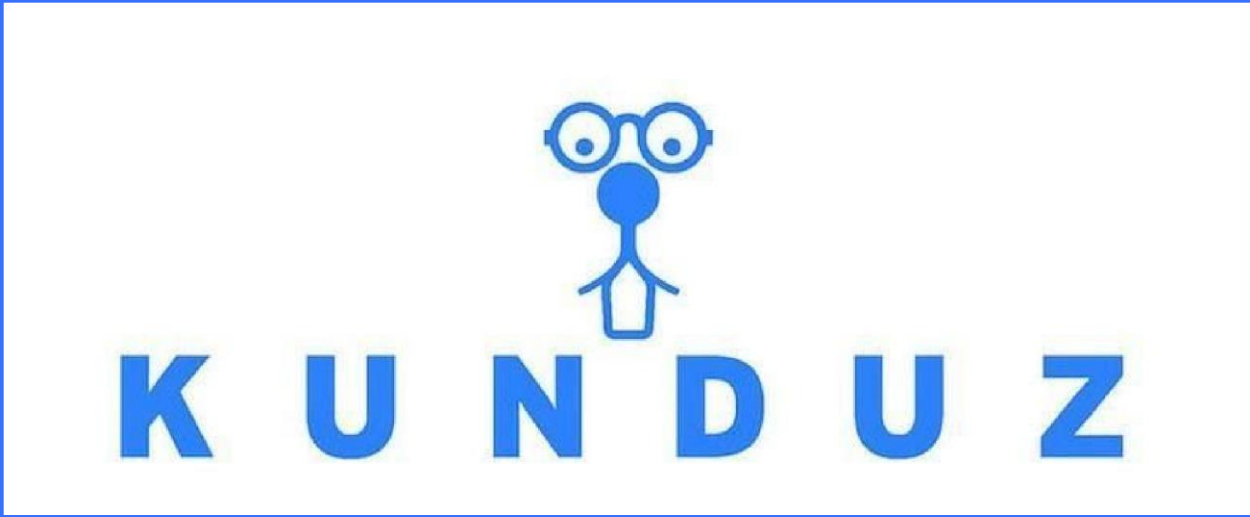


JEE Mains 4th September 2020 shift 2 Physics solutions prepared by KUNDUZ tutors

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Question number

Question and Answers

1

Q1. A body is moving in a low circular orbit about a planet of mass M and radius R. The radius of the orbit can be taken to be R itself. Then the ratio of the speed of this body in the orbit to the escape velocity from the planet is:

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

Sol> we know that escape velocity $= \sqrt{\frac{2GM}{R}}$

$\Rightarrow V_{escape} = \sqrt{\frac{2GM}{R}}$

At distance R, gravitational force $= \frac{GMm}{R^2}$

$\Rightarrow \frac{GMm}{R^2} = \frac{mv^2}{R}$

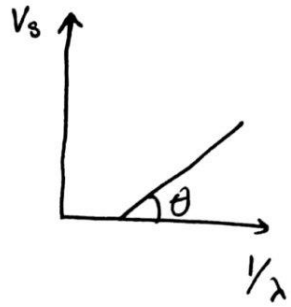
$\Rightarrow v = \sqrt{\frac{GM}{R}}$

$\Rightarrow \frac{v}{V_{escape}} = \sqrt{\frac{GM}{R}} \times \sqrt{\frac{R}{2GM}} = \boxed{\frac{1}{\sqrt{2}}}$

Thus, option 2 is correct.

2

Q2. In a photoelectric effect experiment, the graph of stopping potential V versus reciprocal of wavelength obtained is shown in the figure. As the intensity of the incident radiation is increased:



(1) Slope of the straight line get more steep
(2) Graph does not change
(3) Straight line shifts to right
(4) Straight line shifts to left.

Sol>

we know that $V_s = \frac{hc}{\lambda e} - \frac{\phi}{e}$

$\Rightarrow V_s = \left(\frac{hc}{e}\right)\frac{1}{\lambda} - \frac{\phi}{e}$

comparing with $y = mx + c$

$\Rightarrow y = V_s, \quad x = 1/\lambda, \quad m = \frac{hc}{e}$

$c = -\phi/e$

here m and c are constant.

$\Rightarrow$ neither slope will change, nor the position of line.

