NEET-UG 2013

PHYSICS

1. In an experiment four quantities *a*, *b*, *c* and *d* are measured with percentage error 1%, 2%, 3% and 4% respectively. Quantity *P* is calculated as follows : $P=\frac{a^3b^2}{cd}$

% error in *P* is

(1) 14%
(2) 10%
(3) 7%
(4) 4%

Solution:

$$P=\frac{a^3b^2}{cd}$$

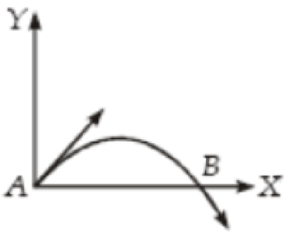
$$\Rightarrow \frac{\Delta P}{P}\times 100=3\left(\frac{\Delta a}{a}\times 100\right)+2\left(\frac{\Delta b}{b}\times 100\right)+\left(\frac{\Delta c}{c}+100\right)+\left(\frac{\Delta d}{d}\times 100\right)$$

$$=3\times 1+2\times 2+3+4$$

$$=3+4+3+4=14\%$$

Hence, the correct option is (4).

2. The velocity of a projectile at the initial point *A* is $(2\hat{i}+3\hat{j})$ m/s. Its velocity (in m/s) at point *B* is



(1) $-2\hat{i}-3\hat{j}$
(2) $-2\hat{i}+3\hat{j}$
(3) $2\hat{i}-3\hat{j}$
(4) $2\hat{i}+3\hat{j}$

Solution:

X component remain unchanged and *Y* component reverses.

Hence, the correct option is (3).

3. A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is

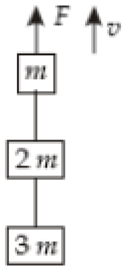
(1) $h_1=2h_2=3h_3$
(2) $h_1=\frac{h_2}{3}=\frac{h_3}{5}$
(3) $h_2=3h_1$ and $h_3=3h_2$
(4) $h_1=h_2=h_3$

Solution:

$h_1:h_2:h_3=1:3:5$

Hence, the correct option is (2).

4. Three blocks with masses *m*, 2*m* and 3*m* are connected by strings, as shown in the figure. After an upward force *F* is applied on block *m*, the masses move upward at constant speed *v*. What is the net force on the block of mass 2 *m*? (*g* is the acceleration due to gravity)



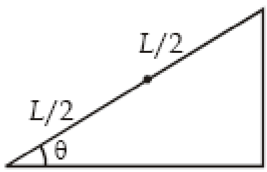
(1) Zero
(2) 2 *mg*
(3) 3 *mg*
(4) 6 *mg*

Solution:
All blocks are moving with constant velocity so net force on all blocks is zero.
Hence, the correct option is (1).

5. The upper half of an inclined plane of inclination θ is perfectly smooth while lower half is rough. A block starting from rest at the top of the plane will again come to rest at the bottom, if the coefficient of friction between the block and lower half of the plane is given by

(1) $\mu = \frac{1}{\tan\theta}$
(2) $\mu = \frac{2}{\tan\theta}$
(3) $\mu = 2\tan\theta$
(4) $\mu = \tan\theta$

Solution:



$$mg\sin\theta \cdot L = \mu mg\cos\theta \times \frac{L}{2}$$

$$\mu = \frac{2\sin\theta}{\cos\theta} = 2\tan\theta$$

Hence, the correct option is (3).

6. A uniform force of $(3\hat{i} + \hat{j})$ newton acts on a particle of mass 2 kg. Hence the particle is displaced from position $(2\hat{i} + \hat{k})$ metre to position $(4\hat{i} + 3\hat{j} - \hat{k})$ metre. The work done by the force on the particle is

(1) 9 J
(2) 6 J
(3) 13 J
(4) 15 J

Solution:
$\vec{F} = 3\hat{i} + \hat{j} \qquad \vec{S} = \vec{r}_2 - \vec{r}_1 = 2\hat{i} + 3\hat{j} - 2\hat{k} \qquad W = \vec{F}\cdot\vec{S} = 6 + 3 + 0 = 9\,\text{J}$
Hence, the correct option is (1).

