FINAL JEE–MAIN EXAMINATION – FEBRUARY, 2021

(Held On Wednesday 24th February, 2021) TIME : 9 : 00 AM to 12 : 00 NOON

PHYSICS | **TEST PAPER WITH ANSWER & SOLUTIONS**

SECTION-A

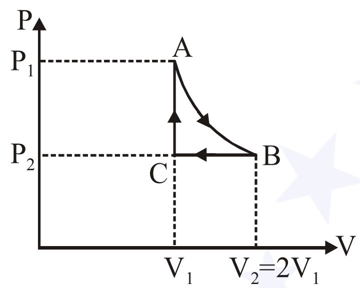
1. n mole a perfect gas undergoes a cyclic process ABCA (see figure) consisting of the following processes.

A → B : Isothermal expansion at temperature T so that the volume is doubled from V_1 to $V_2 = 2V_1$ and pressure changes from P_1 to P_2.

B → C : Isobaric compression at pressure P_2 to initial volume V_1.

C → A : Isochoric change leading to change of pressure from P_2 to P_1.

Total workdone in the complete cycle ABCA is :



(1) 0 (2) $nRT\left(\ln 2 + \frac{1}{2}\right)$

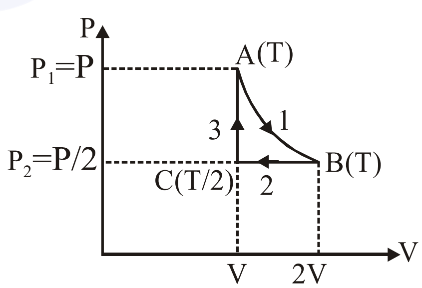
(3) nRTln2 (4) $nRT\left(\ln 2 - \frac{1}{2}\right)$

Official Ans. by NTA (4)

Sol. $W_{Isothermal} = nRT\ln\left(\frac{V_2}{V_1}\right)$

$W_{Isobaric} = P\Delta V = nR\Delta T$

$W_{Isochoric} = 0$



$W_1 = nRT\ \ln\left(\frac{2V}{V}\right) = nRT\ \ln 2$

$W_2 = nR\left(\frac{T}{2} - T\right) = -nR\frac{T}{2}$

$W_3 = 0$

$\Rightarrow W_{net} = W_1 + W_2 + W_3$

$W_{net} = nRT\left(\ln 2 - \frac{1}{2}\right)$

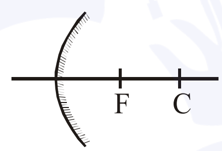
2. The focal length f is related to the radius of curvature r of the spherical convex mirror by:

(1) $f = +\frac{1}{2}r$ (2) $f = -r$

(3) $f = -\frac{1}{2}r$ (4) $f = r$

Official Ans. by NTA (1)

Sol. For convex mirror, focus is behind the mirror.



$\Rightarrow f = +\frac{r}{2}$

3. In a Young's double slit experiment, the width of the one of the slit is three times the other slit. The amplitude of the light coming from a slit is proportional to the slit-width. Find the ratio of the maximum to the minimum intensity in the interference pattern.

(1) 1 : 4 (2) 3 : 1 (3) 4 : 1 (4) 2 : 1

Official Ans. by NTA (3)

Sol. Amplitude ∝ Width of slit

$\Rightarrow A_2 = 3A_1$

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

∵ Intensity $I \propto A^2$

$$\Rightarrow \frac{I_{max}}{I_{min}} = \left(\frac{A_1 + A_2}{|A_1 - A_2|}\right)^2$$

$$= \left(\frac{A_1 + 3A_1}{|A_1 - 3A_1|}\right)^2$$

$\left(4A_1\right)^2$

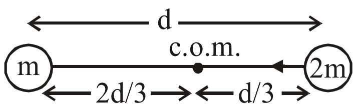
4. Two stars of masses m and 2m at a distance d rotate about their common centre of mass in free space. The period of revolution is :