Thus, option 2 is correct.

3

Q3. A small ball of mass m is thrown upward with velocity v from the ground. The ball experiences a resistive force mkv^2 where v is it speed. The maximum height attained by the ball is:

(1) $\frac{1}{2k}\tan^{-1}\frac{kv^2}{g}$

(2) $\frac{1}{k}\ln\left[1+\frac{kv^2}{2g}\right]$

(3) $\frac{1}{k}\tan^{-1}\frac{kv^2}{2g}$

(4) $\frac{1}{2k}\ln\left[1+\frac{kv^2}{g}\right]$

sol> Accelaration of ball $= -g - \frac{mkv^2}{m}$

$\Rightarrow a = -g - kv^2$

Also $a = v\frac{dv}{dx}$

$\Rightarrow v\frac{dv}{dx} = -g - kv^2$

$\Rightarrow \frac{v}{g+kv^2}\,dv = (-1)\,dx$

$\Rightarrow \int_v^0 \frac{v}{g+kv^2}\,dv = -\int_0^h dx$

$\Rightarrow h = \frac{1}{2k}\ln\left(\frac{g+kv^2}{g}\right) = \boxed{\frac{1}{2k}\ln\left[1+\frac{kv^2}{g}\right]}$

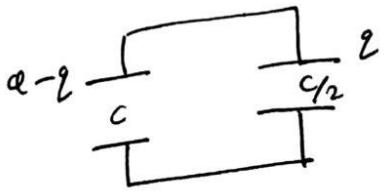
Thus, option 4 is correct.

4

Q4. A capacitor C is fully charged with voltage V_0. After disconnecting the voltage source, it is connected in parallel with another uncharged capacitor of capacitance C/2. The energy loss in the process after the charge is distributed between the two capacitors is:

(1) $\frac{1}{6}CV_0^2$ (2) $\frac{1}{2}CV_0^2$ (3) $\frac{1}{4}CV_0^2$ (4) $\frac{1}{3}CV_0^2$

Sol) $Q = CV_0$



Let q charge flow from capacitor of capacitance C to capacitor of capacitance C/2.

$\Rightarrow \frac{Q-q}{C} = \frac{q}{C/2} \Rightarrow Q = 3q$

$\Rightarrow q = \frac{Q}{3}$

$\Rightarrow U_{initial} = \frac{1}{2}CV_0^2$

$U_{final} = \frac{(Q-q)^2}{2C} + \frac{q^2}{2\frac{C}{2}} = \frac{2Q^2}{9C} + \frac{Q^2}{9C}$

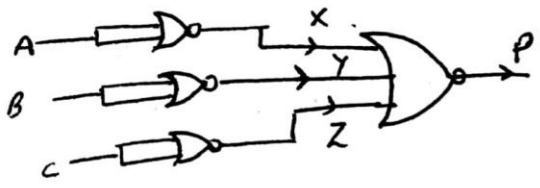
$\Rightarrow U_{final} = \frac{Q^2}{3C}$, $Q = CV_0 \Rightarrow U_{final} = \frac{1}{3}CV_0^2$

$\Rightarrow \Delta U = -\frac{1}{6}CV_0^2 + \frac{1}{2}CV_0^2 = \boxed{\frac{1}{6}CV_0^2}$

5

Q 5) Identify the operation performed by the given circuit.

1) NOT 2) AND
3) NAND 4) OR



Sol) $X = \overline{A + A} = \bar{A}$

Similarly $Y = \bar{B}$, $Z = \bar{C}$

$\Rightarrow P = \overline{\bar{A} + \bar{B} + \bar{C}} = \bar{\bar{A}} \cdot \bar{\bar{B}} \cdot \bar{\bar{C}}$

$= A \cdot B \cdot C$

This is AND operation.

Thus, option 2 is correct.