7. An explosion breaks a rock into three parts in a horizontal plane. Two of them go off at right angles to each other. The first part of mass 1 kg moves with a speed of 12 ms^{-1} and the second part of mass 2 kg moves with 8 ms^{-1} speed. If the third part flies off with 4 ms^{-1} speed, then its mass is

(1) 3 kg
(2) 5 kg
(3) 7 kg
(4) 17 kg

Solution:
$\vec{P}_1 + \vec{P}_2 + \vec{P}_3 = \vec{0}$
$\Rightarrow 1\times 12\hat{i} + 2\times 8\hat{j} + \vec{P}_3 = 0$

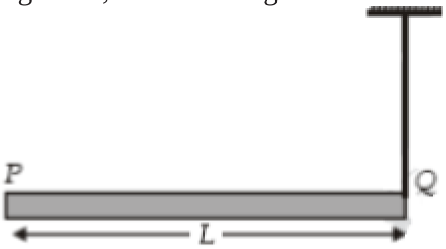
$\vec{P}_3 = -(12\hat{i} + 16\hat{j})$

$P_3 = \sqrt{12^2 + 16^2} = 20 \text{ kg ms}^{-1}$

$m_3 = \frac{P_3}{v_3} = 5\,\text{kg}$

Hence, the correct option is (2).

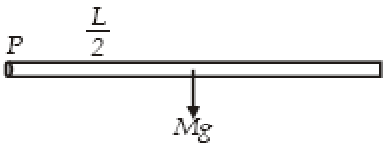
8. A rod PQ of mass M and length L is hinged at end P. The rod is kept horizontal by a massless string tied to point Q as shown in figure. When string is cut, the initial angular acceleration of the rod is



(1) $\frac{3g}{2L}$ (2) $\frac{g}{L}$

(3) $\frac{2g}{L}$ (4) $\frac{2g}{3L}$

Solution:



$Mg\frac{L}{2} = \frac{ML^2}{3}\alpha$

$\alpha = \frac{3g}{2L}$

Hence, the correct option is (1).

9. A small object of uniform density rolls up a curved surface with an initial velocity v. It reaches up to a maximum height of $\frac{3v^2}{4g}$ with respect to the initial position. The object is

(1) Ring (2) Solid sphere

(3) Hollow sphere (4) Disc

Solution:

$v = \sqrt{\frac{2gh}{1 + \frac{k^2}{r^2}}}$

$v^2 = \frac{2g\,3v^2}{4g\left(1 + \frac{k^2}{r^2}\right)}$

$\Rightarrow 1 + \frac{k^2}{r^2} = \frac{3}{2}$

$k^2 = \frac{1}{2}r^2 \rightarrow \text{disc}$

Hence, the correct option is (4).

10. A body of mass '*m*' taken from the earth's surface to the height equal to twice the radius (R) of the earth. The change in potential energy of body will be

(1) $mg2R$

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

(3) $3mgR$

(4) $\frac{1}{3}mgR$

Solution:

$$\Delta u = \frac{mgRh}{R+h} = \frac{mgR2R}{3R} = \frac{2mgR}{3}$$

Hence, the correct option is (2).

11. Infinite number of bodies, each of mass 2 kg are situated on x-axis at distance 1 m, 2 m, 4 m, 8 m, … respectively, from the origin. The resulting gravitational potential due to this system at the origin will be

(1) $-G$

(2) $-\frac{8}{3}G$

(3) $-\frac{4}{3}G$

(4) $-4G$

Solution:

$$V = -2G\left[\frac{1}{1}+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}\cdots\right]$$

$$= -2G\left[1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}\cdots\right]$$

$$= -2G\frac{1}{\left(1-\frac{1}{2}\right)} = -4G$$

Hence, the correct option is (4).