(1) $\frac{1}{2\pi}\sqrt{\frac{d^3}{3Gm}}$ (2) $2\pi\sqrt{\frac{d^3}{3Gm}}$

(3) $\frac{1}{2\pi}\sqrt{\frac{3Gm}{d^3}}$ (4) $2\pi\sqrt{\frac{3Gm}{d^3}}$

Official Ans. by NTA (2)

Sol.



$$F = \frac{G(2m)m}{d^2} = (2m)\omega^2\,(d/3)$$

$$\frac{Gm}{d^2} = \omega^2\frac{d}{3}$$

$$\Rightarrow \omega^2 = \frac{3Gm}{d^3}$$

$$\Rightarrow \omega = \sqrt{\frac{3Gm}{d^3}}$$

$$\Rightarrow T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{d^3}{3Gm}}$$

5. A current through a wire depends on time as $i = \alpha_0 t + \beta t^2$ where $\alpha_0 = 20$ A/s and $\beta = 8$ As^{-2}. Find the charge crossed through a section of the wire in 15 s.

(1) 2250 C (2) 11250 C

(3) 2100 C (4) 260 C

Official Ans. by NTA (2)

Sol. $i = 20t + 8t^2$

$$i = \frac{dq}{dt} \Rightarrow \int dq = \int i dt$$

$$\Rightarrow q = \int_0^{15}(20t + 8t^2)dt$$

$$q = \left(\frac{20t^2}{2} + \frac{8t^3}{3}\right)_0^{15}$$

$$q = 10 \times (15)^2 + \frac{8(15)^3}{3}$$

$q = 2250 + 9000$

$q = 11250$ C

6. Moment of inertia (M.I.) of four bodies, having same mass and radius, are reported as ;

I_1 = M.I. of thin circular ring about its diameter.

I_2 = M.I. of circular disc about an axis perpendicular to the disc and going through the centre,

I_3 = M.I. of solid cylinder about its axis and

I_4 = M.I. of solid sphere about its diameter.

Then :

(1) $I_1 + I_3 < I_2 + I_4$

(2) $I_1 + I_2 = I_3 + \frac{5}{2}I_4$

(3) $I_1 = I_2 = I_3 > I_4$

(4) $I_1 = I_2 = I_3 < I_4$

Official Ans. by NTA (3)

Sol. Ring $I_1 = \frac{MR^2}{2}$ about diameter

Disc $I_2 = \frac{MR^2}{2}$

Solid cylinder $I_3 = \frac{MR^2}{2}$

Solid sphere $I_4 = \frac{2}{5}MR^2$

$I_1 = I_2 = I_3 > I_4$

7. Given below are two statements :

Statement-I : Two photons having equal linear momenta have equal wavelengths.

Statement-II : If the wavelength of photon is decreased, then the momentum and energy of a photon will also decrease.

In the light of the above statements, choose the correct answer from the options given below.

(1) Both Statement I and Statement II are true

(2) Statement I is false but Statement II is true

(3) Both Statement I and Statement II are false

(4) Statement I is true but Statement II is false

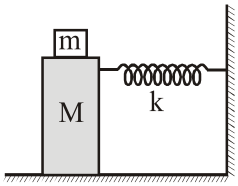
Official Ans. by NTA (4)

Sol. If linear momentum are equal then wavelength also equal

$$p = \frac{h}{\lambda},\ E = \frac{hc}{\lambda}$$

On decreasing wavelength, momentum and

8. In the given figure, a mass M is attached to a horizontal spring which is fixed on one side to a rigid support. The spring constant of the spring is k. The mass oscillates on a frictionless surface with time period T and amplitude A. When the mass is in equilibrium position, as shown in the figure, another mass m is gently fixed upon it. The new amplitude of oscillation will be :

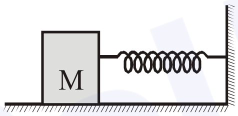


(1) $A\sqrt{\frac{M-m}{M}}$ (2) $A\sqrt{\frac{M}{M+m}}$

(3) $A\sqrt{\frac{M+m}{M}}$ (4) $A\sqrt{\frac{M}{M-m}}$

Official Ans. by NTA (2)

Sol.