6

Q5. The electric field of a plane electromagnetic wave is given by $\vec{E} = E_0(\hat{x} + \hat{y}) \sin(kz - \omega t)$. Its magnetic field will be given by:

(1) $\frac{E_0}{c}(\hat{x} + \hat{y}) \sin(kz - \omega t)$

(2) $\frac{E_0}{c}(\hat{x} - \hat{y}) \sin(kz - \omega t)$

(3) $\frac{E_0}{c}(\hat{x} - \hat{y}) \cos(kz - \omega t)$

(4) $\frac{E_0}{c}(-\hat{x} + \hat{y}) \sin(kz - \omega t)$

Sol> We know that

$$E_0 = B_0 c$$

$$\Rightarrow B_0 = \frac{E_0}{c}$$

Also $\hat{c} = \hat{E} \times \hat{B}$

$\hat{E} = \hat{x} + \hat{y}$, $\hat{c} = \hat{z}$

$\Rightarrow$ $\hat{B}$ should be $\hat{y} - \hat{x}$

$\Rightarrow \vec{B} = \frac{E_0}{c}(-\hat{x} + \hat{y}) \sin(kz - \omega t)$

Thus, option 4 is correct.

7

Q7. The driver of bus approaching a big wall notices that the frequency of his bus's horn changes from 420 Hz to 490 Hz when he hears it after it gets reflected from the wall. Find the speed of the bus if speed of the sound is $330\ ms^{-1}$:

(1) $81\ kmh^{-1}$ (2) $71\ kmh^{-1}$ (3) $61\ kmh^{-1}$ (4) $91\ kmh^{-1}$

sol> Let the frequency received by wall be f'

$$\Rightarrow f' = \left(\frac{V_w - V_o}{V_w - V_s}\right) f_o$$

V_w is speed of sound $= 330\ m/s$

V_o = speed of wall $= 0$

V_s = speed of bus $= V$

$$\Rightarrow f' = \left(\frac{330}{330 - V}\right) 420$$

Frequency received by bus $= f'' = \left(\frac{V_w + V_s}{V_w - V_o}\right) f'$

$$\Rightarrow f'' = 490 = \left(\frac{330 + V}{330}\right) \left(\frac{330}{330 - V}\right) \times 420$$

$$\Rightarrow \frac{49}{42} = \frac{330 + V}{330 - V} \Rightarrow 7 \times 330 = 91V$$

$$\Rightarrow V = 25.38\ m/s \approx \boxed{91\ km/h}$$

8

Q8 A series L-R circuit is connected to a battery of emf V. If the circuit is switched on at $t=0$, then the time at which the energy stored in the inductor reaches $(1/n)$ times of its maximum value, is:

(1) $\frac{L}{R}\ln\left[\frac{\sqrt{n}}{\sqrt{n}-1}\right]$ (2) $\frac{L}{R}\ln\left[\frac{\sqrt{n}-1}{\sqrt{n}}\right]$

(3) $\frac{L}{R}\ln\left[\frac{\sqrt{n}}{\sqrt{n}+1}\right]$ (4) $\frac{L}{R}\ln\left[\frac{\sqrt{n}+1}{\sqrt{n}-1}\right]$

Sol> We know that energy stored in inductor =

$$= \frac{1}{2}Li^2$$

Given $U = \frac{U_0}{n}$

$$\Rightarrow \frac{U}{U_0} = \frac{1}{n} = \left(\frac{i}{i_0}\right)^2$$

Also $I = I_0\left(1-e^{-t/\tau}\right)$

τ = time constant $= L/R$

$$\Rightarrow \frac{i}{i_0} = 1-e^{-Rt/L} \Rightarrow e^{-Rt/L} = 1-\frac{1}{\sqrt{n}}$$

$$\Rightarrow \frac{Rt}{L} = \ln\left(\frac{\sqrt{n}}{\sqrt{n}-1}\right)$$

$$\Rightarrow \boxed{t = \frac{L}{R}\ln\left(\frac{\sqrt{n}}{\sqrt{n}-1}\right)}$$

Thus, option 1 is correct.

9

Q9. A person pushes a box on a rough horizontal plateform surface. He applies a force of 200N over a distance of 15m. Thereafter, he gets progressively tired and his applied force reduces linearly with distance to 100N. The total distance through which the box has been moved is 30m. What is the work done by the person during the total movement of the box?

(1) 5250 J (2) 3280 J (3) 2780 J (4) 5690 J

Sol > Let the point be $x=0$ where force starts to reduce.

