 E^2 Ad$
(2) $\frac{1}{2}\varepsilon_0 E^2 / A.d$
(3) $\varepsilon_0 E^2 / Ad$
(4) $\varepsilon_0 E^2 Ad$

Sol. Answer (1)

Energy required = $\frac{1}{2}CV^2 = \frac{1}{2}\varepsilon_0 E^2 Ad$

26. A thin conducting ring of radius R is given a charge +Q. The electric field at the centre O of the ring due to the charge on the part AKB of the ring is E. The electric field at the centre due to the charge on the part ACDB of the ring is



(1) 3 E along OK
(2) 3 E along KO
(3) E along OK
(4) E along KO

Sol. Answer (3)

$$\vec{E}_0 = 0$$

$$\vec{E}_{AKB} + \vec{E}_{ACDB} = 0$$

$$\Rightarrow \quad \vec{E}_{ACDB} = (-)\vec{E}_{AKB}$$

$$= -E \text{ (along } KO)$$

$$= E \text{ (along } OK)$$

27. The electric potential at a point in free space due to a charge Q coulomb is Q × 10^{11} volts. The electric field at that point is

(1) $12\pi\varepsilon_0 Q\times 10^{22}$ volt/m
(2) $4\pi\varepsilon_0 Q\times 10^{22}$ volt/m
(3) $12\pi\varepsilon_0 Q\times 10^{20}$ volt/m
(4) $4\pi\varepsilon_0 Q\times 10^{20}$ volt/m

Sol. Answer (2)

$$V = \frac{1}{4\pi\varepsilon_0}\cdot\frac{Q}{R} = Q \times 10^{11} \text{ volt} \qquad \text{...(i)}$$

$$E = \frac{1}{4\pi\varepsilon_0}\cdot\frac{Q}{R^2} = \frac{V}{R} = Q \times 10^{11} \times 4\pi\varepsilon_0 \times 10^{11} \text{ [from ...(i)]}$$

$$= 4\pi\varepsilon_0 Q \times 10^{22} \text{ volt/m}$$

28. A cell can be balanced against 110 cm and 100 cm of potentiometer wire, respectively with and without being short circuited through a resistance of 10 Ω. Its internal resistance is

(1) Zero

(2) 1.0 ohm
(3) 0.5 ohm
(4) 2.0 ohm

Sol. Answer (2)

$$\text{Internal resistance} = \left(\frac{110}{100} - 1\right) \times 10\Omega$$

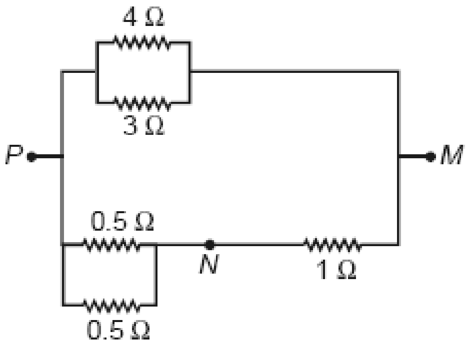
29. A wire of a certain material is stretched slowly by ten per cent. It new resistance and specific resistance become respectively
(1) 1.1 times, 1.1 times
(2) 1.2 times, 1.1 times
(3) 1.21 times, same
(4) Both remain the same

Sol. Answer (3)

$$\frac{R_2}{R_1} = \left(\frac{l_2}{l_1}\right)^2 = \left(\frac{1.1 l_1}{l_1}\right)^2 = 1.21$$

$R_2 = 1.21\, R$

30. In the circuit shown, the current through the 4 Ω resistor is 1 amp when the points P and M are connected to a d.c. voltage source. The potential difference between the points M and N is



(1) 3.2 volt
(2) 1.5 volt
(3) 1.0 volt
(4) 0.5 volt

Sol. Answer (1)

Potential difference between P and M = 1 × 4 = 4 volt

$$\text{Potential drop between points } M \text{ and } N = \frac{4 \times 1}{1 + 0.25} = 3.2\text{ V}$$

31. An electric kettle takes 4A current at 220 V. How much time will it take to boil 1 kg of water from temperature 20°C? The temperature of boiling water is 100°C.
(1) 4.2 min
(2) 6.3 min
(3) 8.4 min

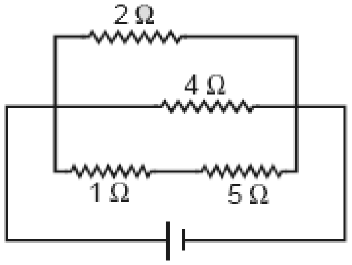
(4) 12.6 min

Sol. Answer (2)

$Vi\,t = mc\Delta\theta$

$t = \frac{1 \times 4200 \times 80}{220 \times 4} = 381.8 \text{ s} = 6.36 \text{ min}$