Momentum of system remains conserved.

$p_i = p_f$

$MA\omega = (m + M) A'\omega'$

$$MA\sqrt{\frac{k}{M}} = (m + M)\, A' \sqrt{\frac{k}{m+M}}$$

$$A' = A\sqrt{\frac{M}{M+m}}$$

9. If Y, K and η are the values of Young's modulus, bulk modulus and modulus of rigidity of any material respectively. Choose the correct

(1) $Y = \frac{9K\eta}{3K-\eta} N/m^2$

(2) $\eta = \frac{3YK}{9K+Y} N/m^2$

(3) $Y = \frac{9K\eta}{2\eta+3K} N/m^2$

(4) $K = \frac{Y\eta}{9\eta-3Y} N/m^2$

Official Ans. by NTA (4)

Sol. Y- Younge modulus, K- Bulk modulus, η- modulus of rigidity

We know that

$y = 3k(1 - 2\sigma)$

$$\sigma = \frac{1}{2}\left(1-\frac{y}{3k}\right) \quad ....(i)$$

$y = 2\eta(1 + \sigma)$

$$\sigma = \frac{y}{2\eta} - 1 \quad ....(ii)$$

From Eq.(i) and Eq. (ii)

$$\frac{1}{2}\left(1-\frac{Y}{3k}\right) = \frac{y}{2\eta} - 1$$

$$1 - \frac{y}{3k} = \frac{y}{\eta} - 2$$

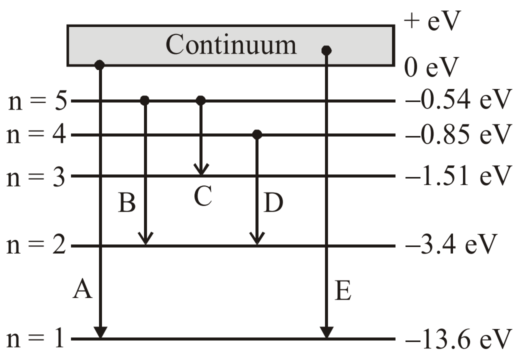
$$\frac{y}{3k} = 3 - \frac{y}{\eta}$$

$$\frac{y}{3k} = \frac{3\eta - y}{\eta}$$

$$\frac{\eta y}{3k} = 3\eta - y$$

$$k = \frac{\eta y}{9\eta - 3y}$$

10. In the given figure, the energy levels of hydrogen atom have been shown along with some transitions marked A, B, C, D and E. The transitions A, B and C respectively represent :



(1) The ionization potential of hydrogen, second member of Balmer series and third member of Paschen series.

(2) The first member of the Lyman series, third member of Balmer series and second member of Paschen series.

(3) The series limit of Lyman series, third member of Balmer series and second member of Paschen series.

(4) The series limit of Lyman series, second member of Balmer series and second member of Paschen series.

Official Ans. by NTA (3)

Sol. A $\rightarrow$ Series limit of Lymen series.

B $\rightarrow$ Third member of Balmer series.

C $\rightarrow$ Second member of Paschen series.

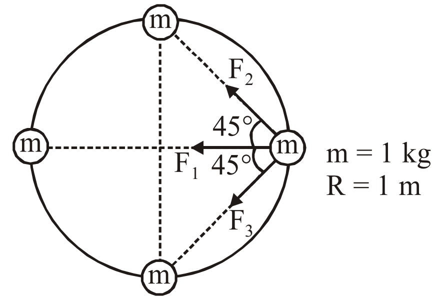
11. Four identical particles of equal masses 1kg made to move along the circumference of a circle of radius 1 m under the action of their own mutual gravitational attraction. The speed of each particle will be :

