FINAL JEE–MAIN EXAMINATION – APRIL, 2019
Held On Tuesday 09th APRIL, 2019
TIME: 09 : 30 AM To 12 : 30 PM

1. In the density measurement of a cube, the mass and edge length are measured as (10.00 ± 0.10) kg and (0.10 ± 0.01) m, respectively. The error in the measurement of density is :

(1) 0.10 kg/m³ (2) 0.31 kg/m³

(3) 0.07 kg/m³ (4) 0.01 kg/m³

Official Ans. by NTA (2)

Answer (Bonus)

Sol. $\rho = \frac{m}{v}$

maximum % error in S will be given by

$$\frac{\Delta\rho}{\rho}\times 100\% = \left(\frac{\Delta m}{m}\right)\times 100\% + 3\left(\frac{\Delta L}{L}\right)\times 100\% \quad ...(i)$$

which is only possible when error is small which is not the case in this question.

Yet if we apply equation (i), we get

$\Delta\rho = 3100$ kg/m³

Now, we will calculate error, without using approximation.

$$\rho_{min} = \frac{m_{min}}{v_{max}} = \frac{9.9}{(0.11)^3} = 7438 kg/m^3$$

$$\& \ \rho_{max} = \frac{m_{max}}{v_{min}} = \frac{10.1}{(0.09)^3} = 13854.6 kg/m^3$$

$\Delta\rho = 6416.6$ kg/m³

No option is matching.

Therefore this question should be awarded bonus

2. An HCl molecule has rotational, translational and vibrational motions. If the rms velocity of HCl molecules in its gaseous phase is $\bar{v}$, m is its mass and k_B is Boltzmann constant, then its temperature will be :

(1) $\frac{m\bar{v}^2}{6k_B}$ (2) $\frac{m\bar{v}^2}{5k_B}$

(3) $\frac{m\bar{v}^2}{3k_B}$ (4) $\frac{m\bar{v}^2}{7k_B}$

Official Ans. by NTA (1)

Answer (3)

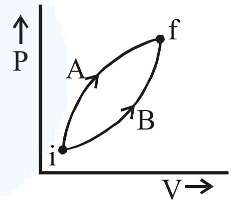
Sol. According to equipartion energy theorem

$$\frac{1}{2}m\left(v_{rms}^2\right) = 3\times\frac{1}{2}K_bT$$

$$T = \frac{m\bar{v}_{rms}^2}{3k}$$

∴ correct option should be (3)

3. Following figure shows two processes A and B for a gas. If ΔQ_A and ΔQ_B are the amount of heat absorbed by the system in two cases, and ΔU_A and ΔU_B are changes in internal energies, respectively, then :



(1) $\Delta Q_A = \Delta Q_B$; $\Delta U_A = \Delta U_B$

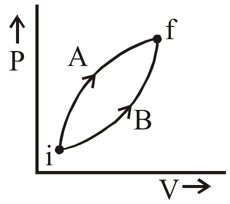
(2) $\Delta Q_A > \Delta Q_B$; $\Delta U_A = \Delta U_B$

(3) $\Delta Q_A > \Delta Q_B$; $\Delta U_A > \Delta U_B$

(4) $\Delta Q_A < \Delta Q_B$; $\Delta U_A < \Delta U_B$

Official Ans. by NTA (2)

Sol.



Initial and final states for both the processes are same.

∴ $\Delta U_A = \Delta U_B$

Work done during process A is greater than in process B.

By First Law of thermodynamics

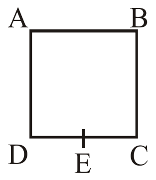
$\Delta Q = \Delta U + W$

$\Rightarrow \Delta Q_A > \Delta Q_B$

Option (2)

4. A wire of resistance R is bent to form a square ABCD as shown in the figure. The effective resistance between E and C is :

(E is mid-point of arm CD)

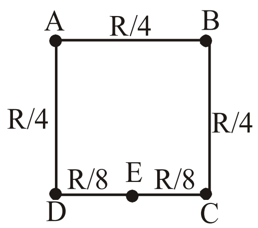


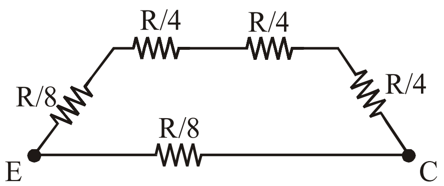
(1) R (2) $\frac{1}{16}R$

(3) $\frac{7}{64}R$ (4) $\frac{3}{4}R$

Official Ans. by NTA (3)

Sol.





$$\frac{1}{R_{eq}} = \frac{8}{7R} + \frac{8}{R}$$

$$\frac{1}{R_{eq}} = \frac{8+56}{7R}$$

$$R_{eq} = \frac{7R}{64}$$

Option (3)