32. A current of 3 amp. flows through the 2 Ω resistor shown in the circuit. The power dissipated in the 5 Ω resistor is



(1) 5 watt
(2) 4 watt
(3) 2 watt
(4) 1 watt

Sol. Answer (1)

Potential difference across 2Ω = 6V

Current through 5Ω = $\frac{6}{6}$ = 1A

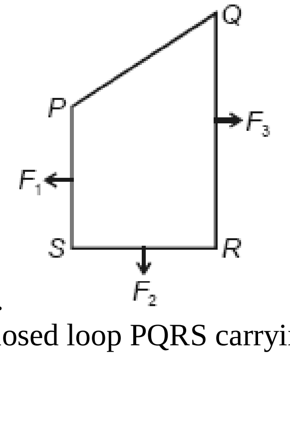
Power dissipated in 5Ω = $(1)^2 \times 5$ = 5 Watt

33. A particle of mass m, charge Q and kinetic energy T enters a transverse uniform magnetic field of induction $\vec{B}$. After 3 seconds the kinetic energy of the particle will be

(1) 4 T
(2) 3 T
(3) 2 T
(4) T

Sol. Answer (4)

Work done by magnetic field on charge particle is zero. Therefore its kinetic energy will be same i.e. T



34.

A closed loop PQRS carrying a current is placed in a uniform magnetic field. If the magnetic forces on segments PS, SR and RQ are F_1, F_2 and F_3 respectively and are in the plane of the paper and along the directions shown, the force on the segment QP is

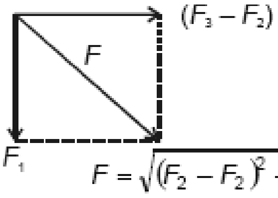
(1) $F_3 - F_1 + F_2$

(2) $F_3 - F_1 - F_2$

(3) $\sqrt{(F_3 - F_1)^2 + F_2^2}$

(4) $\sqrt{(F_3 - F_1)^2 - F_2^2}$

Sol. Answer (3)



$F = \sqrt{(F_2 - F_2)^2 + F_1^2}$

Since net force on current carrying loop in uniform magnetic field is zero therefore force on remaining segment will be equal and oppsoite to F.

35. A circular disc of radius 0.2 meter is placed in a uniform magnetic field of induction $\frac{1}{\pi}\left(\frac{\omega b}{m^2}\right)$ in such a way that its axis makes an angle of 60° with $\vec{B}$. The magnetic flux linked with the disc is

(1) $0.01\ \omega b$

(2) $0.02\ \omega b$

(3) $0.06\ \omega b$

(4) $0.08\ \omega b$

Sol. Answer (2)

$\text{Magnetic flux} = BA\cos\theta = \frac{1}{\pi} \times \pi(0.2)^2 \times \cos 60°$

$= 0.04 \times \frac{1}{2} = 0.02\ \text{wb}$

36. A galvanometer of resistance 50 Ω is connected to a battery of 3 V along with a resistance of 2950 Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 divisions, the resistance in series should be

(1) 4450 Ω

(2) 5050 Ω

(3) 5550 Ω

(4) 6050 Ω

Sol. Answer (1)

$$30\, i_0 = \frac{V}{R_g + 2950};\ R_g = 50\Omega$$

$$20\, i_0 = \frac{V}{R_g + R} \Rightarrow R = 4450\Omega$$

37. Curie temperature is the temperature above which
(1) Ferromagnetic material becomes diamagnetic material
(2) Ferromagnetic material becomes paramagnetic material
(3) Paramagnetic material becomes diamagnetic material
(4) Paramagnetic material becomes ferromagnetic material

Sol. Answer (2)
Above curie temperature domains break down, hence ferromagnetic substances become paramagnetic.

38. A long solenoid has 500 turns. When a current of 2 ampere is passed through it, the resulting magnetic flux linked with each turn of the solenoid is 4×10^{-3} ωb. The self-inductance of the solenoid is
(1) 4.0 henry
(2) 2.5 henry
(3) 2.0 henry
(4) 1.0 henry

Sol. Answer (4)

$N\phi = Li$

$500 \times 4 \times 10^{-3} = 2L$

$L = 1.0$ henry

39. In an a.c. circuit the e.m.f. (e) and the current (i) at any instant are given respectively by

$e = E_0 \sin \omega t$

$i = I_0 \sin(\omega t - \phi)$

The average power in the circuit over one cycle of a.c. is
(1) E_0I_0
(2) $\frac{E_0I_0}{2}$
(3) $\frac{E_0I_0}{2}\sin\phi$
(4) $\frac{E_0I_0}{2}\cos\phi$

Sol. Answer (4)
Since phase difference between current and e.m.f is ϕ

$$\therefore\ P_{av} = \frac{E_0I_0}{2}\cos\phi$$

40. In the phenomenon of electric discharge through gases at low pressure, the coloured glow in the tube appears as a result of