(1) $\sqrt{\frac{G}{2}(1+2\sqrt{2})}$ (2) $\sqrt{G(1+2\sqrt{2})}$

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

Official Ans. by NTA (4)

Sol.



$$F_1 = \frac{Gmm}{(2R)^2} = \frac{Gm^2}{4R^2}$$

$$F_2 = \frac{Gmm}{(\sqrt{2}R)^2} = \frac{Gm^2}{2R^2}$$

$$F_3 = \frac{Gmm}{(\sqrt{2}R)^2} = \frac{Gm^2}{2R^2}$$

$$\Rightarrow F_{net} = F_1 + F_2 \cos 45° + F_3 \cos 45°$$

$$= \frac{Gm^2}{4R^2} + \frac{Gm^2}{2R^2}\frac{1}{\sqrt{2}} + \frac{Gm^2}{2R^2}\frac{1}{\sqrt{2}}$$

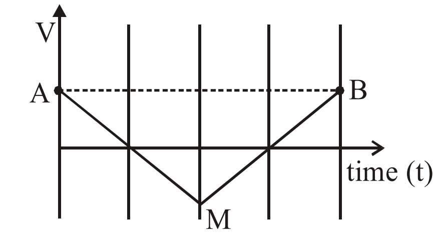
$$= \frac{Gm^2}{R^2}\left(\frac{1}{4} + \frac{1}{2\sqrt{2}} + \frac{1}{2\sqrt{2}}\right)$$

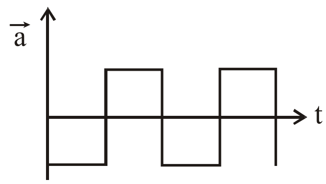
$$= \frac{Gm^2}{R^2}\left(\frac{1}{4} + \frac{1}{\sqrt{2}}\right) = \frac{Gm^2}{4R^2}\left(1+2\sqrt{2}\right)$$

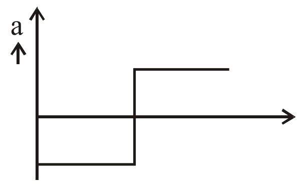
$$F_{net} = \frac{Gm^2}{4R^2}\left(1+2\sqrt{2}\right) = \frac{mv^2}{R}$$

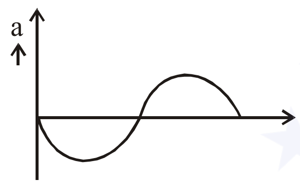
$$\Rightarrow v = \frac{\sqrt{G(1+2\sqrt{2})}}{2}$$

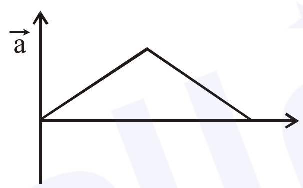
12. If the velocity-time graph has the shape AMB, what would be the shape of the corresponding acceleration-time graph ?



(1) 

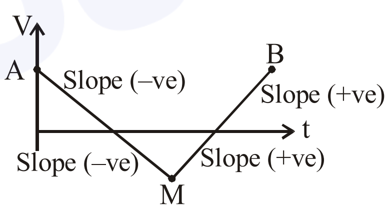
(2) 

(3) 

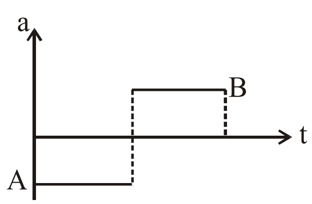
(4) 

Official Ans. by NTA (2)

Sol. Slope of v-t graph gives acceleration



$\Rightarrow$ Acceleration will be



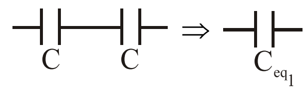
13. Two equal capacitors are first connected in series and then in parallel. The ratio of the equivalent capacities in the two cases will be:

(1) 4 : 1 (2) 2 : 1

(3) 1 : 4 (4) 1 : 2

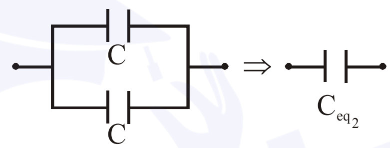
Official Ans. by NTA (3)