$\Rightarrow F = Ax + B$ { Linear relation }

At $x = 15$, $F = 200$

$\Rightarrow 200 = 15A + B$ — ①

At $x = 30$, $F = 100$

$\Rightarrow 100 = 30A + B$ — ②

$\Rightarrow$ ① − ② $\Rightarrow 100 = -15A \Rightarrow A = -\frac{20}{3}$

$\Rightarrow B = 200 + 15 \times \frac{20}{3} \Rightarrow B = 300$

$\Rightarrow F = -\frac{20x}{3} + 300$

$\Rightarrow W_D = (15 \times 200) + \int_{15}^{30} \left(-\frac{20x}{3} + 300\right) dx$

$= 3000 + \left(-\frac{10}{3}\right)(30^2 - 15^2) + (300 \times 15)$

$\Rightarrow \boxed{W_D = 5250\ J}$

Thus, option 1 is correct.

10

Q10. Match the thermodynamics processes taking place in a system with the correct conditions. In the table: ΔQ is the heat supplied, ΔW is the work done and ΔU is change in internal energy of the system. Match the following

(I) Adiabatic	(A) $\Delta W = 0$
(II) Isothermal	(B) $\Delta Q = 0$
(III) Isobaric	(C) $\Delta U \neq 0, \Delta W \neq 0, \Delta Q \neq 0$
(IV) Isochoric	(D) $\Delta U = 0$

(1) I → A II → A III → B IV → C
(2) I → B II → D III → A IV → C
(3) I → A II → B III → D IV → D
(4) I → B II → A III → D IV → Cs

sol > we know that for :

Adiabatic process $\Delta Q = 0$

Isothermal process $\Delta T = 0 \Rightarrow \Delta U = 0$

Isochoric process $\Delta W = 0$ {because $\Delta V = 0$}

Isobaric process have maximum work.

$\Rightarrow \Delta U \neq 0, \Delta W \neq 0, \Delta Q \neq 0$

$\Rightarrow$ I → B II → D III → C IV → A

11

811. Consider two uniform discs of the same thickness and different radii $R_1 = R$ and $R_2 = \alpha R$ made of the same material. If the ratio of their moments of inertia I_1 and I_2, respectively, about their axes is $I_1 : I_2 = 1 : 16$ then the value of α is:

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

Sol) Density of both the discs is same

$\Rightarrow m = \rho V$

$\Rightarrow m_1 = \rho \pi R^2 t$, $m_2 = \rho \pi \alpha^2 R^2 t$

$\Rightarrow I = mR^2 \Rightarrow I \propto R^4$

$\Rightarrow \frac{I_1}{I_2} = \frac{R^4}{\alpha^4 R^4} \Rightarrow \frac{1}{16} = \frac{1}{\alpha^4}$

$\Rightarrow \alpha = 16^{1/4} = \boxed{2}$

Thus, option 1 is correct.

12

Q12. A quantity x is given by $(IF v^2/WL^4)$ in terms of moment of inertia I, force F, velocity v, work W and length L. The dimensional formula for x is same as that of:

(1) force constant
(2) energy density
(3) Planck's constant
(4) coefficient of viscosity

Sol>

Dimension of $I = ML^2$

Dimension of $F = MLT^{-2}$

Dimension of $V = LT^{-1}$

Dimension of $W = ML^2T^{-2}$

$$\Rightarrow X = \frac{(ML^2)(MLT^{-2})(LT^{-1})^2}{ML^2T^{-2} \times L^4}$$

$$\Rightarrow \boxed{X = ML^{-1}T^{-2}}$$

Dimension of energy density $= \frac{ML^2T^{-2}}{L^3}$

$$= \boxed{ML^{-1}T^{-2}}$$

Thus, option 2 is correct.

13

Q13 A circular coil has moment of inertia $0.8\ kg\ m^2$ around any diameter and is carrying current to produce a magnetic moment of $20\ Am^2$. The coil is kept initially in a vertical position and it can rotate freely around a horizontal diameter. When a uniform magnetic field of 4T is applied along the vertical, it starts rotating around its horizontal diameter. The angular speed the coil acquires after rotating by 60° will be:

(1) $20\ rad\ s^{-1}$ (2) $10\ rad\ s^{-1}$ (3) $20\pi\ rad\ s^{-1}$ (4) $10\pi\ rad\ s^{-1}$