5. The total number of turns and cross-section area in a solenoid is fixed. However, its length L is varied by adjusting the separation between windings. The inductance of solenoid will be proportional to :

(1) $1/L^2$ (2) $1/L$

(3) L (4) L^2

Official Ans. by NTA (2)

Sol. $\phi = NBA = LI$

$N \mu_0 nI\pi R^2 = LI$

$N \mu_0 \frac{N}{\ell} I\pi R^2 = LI$

N & R constant

self inductance (L) $\propto \frac{1}{\ell} \propto \frac{1}{\text{length}}$

Option (2)

6. A simple pendulum oscillating in air has period T. The bob of the pendulum is completely immersed in a non-viscous liquid. The density of the liquid is $\frac{1}{16}$ th of the material of the bob. If the bob is inside liquid all the time, its period of oscillation in this liquid is :

(1) $4T\sqrt{\frac{1}{15}}$ (2) $2T\sqrt{\frac{1}{10}}$

(3) $4T\sqrt{\frac{1}{14}}$ (4) $2T\sqrt{\frac{1}{14}}$

Official Ans. by NTA (1)

Sol. For a simple pendulum $T = 2\pi\sqrt{\frac{L}{g_{eff}}}$

situation 1 : when pendulum is in air $\rightarrow g_{eff} = g$

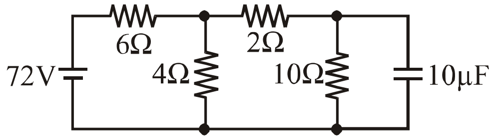
situation 2 : when pendulum is in liquid

$$\rightarrow g_{eff} = g\left(1 - \frac{\rho_{liquid}}{\rho_{body}}\right) = g\left(1 - \frac{1}{16}\right) = \frac{15g}{16}$$

$$\text{So, } \frac{T'}{T} = \frac{2\pi\sqrt{\frac{L}{15g/16}}}{2\pi\sqrt{\frac{L}{g}}} \Rightarrow T' = \frac{4T}{\sqrt{15}}$$

Option (1)

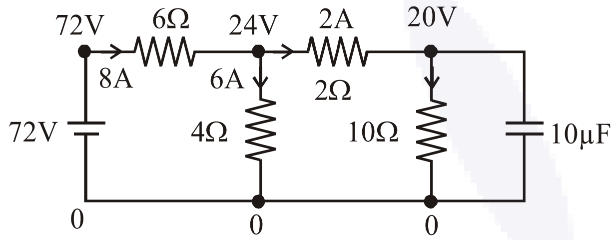
7. Determine the charge on the capacitor in the following circuit :



(1) 2μC (2) 60μC
(3) 200μC (4) 10μC

Official Ans. by NTA (3)

Sol. Applying point potential method

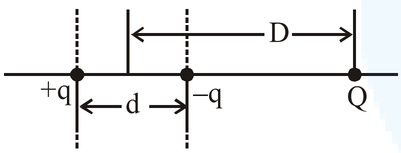


q = cV

q = 10μF × 20 = 200μC

Option (3)

8. A system of three charges are placed as shown in the figure :



If D >> d, the potential energy of the system is best given by :

(1) $\frac{1}{4\pi\varepsilon_0}\left[-\frac{q^2}{d}-\frac{qQd}{2D^2}\right]$

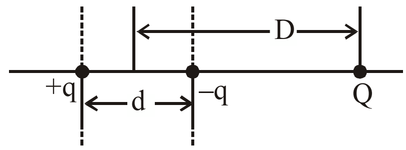
(2) $\frac{1}{4\pi\varepsilon_0}\left[+\frac{q^2}{d}+\frac{qQd}{D^2}\right]$

(3) $\frac{1}{4\pi\varepsilon_0}\left[-\frac{q^2}{d}+\frac{2qQd}{D^2}\right]$

(4) $\frac{1}{4\pi\varepsilon_0}\left[-\frac{q^2}{d}-\frac{qQd}{D^2}\right]$

Official Ans. by NTA (4)

Sol.



D >> d

$U_{total} = U_{self\ of\ dipole} + U_{interaction}$

$= -\frac{kq^2}{d} - \left(\frac{kQ}{D^2}\right)qd$

$= -\ k\left[\frac{q^2}{d}+\frac{qQd}{D^2}\right]$

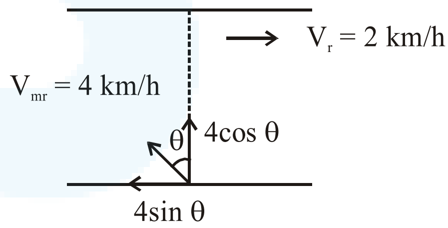
Option (4)

9. The stream of a river is flowing with a speed of 2km/h. A swimmer can swim at a speed of 4km/h. What should be the direction of the swimmer with respect to the flow of the river to cross the river straight ?