Sol. For series combination



$$\frac{1}{C_{eq_1}} = \frac{1}{C} + \frac{1}{C} \Rightarrow \boxed{C_{eq_1} = \frac{C}{2}}$$

For parallel combination



$$C_{eq_2} = C + C \Rightarrow C_{eq_2} = 2C$$

$$\Rightarrow \frac{C_{eq_1}}{C_{eq_2}} = \frac{(C/2)}{2C} = \frac{1}{4} = 1 : 4$$

14. If an emitter current is changed by 4 mA, the collector current changes by 3.5 mA. The value of β will be :

(1) 7 (2) 0.5

(3) 0.875 (4) 3.5

Official Ans. by NTA (1)

Sol. $I_\varepsilon = I_C + I_B$

$\Rightarrow \Delta I_\varepsilon = \Delta I_C + \Delta I_B$

$4mA = 3.5\ mA + \Delta I_B$

$\Rightarrow \Delta I_B = 0.5\ mA$

$$\Rightarrow \beta = \frac{\Delta I_C}{\Delta I_B}$$

$$\beta = \frac{3.5}{0.5}$$

15. Match List-I with List-II :

List-I	List-II
(a) Isothermal	(i) Pressure constant
(b) Isochoric	(ii) Temperature constant
(c) Adiabatic	(iii) Volume constant
(d) Isobaric	(iv) Heat content is constant

Choose the correct answer from the options given below :

(1) (a) → (i), (b) → (iii), (c) → (ii), (d) → (iv)
(2) (a) → (ii), (b) → (iii), (c) → (iv), (d) → (i)
(3) (a) → (ii), (b) → (iv), (c) → (iii), (d) → (i)
(4) (a) → (iii), (b) → (ii), (c) → (i), (d) → (iv)

Official Ans. by NTA (2)

Sol. (a) Isothermal ⇒ Temperature constant
(a) → (ii)
(b) Isochoric ⇒ Volume constant
(a) → (iii)
(c) Adiabatic ⇒ $\Delta Q = 0$
⇒ Heat content is constant
(c) → (iv)
(d) Isobaric ⇒ Pressure constant
(d) → (i)

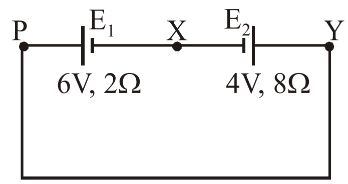
16. Each side of a box made of metal sheet in cubic shape is 'a' at room temperature 'T', the coefficient of linear expansion of the metal sheet is 'α'. The metal sheet is heated uniformly, by a small temperature ΔT, so that its new temperature is T + ΔT. Calculate the increase in the volume of the metal box.

(1) $3a^3\alpha\Delta T$ (2) $4a^3\alpha\Delta T$
(3) $4\pi a^3\alpha\Delta T$ (4) $\frac{4}{3}\pi a^3\alpha\Delta T$

Official Ans. by NTA (1)

Sol. $\Delta V = V\gamma\Delta T$
$\Delta V = 3a^3\alpha\Delta T$

17. A cell E_1 of emf 6V and internal resistance 2Ω is connected with another cell E_2 of emf 4V and internal resistance 8Ω (as shown in the figure). The potential difference across points X and Y is :



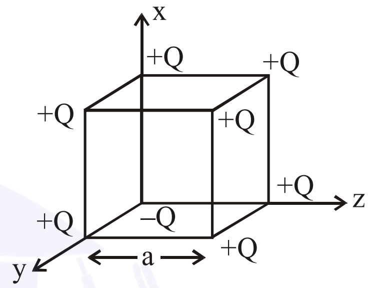
(1) 10.0 V (2) 3.6 V
(3) 5.6V (4) 2.0 V

Sol. $I = \frac{6-4}{10} = \frac{1}{5}$ A

$V_x + 4 + 8 \times \frac{1}{5} - V_y = 0$

$V_x - V_y = -5.6 \Rightarrow |Vx - Vy| = 5.6$ V

18. A cube of side 'a' has point charges +Q located at each of its vertices except at the origin where the charge is –Q. The electric field at the centre of cube is :