(1) Collision between different electrons of the atoms of the gas
(2) Excitation of electrons in the atoms
(3) Collision between the atoms of the gas
(4) Collisions between the charged particles emitted from the cathode and the atoms of the gas

Sol. Answer (2)
Due to excitation of electrons in atoms.
41. The work function of a surface of a photosensitive material is 6.2 eV. The wavelength of the incident radiation for which the stopping potential is 5 V lies in the
(1) X-ray region
(2) Ultraviolet region
(3) Visible region
(4) Infrared region

Sol. Answer (2)

$$eV_0 = E - \phi$$

$$E = eV_0 + \phi$$

$$= 5eV + 6.2\ eV$$

$$= 11.2\ eV$$

$$\therefore \quad \lambda = \left(\frac{12400}{11.2}\right) Å \approx 1000\ Å$$

$\Rightarrow$ hence lies in ultraviolet region.
42. A particle of mass 1 mg has the same wavelength as an electron moving with a velocity of 3 × 106 ms^{-1}. The velocity of the particle is (mass of electron = 9.1×10^{-31} kg)
(1) 2.7×10^{-21} ms^{-1}
(2) 2.7×10^{-18} ms^{-1}
(3) 9×10^{-2} ms^{-1}
(4) 3×10^{-31} ms^{-1}

Sol. Answer (2)
Same momentum of both particles

$$1 \times 10^{-3} \times v = 9 \times 10^{-31} \times 3 \times 10^{6}$$

$$v = 2.7 \times 10^{-18}\ m/s$$

43. The ground state energy of hydrogen atom is -13.6 eV. When its electron is in the first excited state, its excitation energy is
(1) 0
(2) 3.4 eV
(3) 6.8 eV
(4) 10.2 eV

Sol. Answer (4)
Excitation energy = $E_f - E_i$
= -3.4 - (-13.6) = 10.2 eV

44. Two radioactive materials X_1 and X_2 have decay constants 5λ and λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be $\frac{1}{e}$ after a time

(1) $\frac{e}{\lambda}$

(2) λ

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

(4) $\frac{1}{4\lambda}$

Sol. Answer (4)

$$\frac{N_{x_1}}{N_{x_2}} = \frac{e^{-5\lambda t}}{e^{-\lambda t}} = \frac{1}{e}$$

$$\Rightarrow \quad t = \frac{1}{4\lambda}$$

45. Two nuclei have their mass numbers in the ratio of 1:3. The ratio of their nuclear densities would be

(1) 1 : 1

(2) 1 : 3

(3) 3 : 1

(4) $(3)^{1/3}$: 1

Sol. Answer (1)

Density is independent of mass number of nuclei.

46. If M(A; Z), M_p and M_n denote the masses of the nucleus $^{A}_{Z}X$, proton and neutron respectively in units of u (1u = 931.5 MeV / C^2) and BE represents its bonding energy in MeV, then

(1) $M(A, Z) = ZM_p + (A - Z)\, M_n + BE / C^2$

(2) $M(A, Z) = ZM_p + (A - Z)\, M_n - BE / C^2$

(3) $M(A, Z) = ZM_p + (A - Z)\, M_n + BE$

(4) $M(A, Z) = ZM_p + (A - Z)\, M_n - BE$

Sol. Answer (2)

$BE = [ZM_p + (A - Z)\, M_n - M(A, Z)]C^2$

47. The voltage gain of an amplifier with 9% negative feedback is 10. The voltage gain without feedback will be

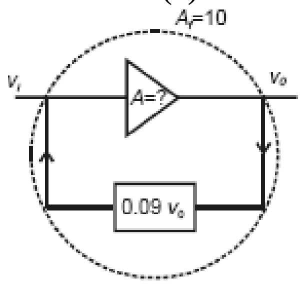
(1) 100

(2) 90

(3) 10

(4) 1.25

Sol. Answer (1)



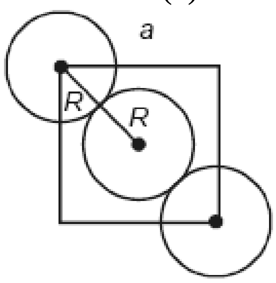
Given $\frac{v_0}{v_i} = 10$

and $(v_i - 0.09\, v_0)\, A = v_0$

$\Rightarrow$ $A = 100$

48. If the lattice parameter for a crystalline structure is 3.6 Å, then the atomic radius in fcc crystal is
(1) 1.27 Å
(2) 1.81 Å
(3) 2.10 Å
(4) 2.92 Å

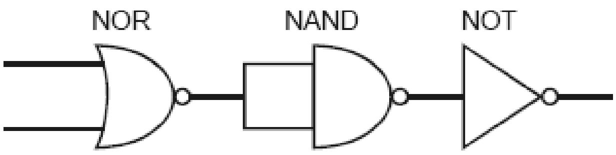
Sol. Answer (1)