Sol) we know that

$$energy = -\vec{M}\cdot\vec{B}$$
$$= -MB\cos\theta$$

$$\Rightarrow U_{initial} = -MB\cos 0^\circ = -(20\times 4\times 1)$$
$$= -80\ J$$

$$U_{final} = -MB\cos(60^\circ) = -(20\times 4\times \tfrac{1}{2})$$
$$= -40\ J$$

$$\Rightarrow \Delta U = -40 - (-80) = 40\ J$$

Thus ΔU increase kinetic energy.

$$KE = \tfrac{1}{2} I\omega^2 \rightarrow \tfrac{1}{2}\times 0.8\times \omega^2 = 40$$

$$\Rightarrow \omega = \sqrt{\frac{40\times 2}{0.8}} = \boxed{10\ rad/s}$$

Thus, option 2 is correct.

14

Q14. A paramagnetic sample shows a net magnetisation of 6A/m when it is placed in an external magnetic field of 0.4T at a temperature of 4K. When the sample is placed in an external magnetic field of 0.3T at a temperature of 24K, then the magnetisation be:

(1) 4A/m (2) 0.75A/m (3) 2.25A/m (4) 1A/m

Sol) By Curie's Law we know that

$$\chi \propto T^{-1}$$

$$\Rightarrow \frac{M}{B} \propto \frac{1}{T} \Rightarrow \frac{M_1}{B_1} \times \frac{B_2}{M_2} = \frac{T_2}{T_1}$$

Given $M_1 = 6\ A/m$, $B_1 = 0.4\ T$, $T_1 = 4K$

$B_2 = 0.3\ T$, $T_2 = 24K$

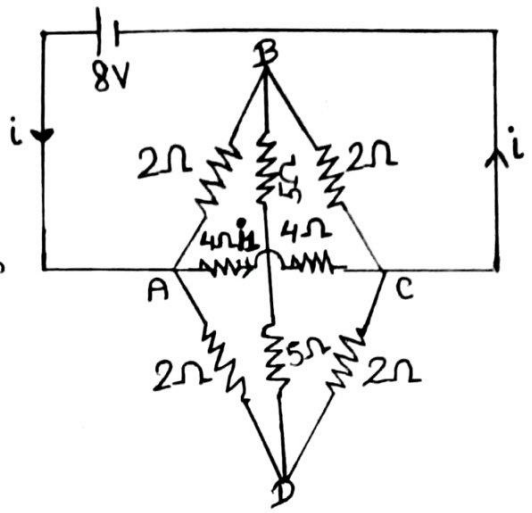
$$\Rightarrow \frac{6}{0.4} \times \frac{0.3}{M_2} = \frac{24}{4} \Rightarrow M_2 = \frac{3}{4}$$

$$\Rightarrow \boxed{M_2 = 0.75\ A/m}$$

15

Q15 The value of current i_1 flowing from A to C in the current diagram is:

(1) 5A (2) 0.75 A/m
(3) 2.25 A/m (4) 1 A/m



sol> In the given circuit no current flows from 5Ω resistor as it forms wheat stone bridge.

$$\Rightarrow R_{eq} = \left(\frac{1}{2+2} + \frac{1}{4+4} + \frac{1}{2+2}\right)^{-1}$$

$$= \left(\frac{1}{4} + \frac{1}{8} + \frac{1}{4}\right)^{-1} = \frac{8}{5}\ \Omega$$

$$\Rightarrow i = \frac{V}{R_{eq}} = \frac{8}{8/5} = 5A$$

$$\Rightarrow i_1 = \frac{i \times R_{eq}}{4+4} = \frac{5}{8} \times \frac{8}{5} = 1A$$

$$\Rightarrow \boxed{i_1 = 1A}$$

Thus, option 4 is correct.

16

Q16. A particle of charge q and mass m is subjected to an electric field $E = E_0(1 - ax^2)$ in the x-direction, where a and E_0 are constants. Initially the particle was at rest at x=0. Other than the initial position the kinetic energy of the particle becomes zero when the distance of the particle from the origin is:

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

Sol> Given $E = E_0(1-ax^2)$

$\Rightarrow F = qE = qE_0(1-ax^2)$

$\Rightarrow ma_c = qE_0(1-ax^2)$

a_c is acceleration

$\Rightarrow a_c = \frac{qE_0}{m}(1-ax^2)$

Initial and final kinetic energy is zero.