(1) 60° (2) 150° (3) 90° (4) 120°

Official Ans. by NTA (4)

Sol.



For swimmer to cross the river straight

$\Rightarrow\ 4\sin\theta = 2$

$\Rightarrow \sin\theta = \frac{1}{2} \Rightarrow \theta = 30°$

So, angle with direction of river flow = 90° + θ = 120°

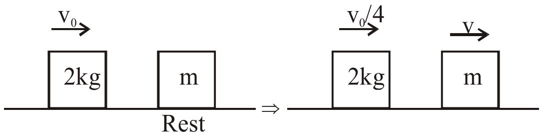
Option (4)

10. A body of mass 2 kg makes an eleastic collision with a second body at rest and continues to move in the original direction but with one fourth of its original speed. What is the mass of the second body ?

(1) 1.8 kg (2) 1.2 kg
(3) 1.5 kg (4) 1.0 kg

Official Ans. by NTA (2)

Sol.



By conservation of linear momentum :-

$$2v_0 = 2\left(\frac{v_0}{4}\right) + mv \Rightarrow 2v_0 = \frac{v_0}{2} + mv$$

$$\Rightarrow \frac{3v_0}{2} = mv \text{ ....(1)}$$

Since collision is elastic →

$V_{separation} = v_{approch}$

$$\Rightarrow v - \frac{v_0}{4} = v_0 \Rightarrow \frac{5v_0}{4} = v \text{ .....(2)}$$

equating (2) and (1)

$$\frac{3v_0}{2} = m\left(\frac{5v_0}{4}\right) \Rightarrow m = \frac{6}{5} = 1.2 \text{ kg}$$

Option (2)

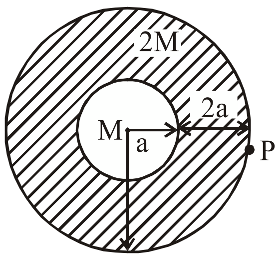
11. A solid sphere of mass 'M' and radius 'a' is surrounded by a uniform concentric spherical shell of thickness 2a and mass 2M. The gravitational field at distance '3a' from the centre will be :

(1) $\frac{2GM}{9a^2}$ (2) $\frac{GM}{3a^2}$

(3) $\frac{GM}{9a^2}$ (4) $\frac{2GM}{3a^2}$

Official Ans. by NTA (2)

Sol.



We use gauss's Law for gravitation

$g \cdot 4\pi r^2 = $ (Mass enclosed) $4\pi G$

$$g = \frac{3M4\pi G}{4\pi(3a)^2}$$

$$= \frac{MG}{3a^2}$$

Option (2)

12. The pressure wave, $P = 0.01 \sin [1000t - 3x]$ Nm^{-2}, corresponds to the sound produced by a vibrating blade on a day when atmospheric temperature is 0°C. On some other day, when temperature is T, the speed of sound produced by the same blade and at the same frequency is found to be 336 ms^{-1}. Approximate value of T is :

(1) 15°C (2) 12°C

(3) 4°C (4) 11°C

Official Ans. by NTA (3)

Sol. Speed of wave from wave equation

$$v = -\frac{(\text{coeffecient of } t)}{(\text{coeffecient of } x)}$$

$$v = -\frac{1000}{(-3)} = \frac{1000}{3}$$

since speed of wave $\propto \sqrt{T}$

$$\text{so } = \frac{\frac{1000}{3}}{336} = \sqrt{\frac{273}{T}}$$

$\Rightarrow T = 277.41$ K

$T = 4.41°C$

Option (3)

13. An NPN transistor is used in common emitter configuration as an amplifier with 1 kΩ load resistance. Signal voltage of 10 mV is applied across the base-emitter. This produces a 3 mA change in the collector current and 15μA change in the base current of the amplifier. The input resistance and voltage gain are :

(1) 0.33 kΩ, 1.5

(2) 0.67 kΩ, 200

(3) 0.33 kΩ, 300

(4) 0.67 kΩ, 300

Official Ans. by NTA (4)

Sol. input current = 15×10^{-6}

output current = 3×10^{-3}

resistance output = 1000

$V_{input} = 10 \times 10^{-3}$

Now $V_{input} = r_{input} \times i_{input}$

$10 \times 10^{-3} = r_{input} \times 15 \times 10^{-6}$

$$r_{input} = \frac{2000}{3} = 0.67\ K\Omega.$$

$$\text{voltage gain} = \frac{V_{output}}{V_{input}} = \frac{1000\times3\times10^{-3}}{10\times10^{-3}} = 300$$

Option (4)

14. A moving coil galvanometer has resistance 50Ω and it indicates full deflection at 4mA current. A voltmeter is made using this galvanometer and a 5 kΩ resistance. The maximum voltage, that can be measured using this voltmeter, will be close to :