$2R = \frac{a}{\sqrt{2}}$

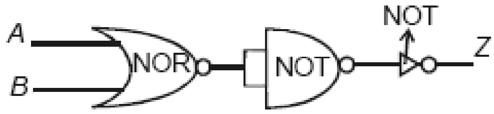
$\therefore\ R = \frac{a}{2\sqrt{2}}$

49. The circuit



is equivalent to
(1) OR gate
(2) AND gate
(3) NAND gate
(4) NOR gate

Sol. Answer (4)



A	B	Z
0	0	1
0	1	0
1	0	0
1	1	0

Hence NOR gate

50. A p-n photodiode is made of a material with a band gap of 2.0 eV. The minimum frequency of the radiation that can be absorbed by the material is nearly

(1) 20×10^{14} Hz
(2) 10×10^{14} Hz
(3) 5×10^{14} Hz
(4) 1×10^{14} Hz

Sol. Answer (3)

$\nu = \frac{E}{h} = 5 \times 10^{14}$ Hz

51. If uncertainty in position and momentum are equal, then uncertainty in velocity is

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

Sol. Answer (2)

$\Delta x = \Delta p$

$\Delta p^2 = \frac{h}{4\pi}$

or $\Delta p = \frac{1}{2}\sqrt{\frac{h}{\pi}}$

or $m\Delta v = \frac{1}{2}\sqrt{\frac{h}{\pi}}$

or $\Delta v = \frac{1}{2m}\sqrt{\frac{h}{\pi}}$

52. If a gas expands at constant temperature, it indicates that

(1) Number of the molecules of gas increases
(2) Kinetic energy of molecules decreases
(3) Pressure of the gas increases
(4) Kinetic energy of molecules remains the same

Sol. Answer (4)
Kinetic energy of gaseous molecules depends on temperature only.

53. The value of equilibrium constant of the reaction

$HI(g) \rightleftharpoons \frac{1}{2}H_2(g) + \frac{1}{2}I_2$ is 8.0

The equilibrium constant of the reaction $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ will be

(1) $\frac{1}{8}$
(2) $\frac{1}{16}$
(3) $\frac{1}{64}$
(4) 16

Sol. Answer (3)

$HI \rightleftharpoons \frac{1}{2}H_2 + \frac{1}{2}I_2, K_1 = 8.0$

or $2HI \rightleftharpoons H_2 + I_2, K_2 = 64$

or $H_2 + I_2 \rightleftharpoons 2HI, K_3 = \frac{1}{64}$

54. If 'a' stands for the edge length of the cubic systems : simple cubic, body centred cubic and face centred cubic, then the ratio of radii of the spheres in these systems will be respectively

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

Sol. Answer (2)

For simple cube, a = 2r

or $r = \frac{a}{2}$

For BCC, $4r = \sqrt{3}a$

or $r = \frac{\sqrt{3}}{4}a$

For FCC, $4r = \sqrt{2}a$

or $r = \frac{a}{2\sqrt{2}}$

Thus, the ratio is $\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a$

55. Kohlrausch's law states that at
(1) Infinite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte
(2) Finite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte
(3) Infinite dilution each ion makes definite contribution to equivalent conductance of an electrolyte depending on the nature of the other ion of the electrolyte
(4) Infinite dilution, each ion makes definite contribution to conductance of an electrolyte whatever be the nature of the other ion of the electrolyte

Sol. Answer (1)
Kohlrausch's law states, "at infinite dilution each ion contributes its fixed value towards equivalent conductance irrespective of the other ion in combination with it at fixed temperature."

56. The measurement of the electron position is associated with an uncertainty in momentum, which is equal to 1×10^{-18} g cm s^{-1}. The uncertainty in electron velocity is, (mass of an electron is 9×10^{-28} g)
(1) 1×10^{11} cm s^{-1}
(2) 1×10^{9} cm s^{-1}
(3) 1×10^{6} cm s^{-1}
(4) 1×10^{5} cm s^{-1}

Sol. Answer (2)
$\Delta p = 1 \times 10^{-18}$ g cm s^{-1}
or $\Delta p = m\Delta v$

or $\Delta v = \frac{\Delta p}{m} = \frac{1 \times 10^{-18}}{9 \times 10^{-28}} \simeq 1 \times 10^{9}$ cm/second

57. Which of the following are not state functions?
(I) q + w
(II) q

(III) w
(IV) H-TS
(1) (II) and (III)
(2) (I) and (IV)
(3) (II), (III) and (IV)
(4) (I), (II) and (III)

Sol. Answer (1)

$\Delta U = q + w$

$\Delta G = \Delta H - T\Delta S$

ΔU and ΔG are state functions but q and w are not state functions.