$\Rightarrow \int_0^x F\,dx = 0 = \Delta KE$

$\Rightarrow \int_0^x q\,E_0(1-ax^2) = 0 \Rightarrow qE_0 x - qE_0 a\frac{x^3}{3} = 0$

$\Rightarrow x = \frac{ax^3}{3} \Rightarrow \boxed{x = \sqrt{\frac{3}{a}}}$

Thus, option 3 is correct

17

Q17. Two identical cylindrical vessels are kept on the ground and each contain the same liquid of density d. The area of the base of both vessels is S but the height of the liquid in one vessel is x_1 and in the other, x_2. When the both cylinders are connected through a fine of negligible volume very close to the bottom, the liquid flows from one vessel to the other until it comes to equilibrium at a new height. the change in energy of the system in the process is:

(1) $\frac{3}{4} gdS(x_2 - x_1)^2$

(2) $\frac{1}{4} gdS(x_2 - x_1)^2$

(3) $gdS(x_2 + x_1)^2$

(4) $gdS(x_2^2 + x_1^2)^2$

sol) Energy stored in liquid is given by:

$$U = \frac{1}{2} \rho A x^2$$

$$\Rightarrow U_{initial} = \frac{1}{2} \rho S x_1^2 + \frac{1}{2} \rho S x_2^2$$

Let the height liquid be h finally.

$$\Rightarrow S x_1 + S x_2 = Sh + Sh \Rightarrow h = \frac{x_1 + x_2}{2}$$

$$\Rightarrow U_{final} = \frac{1}{2} \rho S \frac{(x_1 + x_2)^2}{2^2} \times 2$$

$$= \frac{1}{2} \rho S \frac{(x_1 + x_2)^2}{2}$$

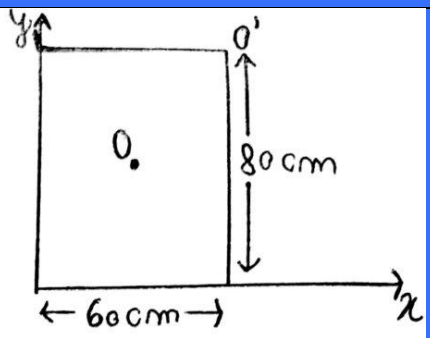
$$\Rightarrow \Delta U = -\frac{1}{2} \rho S \left(\frac{x_1^2}{2} + \frac{x_2^2}{2} + x_1 x_2 - x_1^2 - x_2^2 \right)$$

$$\Rightarrow \Delta U = \frac{1}{2} \rho S \frac{(x_1 - x_2)^2}{2} = \boxed{\frac{\rho S (x_1 - x_2)^2}{4}}$$

Thus option 2 is correct.

18

Q18 For a uniform rectangular sheet shown in the figure, the ratio of moments of inertia about the axes perpendicular to the sheet and passing through O (the centre of mass) and O' (corner point) is:



(1) 1/2 (2) 1/4 (3) 2/3 (4) 1/8

Sol) Let MOI about axis passing through O be I_o and through O' be I_o'

$$\Rightarrow I_o = \frac{M}{12}a^2 + \frac{Mb^2}{12} = \frac{M}{12}(a^2+b^2)$$

Distance between O and O' = d

$$\Rightarrow d = \sqrt{\left(\frac{a}{2}\right)^2+\left(\frac{b}{2}\right)^2} = \sqrt{\frac{a^2}{4}+\frac{b^2}{4}}$$

$$\Rightarrow I_o' = I_o + Md^2$$

$$= \frac{M}{12}(a^2+b^2) + \frac{M}{4}(a^2+b^2)$$

$$= \frac{M}{3}(a^2+b^2)$$

$$\Rightarrow \frac{I_o}{I'} = \frac{1}{12}\times\frac{3}{1} = \boxed{\frac{1}{4}}$$

Thus, option 2 is correct.