12. The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied?

(1) Length = 50 cm, diameter = 0.5 mm

(2) Length = 100 cm, diameter = 1 mm

(3) Length = 200 cm, diameter = 2 mm

(4) Length = 300 cm, diameter = 3 mm

Solution:

$\Delta L = \frac{FL}{AY}, \frac{L}{A}$ is maximum for option (1).

Hence, the correct option is (1).

13. The wettability of a surface by a liquid depends primarily on

(1) Viscosity

(2) Surface tension

(3) Density

(4) Angle of contact between the surface and the liquid

Solution:

The wettability of a surface by a liquid depends primarily on angle of contact between the surface and the liquid.

Hence, the correct option is (4).

14. The molar specific heats of an ideal gas at constant pressure and volume are denoted by C_p and C_v respectively. If $\gamma = \frac{C_p}{C_v}$ and R is the universal gas constant, then C_v is equal to

(1) $\frac{1+\gamma}{1-\gamma}$

(2) $\frac{R}{(\gamma-1)}$

(3) $\frac{(\gamma-1)}{R}$

(4) γR

Solution:

$$C_v = \frac{R}{\gamma - 1}$$

Hence, the correct option is (2).

15. A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using

(1) Stefan's Law

(2) Wien's displacement Law

(3) Kirchoff's Law

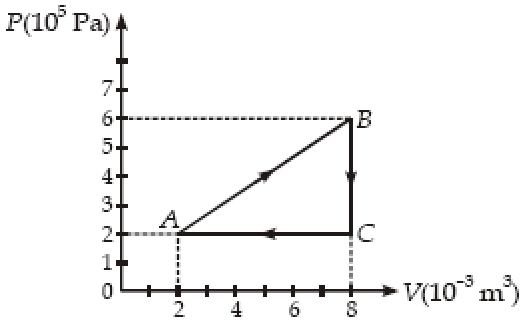
(4) Newton's Law of cooling

Solution:

$\lambda_m T = \text{constant}$

Hence, the correct option is (2).

16. A gas is taken through the cycle $A \rightarrow B \rightarrow C \rightarrow A$, as shown. What is the net work done by the gas?



(1) 2000 J

(2) 1000 J

(3) Zero

(4) –2000 J

Solution:

W = Area enclosed in $P - V$ curve

$$= \frac{1}{2} \times 5 \times 10^{-3} \times 4 \times 10^{5}$$

$$= 10 \times 10^{2}$$

$$= 1000\,\text{J}$$

Hence, the correct option is (2).

17. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its temperature. The ratio of $\frac{C_p}{C_v}$ for the gas is

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

(2) 2

(3) $\frac{5}{3}$

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

Solution:

$P \propto T^3,$

$PV = nRT$

$P \propto T^3$

$P \propto (PV)^3$

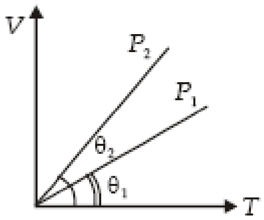
$P^2V^3 = \text{constant}$

$PV^{\frac{3}{2}} = \text{constant}$

$\gamma = \frac{3}{2}$

Hence, the correct option is (4).

18. In the given $(V - T)$ diagram, what is the relation between pressures P_1 and P_2?



(1) $P_2 = P_1$

(2) $P_2 > P_1$

(3) $P_2 < P_1$

(4) Cannot be predicted

Solution:

Slope of the graph $\propto \frac{1}{\text{Pressure}}$.

Hence, the correct option is (3).

19. The amount of heat energy required to raise the temperature of 1 g of Helium at NTP, from T_1K to T_2K is

(1) $\frac{3}{8}N_a k_B(T_2 - T_1)$

(2) $\frac{3}{2}N_a k_B(T_2 - T_1)$

(3) $\frac{3}{4}N_a k_B(T_2 - T_1)$

(4) $\frac{3}{4}N_a k_B\left(\frac{T_2}{T_1}\right)$

Solution:

$Q = \frac{f}{2}nR\Delta T$

$\frac{3}{2} \times \frac{1}{4} \times k_B N_a \Delta T = \frac{3}{8}N_a k_B(T_2 - T_1) = \frac{3}{8}N_a k_B(T_2 - T_1)$

Hence, the correct option is (1).