(1) $\frac{-Q}{3\sqrt{3}\pi\varepsilon_0 a^2}(\hat{x}+\hat{y}+\hat{z})$

(2) $\frac{-2Q}{3\sqrt{3}\pi\varepsilon_0 a^2}(\hat{x}+\hat{y}+\hat{z})$

(3) $\frac{2Q}{3\sqrt{3}\pi\varepsilon_0 a^2}(\hat{x}+\hat{y}+\hat{z})$

(4) $\frac{Q}{3\sqrt{3}\pi\varepsilon_0 a^2}(\hat{x}+\hat{y}+\hat{z})$

Official Ans. by NTA (2)

Sol. We can replace –Q charge at origin by +Q and –2Q . Now due to +Q charge at every corner of cube. Electric field at center of cube is zero so now net electric field at center is only due to –2Q charge at origin.

$$\vec{E} = \frac{kq\vec{r}}{r^3} = \frac{1(-2Q)\frac{a}{2}(\hat{x}+\hat{y}+\hat{z})}{4\pi\varepsilon_0\left(\frac{a}{2}\sqrt{3}\right)^3}$$

$$\vec{E} = \frac{-2Q(\hat{x}+\hat{y}+\hat{z})}{\sqrt{\ }}$$

19. Consider two satellites S_1 and S_2 with periods of revolution 1 hr. and 8hr. respectively revolving around a planet in circular orbits. The ratio of angular velocity of satellite S_1 to the angular velocity of satellites S_2 is :

(1) 8 : 1 2) 1 : 4

(3) 2 : 1 (4) 1 : 8

Official Ans. by NTA (3)

Official Ans. by (1)

Sol. $\frac{T_1}{T_2}=\frac{1}{8}$

$$\frac{2\pi/\omega_1}{2\pi/\omega_2}=\frac{1}{8}$$

$$\frac{\omega_1}{\omega_2}=\frac{8}{1}$$

20. The workdone by a gas molecule in an isolated system is given by, $W=\alpha\beta^2 e^{-\frac{x^2}{\alpha kT}}$, where x is the displacement, k is the Boltzmann constant and T is the temperature, α and β are constants. Then the dimension of β will be :

(1) $[M L^2 T^{-2}]$ (2) $[M L T^{-2}]$

(3) $[M^2 L T^2]$ (4) $[M^0 L T^0]$

Official Ans. by NTA (2)

Sol. $\frac{x^2}{\alpha kT}$ → dimensionless

$$\Rightarrow [\alpha] = \frac{[x^2]}{[kT]} = \frac{L^2}{ML^2T^{-2}} = M^{-1}T^2$$

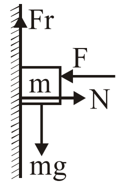
Now $[W] = [\alpha]\,[\beta]^2$

$$[\beta] = \sqrt{\frac{ML^2T^{-2}}{M^{-1}T^2}} = M^1L^1T^{-2}$$

SECTION-B

1. The coefficient of static friction between a wooden block of mass 0.5 kg and a vertical rough wall is 0.2. The magnitude of horizontal force that should be applied on the block to keep it adhere to the wall will be ______N. [$g = 10\ ms^{-2}$]

Sol. F.B.D. of the block is shown in the diagram



Since block is at rest therefore

fr – mg = 0 ....(1)

F – N = 0 ....(2)

fr ≤ μN

In limiting case

fr = μN = μF ....(3)

Using eq. (1) and (3)

∴ μF = mg

$$\Rightarrow F = \frac{0.5\times10}{0.2} = 25\ N$$

Ans. 25.00

2. A resonance circuit having inductance and resistance 2×10^{-4} H and 6.28 Ω respectively oscillates at 10 MHz frequency. The value of quality factor of this resonator is _______. [π = 3.14]