19

Q19

A cube of metal is subjected to a hydrostatic pressure 4 GPa. The percentage change in the length of the side of the cube is close to : (Given bulk modulus of metal, $B = 8 \times 10^{10}$ Pa)

(1) 1.67 (2) 5 (3) 20 (4) 0.6

Sol) We know that $P = B \frac{\Delta V}{V}$

$\Rightarrow 4 \times 10^9 = 8 \times 10^{10} \frac{\Delta V}{V}$

$\Rightarrow \frac{\Delta V}{V} = 0.05$

$\Rightarrow$ % change in $V = 0.05 \times 100 = 5\%$

Also $V = a^3$

$\Rightarrow dV = 3a^2 da$

$\Rightarrow \frac{\Delta V}{V} = \frac{\Delta a}{a} \times 3$

$\Rightarrow$ % change in $a = \frac{5}{3} = \boxed{1.67\%}$

Thus, option 1 is correct.

20

Q.20
Find the Binding energy per nucleon for $^{120}_{50}Sn$.
Mass of proton $m_p = 1.00783\,U$,
mass of neutron $m_n = 1.00867\,U$ and mass of tin nucleus $m_{Sn} = 119.902199\,U$. (Take $1U = 931\,MeV$)

(1) 9.0 MeV (2) 8.5 MeV (3) 8.0 MeV (4) 7.5 MeV

Sol) no. of protons = 50

$\Rightarrow$ no. of neutrons = 120 − 50 = 70

$\Rightarrow \Delta m = |m_{Sn} - 50m_p - 70m_n|$

$= |119.902199 - (50 \times 1.00783) - (70 \times 1.00867)|$

$= 1.096201$

$\Rightarrow$ Energy $= \Delta m c^2 = 1.096201 \times 931$ MeV

$= 1020.56$ MeV

$\Rightarrow$ Energy/nucleon $= \frac{1020.56}{120}$ MeV

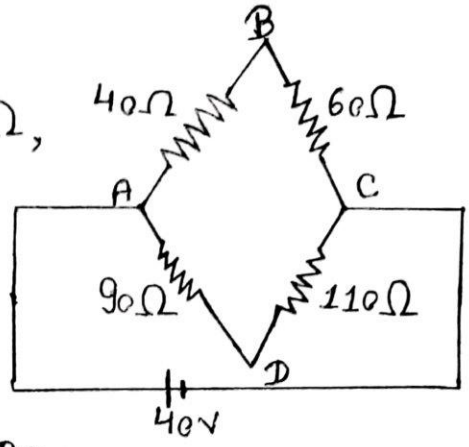
$= \boxed{8.5\,MeV}$

Thus, option 2 is correct.

21

Q21

Four resistance 40Ω, 60Ω, 90Ω and 110Ω make the arms of a quadrilateral ABCD. Across AC is a battery of emf 40V and internal resistance negligible. The potential difference across BD in V is.....



Sol) $R_{eq} = \left(\frac{1}{40+60} + \frac{1}{90+110}\right)^{-1}$

$= \left(\frac{1}{100} + \frac{1}{200}\right)^{-1} = \frac{200}{3}\ \Omega$

$\Rightarrow I = \frac{V}{R_{eq}} = \frac{40 \times 3}{200} = \frac{3}{5}\ A$

$\Rightarrow$ current through B $= I_B = \frac{I R_{eq}}{40+60} = \frac{3}{5} \times \frac{200}{3 \times 100}$

$= 2/5\ A$

$\Rightarrow I_D = I - I_B = \frac{3}{5} - \frac{2}{5} = 1/5\ A$

$\Rightarrow V_B = 40 - 40 I_B = 24\ V$

$V_D = 40 - 90 I_D = 22\ V$

$\Rightarrow V_B - V_D = 24 - 22 = \boxed{2V}$

22

Q22.

The distance between an object and a screen is 100 cm. A lens can produce real image of the object on the screen for two different positions between the screen and the object. The distance between these two positions is 40 cm. If the power of the lens is close to $\left[\frac{N}{100}\right]$ D where N is an integer, the value of N is.....