20. A wave travelling in the +ve x-direction having displacement along y-direction as 1 m, wavelength 2π m and frequency of $\frac{1}{\pi}$ Hz is represented by

(1) $y = \sin(x - 2t)$

(2) $y = \sin(2\pi x - 2\pi t)$

(3) $y = \sin(10\pi x - 20\pi t)$

(4) $y = \sin(2\pi x + 2\pi t)$

Solution:

$y = a\sin(kx - \omega t)$

$= \sin\left[\frac{2\pi}{2\pi} \times -2\pi \times \frac{1}{\pi}t\right]$

$= \sin(x - 2t)$

Hence, the correct option is (1).

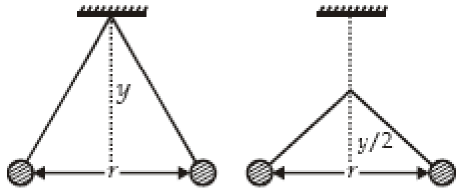
21. If we study the vibration of a pipe open at both ends, then the following statement is not true
(1) Open end will be anti-node
(2) Odd harmonics of the fundamental frequency will be generated
(3) All harmonics of the fundamental frequency will be generated
(4) Pressure change will be maximum at both ends

Solution:
At open ends pressure change will be zero.
Hence, the correct option is (4).

22. A source of unknown frequency gives 4 beats/s, when sounded with a source of known frequency 250 Hz. The second harmonic of the source of unknown frequency gives five beats per second, when sounded with a source of frequency 513 Hz. The unknown frequency is
(1) 254 Hz (2) 246 Hz
(3) 240 Hz (4) 260 Hz

Solution:
Number of beats produced with fundamental note are 4. It means unkown frequency is (250 ± 4)Hz that is either 254 Hz or 246 Hz. With first overtone, that is double the frequency number of beats is 5. Frequency will be (246×2)Hz = 492 Hz or (254×2)Hz = 508 Hz.
$\therefore$ Unknown frequency is 254 Hz.
Hence, the correct option is (1).

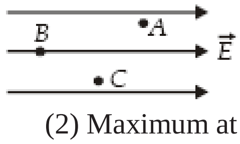
23. Two pith balls carrying equal charges are suspended from a common point by strings of equal length, the equilibrium separation between them is r. Now the strings are rigidly clamped at half the height. The equilibrium separation between the balls now become



(1) $\left(\frac{1}{\sqrt{2}}\right)^2$ (2) $\left(\frac{r}{\sqrt[3]{2}}\right)$
(3) $\left(\frac{2r}{\sqrt{3}}\right)$ (4) $\left(\frac{2r}{3}\right)$

Solution:
$F_e = mg\tan\theta, \frac{F_e'}{F_e} = \frac{\tan\theta_2}{\tan\theta_1}$
Hence, the correct option is (2).

24. A, B and C are three points in a uniform electric field. The electric potential is



(1) Maximum at A (2) Maximum at B
(3) Maximum at C (4) Same at all the three points A, B and C

Solution:
Electric field is directed along decreasing potential $V_B > V_C > V_A$.
Hence, the correct option is (2).

25. A wire of resistance 4 Ω is stretched to twice its original length. The resistance of stretched wire would be

(1) 2 Ω
(2) 4 Ω
(3) 8 Ω
(4) 16 Ω

Solution:

$R' = 16\Omega \qquad (R' = n^2 R)$

Hence, the correct option is (4).

26. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is

(1) 0.2 Ω
(2) 0.5 Ω
(3) 0.8 Ω
(4) 1.0 Ω

Solution:

$$I = \frac{E}{R+r}$$

$$0.2 \times (10 + r) = 2.1$$

$$10 + r = \frac{2.1}{2} \times 10$$

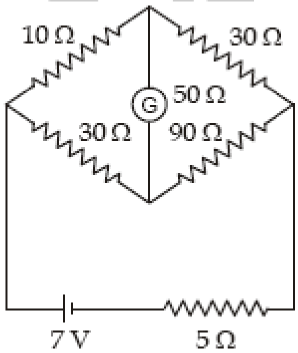
$$r = 10.5 - 10 = 0.5\Omega$$

Hence, the correct option is (2).