Official Ans. by NTA (200)

Official Ans. by (2000)

Sol. Given : $L = 2 \times 10^{-4}$ H

R = 6.28 Ω

f = 10 MHz = 10^7 Hz

Since quality factor,

$$Q = \omega_0 \frac{L}{R} = 2\pi f\frac{L}{R}$$

$$\therefore Q = 2\pi \times 10^7 \times \frac{2\times10^{-4}}{6.28}$$

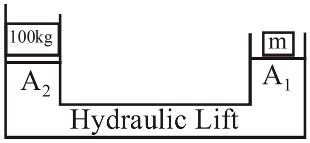
$Q = 2 \times 10^3 = 2000$

∴ Ans. is 2000

3. A hydraulic press can lift 100 kg when a mass 'm' is placed on the smaller piston. It can lift _______kg when the diameter of the larger piston is increased by 4 times and that of the smaller piston is decreased by 4 times keeping the same mass 'm' on the smaller piston.

Official Ans. by NTA (25600)

Sol. Using Pascals law



$$\frac{100\times g}{A_2}=\frac{mg}{A_1} \quad ....(1)$$

Let m mass can lift M_0 in second case then

$$\frac{M_0 g}{16A_2} = \frac{mg}{A_1/16} \quad ....(2)$$

$\{$Since A = $\frac{\pi d^2}{4}\}$

From equation (1) and (2) we get

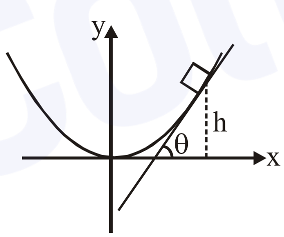
$$\frac{M_0}{16.100} = 16$$

$\Rightarrow M_0 = 25600$ kg

4. An inclined plane is bent in such a way that the vertical cross-section is given by $y=\frac{x^2}{4}$ where y is in vertical and x in horizontal direction. If the upper surface of this curved plane is rough with coefficient of friction $\mu = 0.5$, the maximum height in cm at which a stationary block will not slip downward is ________ cm.

Official Ans. by NTA (25)

Sol.



At maximum ht. block will experience maximum friction force. Therefore if at this height slope of the tangent is tan θ, then θ = Angle of repose.

$$\therefore \tan\theta = \frac{dy}{dx} = \frac{2x}{4} = \frac{x}{2} = 0.5$$

$\Rightarrow$ x = 1 and therefore $y = \frac{x^2}{4} = 0.25$ m

= 25 cm

$\therefore$ Answer is 25 cm

(Assuming that x & y in the equation are given in meter)

5. An electromagnetic wave of frequency 5 GHz, is travelling in a medium whose relative electric permittivity and relative magnetic permeability both are 2. Its velocity in this medium is ________$\times 10^7$ m/s.

Official Ans. by NTA (15)

Sol. Given : Frequency of wave f = 5 GHz

= 5×10^9 Hz

Relative permittivity, $\epsilon_r = 2$

and Relative permeability, $\mu_r = 2$

Since speed of light in a medium is given by,

$$v = \frac{1}{\sqrt{\mu\epsilon}} = \frac{1}{\sqrt{\mu_r\mu_0\cdot\epsilon_r\epsilon_0}}$$

$$v = \frac{1}{\sqrt{\mu_r\epsilon_r}}\frac{1}{\sqrt{\mu_0\epsilon_0}} = \frac{C}{\sqrt{\mu_r\epsilon_r}}$$

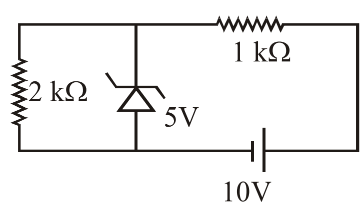
Where C is speed of light is vacuum.

$$\therefore v = \frac{3\times 10^8}{\sqrt{4}} = \frac{30\times 10^7}{2} \text{ m/s}$$

= 15×10^7 m/s

$\therefore$ Ans. is 15

6. In connection with the circuit drawn below, the value of current flowing through 2 kΩ resistor is ________ $\times 10^{-4}$ A.