Sol> We know that $f = \frac{D^2 - d^2}{4D}$

Given $D - d = 40$

$D + D = 100$

$\Rightarrow f = \frac{(D+d)(D-d)}{4D} = \frac{100 \times 40}{4D}$

$\Rightarrow f = \frac{1000}{D}$

$\Rightarrow$ Power $= \frac{1}{f} = \frac{D}{1000}\ cm^{-1} = \frac{D}{10}\ m^{-1}$

$\Rightarrow \frac{ND}{100} = \frac{D \times 100}{1000} \Rightarrow N = \frac{100}{10}$

$\Rightarrow \boxed{N = 10}$

23

Q23
The change in the magnitude of the volume of an ideal gas when a small additional pressure ΔP is applied at a constant temperature, is the same as the change when the temperature is reduced by a small quantity ΔT at constant pressure. The initial temperature and pressure of the gas were 300 K and 2 atm respectively. If $|\Delta T| = C|\Delta P|$ then value of C in (K/atm) is.....

sol) $PV = nRT$

Differentiating both the sides

$\Rightarrow P\,dV + V\,dP = 0 \Rightarrow \Delta V = -\frac{\Delta P}{P} \times V$ — (1)

In second case:

$P\,\Delta V = nR\Delta T \Rightarrow \Delta V = \frac{nR\Delta T}{P}$ — (2)

(1) & (2) $\Rightarrow -\frac{\Delta P}{P} V = \frac{nR\Delta T}{P}$

$\Rightarrow |\Delta T| = \frac{V}{nR}|\Delta P| \Rightarrow \boxed{C = \frac{V}{nR}}$

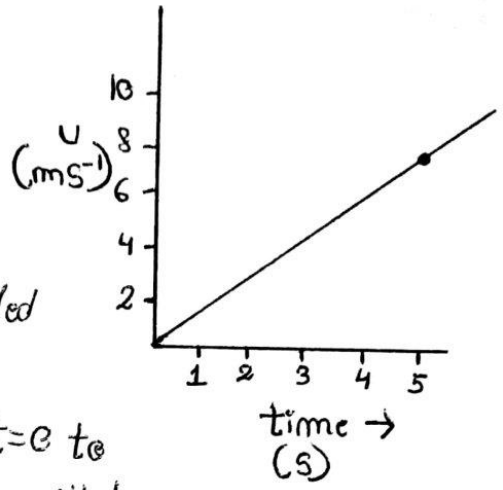
$\Rightarrow C = \frac{nRT}{P \times nR} = \frac{T}{P} = \frac{300}{2} = \boxed{150\ K/atm}$

$\Rightarrow \boxed{C = 150\ K/atm}$

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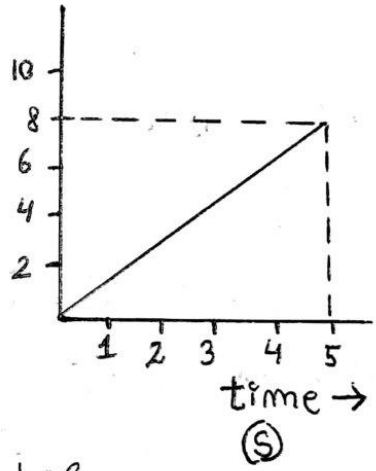
Q.24

The speed verses time graph for a particle is shown in the figure. The distance travelled (in m) by the particle during the time interval $t=0$ to $t=5s$ will be.....



Sol) From the graph we came to know that velocity of the particle at $t = 5$ sec $= 8$ m/s.

We know that "area under speed verses time graph gives us displacement".



∴ Distance travelled by particle during the time interval $t=0$ to $t=5$ sec = Area of triangle

$= \frac{1}{2} \times$ base $\times$ height

$= \frac{1}{2} \times 5 \times 8 = \boxed{20\text{m}}$

Thus, distance travelled by the particle is $= \underline{20\text{m}}$

25

Q25

Orange light of wavelength 6000×10^{-10} m illuminates a single slit of width 0.6×10^{-4} m. The maximum possible number of diffraction minima produced on both sides of the central maximum is:

sol> We know that

path difference $= n\lambda$ {for maxima}

$\Rightarrow d\sin(\theta) = n\lambda$

$\Rightarrow \sin(\theta) = \frac{n\lambda}{d}$

Since $\sin(\theta) < 1$

$\Rightarrow \frac{n\lambda}{d} \leq 1 \Rightarrow n \leq \frac{d}{\lambda}$

$\Rightarrow n \leq \frac{0.6 \times 10^{-4}}{6000 \times 10^{-10}} = \frac{10^{-5}}{10^{-7}}$

$\Rightarrow \boxed{n \leq 100}$

$\Rightarrow$ Total no. of fringes $= 2n = \boxed{200}$

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