27. The resistances of the four arms *P*, *Q*, *R* and *S* in a Wheatstone's bridge are 10 ohm, 30 ohm, 30 ohm and 90 ohm, respectively. The e.m.f. and internal resistance of the cell are 7 volt and 5 ohm respectively. If the galvanometer resistance is 50 ohm, the current drawn from the cell will be

(1) 1.0 A
(2) 0.2 A
(3) 0.1 A
(4) 2.0 A

Solution:



$$R_{\text{eff}} = \frac{40 \times 120}{120 + 40} = 30\,\Omega$$

$$I = \frac{7\,\text{V}}{(30+5)\Omega} = 0.2\,\text{A}$$

Hence, the correct option is (2).

28. When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration $3a_0$ toward west. The electric and magnetic fields in the room are

(1) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ up
(2) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ down
(3) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ up
(4) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ down

Solution:

$$a_0 = \frac{eE}{m} \Rightarrow E = \frac{ma_0}{e}$$

$$\frac{ev_0B+eE}{m}=3a_0$$

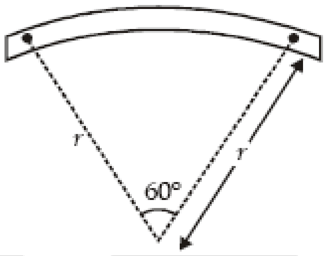
$$ev_0B = 3ma_0 - eE$$
$$= 3ma_0 - ma_0$$
$$= 2ma_0$$
$$B=\frac{2ma_0}{ev_0}$$

Hence, the correct option is (2).

29. A current loop in a magnetic field
(1) Experiences a torque whether the field is uniform or non uniform in all orientations
(2) Can be in equilibrium in one orientation
(3) Can be in equilibrium in two orientations, both the equilibrium states are unstable
(4) Can be in equilibrium in two orientations, one stable while the other is unstable

Solution:
Parallel $\vec{M}$ - stable
Anti-parallel $\vec{M}$ -unstable.
Hence, the correct option is (4).

30. A bar magnet of length *l* and magnetic dipole moment *M* is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be



(1) M
(2) $\frac{3}{\pi}M$
(3) $\frac{2}{\pi}M$
(4) $\frac{M}{2}$

Solution:
$M = mL$

$$L=\frac{\pi}{3}\times r \quad r=\frac{3L}{\pi}$$

$$M'=m\times r=m\frac{3L}{\pi}=\frac{3M}{\pi}$$

Hence, the correct option is (2).

31. A wire loop is rotated in a magnetic field. The frequency of change of direction of the induced e.m.f. is
(1) Once per revolution
(2) Twice per revolution
(3) Four times per revolution
(4) Six times per revolution

Solution:
A wire loop is rotated in a magnetic field. The frequency of change of direction of the induced e.m.f. is twice per revolution.
Hence, the correct option is (2).

32. A coil of self-inductance *L* is connected in series with a bulb *B* and an AC source. Brightness of the bulb decreases when

(1) Frequency of the AC source is decreased
(2) Number of turns in the coil is reduced
(3) A capacitance of reactance $X_C = X_L$ is included in the same circuit
(4) An iron rod is inserted in the coil

Solution:

$$Z = \sqrt{R^2 + X_L^2} = \sqrt{R^2 + (2\pi fL)^2}$$

$$I = \frac{V}{Z'}, P = I^2 R, \mu \uparrow L \uparrow Z \uparrow I \downarrow P \downarrow$$

Hence, the correct option is (4).