Official Ans. by NTA (25)

Sol. Current through 2kΩ resistance

$$I = \frac{5}{2\times 10^3} = 2.5 \times 10^{-3} \text{ A}$$

$I = 25 \times 10^{-4}$ A

7. An audio signal $v_m = 20 \sin 2\pi (1500\,t)$ amplitude modulates a carrier

$$v_C = 80 \sin 2\pi (100{,}000\ t).$$

The value of percent modulation is _______.

Official Ans. by NTA (25)

Sol. $\%\ \text{modulation} = \dfrac{\text{Am}}{\text{Ac}} \times 100$

$\%\ \text{modulation} = \dfrac{20}{80} \times 100$

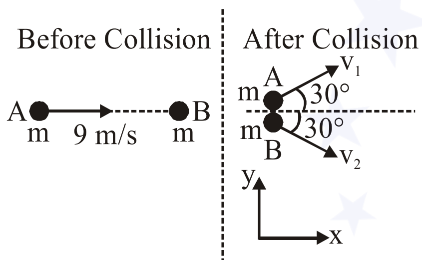
$\%\ \text{modulation} = 25\%$

Ans 25

8. A ball will a speed of 9 m/s collides with another identical ball at rest. After the collision, the direction of each ball makes an angle of 30° with the original direction. The ratio of velocities of the balls after collision is x : y, where x is ________.

Official Ans. by NTA (1)

Sol.



From conservation of momentum along y-axis.

$\vec{P}_{iy} = \vec{P}_{fy}$

$0 + 0 = mv_1 \sin 30° \hat{j} + mv_2 \sin 30° (-\hat{j})$

$mv_2 \sin 30° = mv_1 \sin 30°$

$v_2 = v_1$ or $\dfrac{v_1}{v_2} = 1$

Ans. 1

9. A common transistor radio set requires 12V (D.C.) for its operation. The D.C. source is constructed by using a transformer and a rectifier circuit, which are operated at 220 V (A.C.) on standard domestic A.C. supply. The number of turns of secondary coil are 24, then the number of turns of primary are _______.

Official Ans. by NTA (440)

Sol. $\dfrac{N_P}{N_S} = \dfrac{V_P}{V_S}$

$\dfrac{N_P}{24} = \dfrac{220}{12}$

$N_P = \dfrac{220 \times 24}{12}$

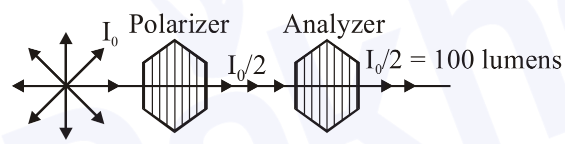
$N_P = 440$

Ans. 440 turns

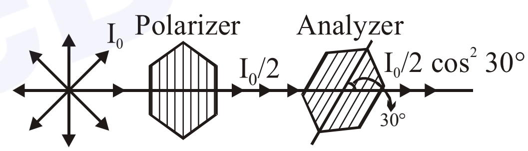
10. An unpolarized light beam is incident on the polarizer of a polarization experiment and the intensity of light beam emerging from the analyzer is measured as 100 Lumens. Now, if the analyzer is rotated around the horizontal axis (direction of light) by 30° in clockwise direction, the intensity of emerging light will be _______ Lumens.

Official Ans. by NTA (75)

Sol.



Assuming initially axis of Polarizer and Analyzer are parallel



Now emerging intensity $= \dfrac{I_0}{2} \cos^2 30°$

$= 100\left(\dfrac{\sqrt{3}}{2}\right)^2 = 100 \times \dfrac{3}{4} = 75$

Ans. 75