33. The condition under which a microwave oven heats up a food item containing water molecules most efficiently is
(1) The frequency of the microwaves must match the resonant frequency of the water molecules
(2) The frequency of the microwaves has no relation with natural frequency of water molecules
(3) Microwaves are heat waves, so always produce heating
(4) Infra-red waves produce heating in a microwave oven

Solution:
Electromagnetic waves.
Hence, the correct option is (1).

34. Ratio of longest wavelengths corresponding to Lyman and Balmer series in hydrogen spectrum is
(1) $\frac{5}{27}$
(2) $\frac{3}{23}$
(3) $\frac{7}{29}$
(4) $\frac{9}{31}$

Solution:

$$\lambda_L = \frac{1}{R\left(1 - \frac{1}{4}\right)} = \frac{4}{3R}$$

$$\lambda_B = \frac{1}{R\left(\frac{1}{4} - \frac{1}{9}\right)} = \frac{1}{R\left(\frac{5}{36}\right)} = \frac{36}{5R}$$

$$\frac{\lambda_L}{\lambda_B} = \frac{4}{3R} \times \frac{5R}{36}$$

$$= \frac{5}{27}$$

Hence, the correct option is (1).

35. The half life of a radioactive isotope '*X*' is 20 years. It decays to another element '*Y*' which is stable. The two elements '*X*' and '*Y*' were found to be in the ratio 1 : 7 in a sample of a given rock. The age of the rock is estimated to be
(1) 40 years
(2) 60 years
(3) 80 years
(4) 100 years

Solution:

$$\frac{N}{N_0} = \frac{1}{8} = \frac{1}{2^3}$$

3 half lives, $T = 3 \times 20 = 60$ years
Hence, the correct option is (2).

36. A certain mass of Hydrogen is changed to Helium by the process of fusion. The mass defect in fusion reaction is 0.02866 u. The energy liberated per u is (given 1 u = 931 MeV)

(1) 2.67 MeV
(2) 26.7 MeV
(3) 6.675 MeV
(4) 13.35 MeV

Solution:

$$\frac{0.02866 \times 931}{4}\,\text{MeV} = \frac{26.7}{4}\,\text{MeV} = 6.675\,\text{MeV}$$

Hence, the correct option is (3).

37. For photoelectric emission from certain metal the cut-off frequency is v. If radiation of frequency $2v$ impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is the electron mass)

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

Solution:

$$\frac{1}{2}mv_{\max}^2 = h2v - hv$$

$$v_{\max} = \sqrt{\frac{2hv}{m}}$$

Hence, the correct option is (3).

38. The wavelength λ_e of an electron and λ_p of a photon of same energy E are related by

(1) $\lambda_p \propto \lambda_e^2$
(2) $\lambda_p \propto \lambda_e$
(3) $\lambda_p \propto \sqrt{\lambda_e}$
(4) $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$

Solution:

$$\lambda_e = \frac{h}{\sqrt{2mE}}$$

$$\lambda_p = \frac{hc}{E}$$

$$\lambda_e^2 = \frac{h^2}{2mE}$$

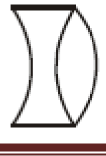
$$\lambda_e^2 = \frac{h^2}{2m\frac{hc}{\lambda_p}} \Rightarrow \lambda_e^2 \propto \lambda_p$$

Hence, the correct option is (1).

39. A plano-convex lens fits exactly into a planoconcave lens. Their plane surfaces are parallel to each other. If lenses are made of different materials of refractive indices μ_1 and μ_2 and R is the radius of curvature of the curved surface of the lenses, then the focal length of the combination is

(1) $\frac{R}{2(\mu_1 + \mu_2)}$
(2) $\frac{R}{2(\mu_1 - \mu_2)}$
(3) $\frac{R}{(\mu_1 - \mu_2)}$
(4) $\frac{2R}{(\mu_2 - \mu_1)}$

Solution:



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

$$f_1 = \frac{R}{(\mu_1 - 1)};\ f_2 = \frac{-R}{(\mu_2 - 1)}$$

$$\frac{1}{f} = \frac{(\mu_1 - 1)}{R} - \frac{(\mu_2 - 1)}{R}$$

$$= \frac{[\mu_1 - 1 - \mu_2 + 1]}{R}$$

$$= \frac{[\mu_1 - \mu_2]}{R}$$

Hence, the correct option is (3).

40. For a normal eye, the cornea of eye provides a converging power of 40 D and the least converging power of the eye lens behind the cornea is 20 D. Using this information, the distance between the retina and the cornea - eye lens can be estimated to be

(1) 5 cm (2) 2.5 cm

(3) 1.67 cm (4) 1.5 cm

Solution:

$$P_{\text{eff}} = 40D + 20D = 60D$$

$$f = \frac{100}{P_{\text{eff}}}$$

Hence, the correct option is (3).

41. In Young's double slit experiment, the slits are 2 mm apart and are illuminated by photons of two wavelengths λ_1 = 12000 Å and λ_2 = 10000 Å. At what minimum distance from the common central bright fringe on the screen 2 m from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other?

(1) 8 mm (2) 6 mm

(3) 4 mm (4) 3 mm

Solution:

$$\frac{\lambda_1}{\lambda_2} = \frac{n_2}{n_1} = \frac{1200}{1000} = \frac{6}{5}$$

$$x = \frac{n_1 \lambda_1 D}{d} = \frac{5 \times 12000 \times 10^{-10} \times 2}{2 \times 10^{-3}}$$

$$= 6 \text{ mm}$$

Hence, the correct option is (2).

42. A parallel beam of fast moving electrons is incident normally on a narrow slit. A fluorescent screen is placed at a large distance from the slit. If the speed of the electrons is increased, which of the following statements is correct?

(1) Diffraction pattern is not observed on the screen in the case of electrons

(2) The angular width of the central maximum of the diffraction pattern will increase

(3) The angular width of the central maximum will decrease

(4) The angular width of the central maximum will be unaffected

Solution:

$v\uparrow \quad \lambda\downarrow$

Hence, the correct option is (3).

43. In a *n*-type semiconductor, which of the following statement is true?

(1) Electrons are majority carriers and trivalent atoms are dopants.

(2) Electron are minority carriers and pentavalent atoms are dopants.
(3) Holes are minority carriers and pentavalent atoms are dopants.
(4) Holes are majority carriers and trivalent atoms are dopants.

Solution:
Holes are minority carriers and pentavalent atoms are dopants.
Hence, the correct option is (3).

44. In a common emitter (CE) amplifier having a voltage gain G, the transistor used has transconductance 0.03 mho and current gain 25. If the above transistor is replaced with another one with transconductance 0.02 mho and current gain 20, the voltage gain will be

(1) $\frac{2}{3}G$ (2) 1.5 G
(3) $\frac{1}{3}G$ (4) $\frac{5}{4}G$

Solution:

$$A_v = \beta \frac{R_L}{R_i} \qquad \left(g_m = \frac{\Delta I_C}{\Delta V_B} = \frac{\Delta I_C}{\Delta I_B R_i} \right)$$

$$G = \left(\frac{\beta}{R_i} \right) R_L \qquad \left(g_m = \frac{\beta}{R_i} \right)$$

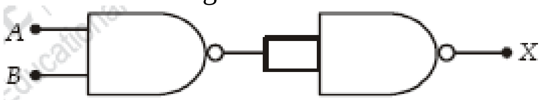
$$= g_m R_L \Rightarrow G \propto g_m$$

$$\frac{G_2}{G_1} = \frac{g_{m_2}}{g_{m_1}} \Rightarrow G_2 = \frac{0.02}{0.03} \times G$$

$$= \frac{2}{3}G$$

Hence, the correct option is (1).

45. The output (X) of the logic circuit shown in figure will be



(1) $X = \overline{\overline{A}}.\overline{\overline{B}}$ (2) $X = \overline{A.B}$
(3) $X = A.B$ (4) $X = \overline{A + B}$

Solution:

$$X = \overline{\overline{AB}} = A \cdot B$$

Hence, the correct option is (3).