(1) 10 V (2) 20 V

(3) 40 V (4) 15 V

Official Ans. by NTA (2)

Sol. $G = 50\ \Omega$

$S = 5000\ \Omega$

$i_g = 4 \times 10^{-3}$

$V = i_g (G + S)$

$V = 4 \times 10^{-3} (50 + 5000)$

$= 4 \times 10^{-3}(5050)$

$= 20.2$ volt

Option (2)

15. The electric field of light wave is given as

$$\vec{E} = 10^{-3}\cos\left(\frac{2\pi x}{5\times10^{-7}} - 2\pi\times6\times10^{14}t\right)\hat{x}\frac{N}{C}.\text{This}$$

light falls on a metal plate of work function 2eV. The stopping potential of the photo-electrons is :

$$\text{Given, E (in eV)} = \frac{12375}{\lambda(\text{in Å})}$$

(1) 0.48 V (2) 2.0 V

(3) 2.48 V (4) 0.72 V

Official Ans. by NTA (1)

Sol. $\omega = 6 \times 10^{14} \times 2\pi$

$f = 6 \times 10^{14}$

$C = f\lambda$

$$\lambda = \frac{C}{f} = \frac{3\times10^{8}}{6\times10^{14}} = 5000Å$$

$$\text{energy of photon} \Rightarrow \frac{12375}{5000}$$

$= 2.475$ eV

from Einstein's equation

$KE_{max} = E - \phi$

$eV_s = E - \phi$

$eV_s = 2.475 - 2$

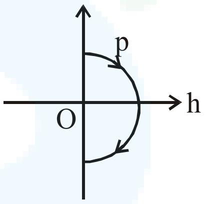
$eV_s = 0.475 - 2$

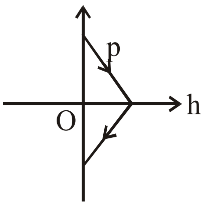
$eV_s = 0.475$ eV

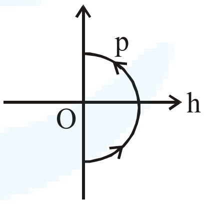
$V_s = 0.475$ V $= 0.48$ volt

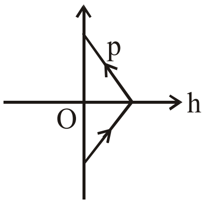
Option (1)

16. A ball is thrown vertically up (taken as +z-axis) from the ground. The correct momentum-height (p-h) diagram is :

(1)


(2)


(3)


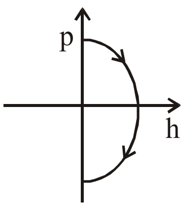
(4)


Official Ans. by NTA (1)

Sol. Momentum $p = mv$ .....(1)

and for motion under gravity $h = \frac{u^2 - v^2}{2g}$ ...(2)

$$h = \frac{u^2 - p^2/m^2}{2g}$$



Option (1)

17. A capacitor with capacitance 5μF is charged to 5μC. If the plates are pulled apart to reduce the capacitance to 2μF, how much work is done ?

(1) 3.75×10^{-6} J

(2) 2.55×10^{-6} J

(3) 2.16×10^{-6} J

(4) 6.25×10^{-6} J

Official Ans. by NTA (1)

Sol. Work done = ΔU

$= U_f - U_i$

$= \frac{q^2}{2C_f} - \frac{q^2}{2C_i}$

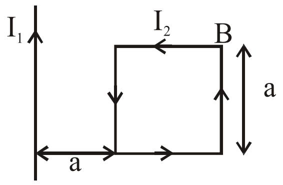
$= \frac{(5\times10^{-6})^2}{2}\left(\frac{1}{2\times10^{-6}} - \frac{1}{5\times10^{-6}}\right)$

$= \frac{15}{4} \times 10^{-6}$

$= 3.75 \times 10^{-6}$ J

Option (1)

18. A rigid square loop of side 'a' and carrying current I_2 is lying on a horizontal surface near a long current I_1 carrying wire in the same plane as shown in figure. The net force on the loop due to wire will be :



(1) Attractive and equal to $\frac{\mu_0 I_1 I_2}{3\pi}$

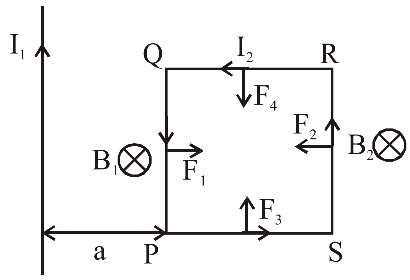
(2) Repulsive and equal to $\frac{\mu_0 I_1 I_2}{4\pi}$

(3) Repulsive and equal to $\frac{\mu_0 I_1 I_2}{2\pi}$

(4) Zero

Official Ans. by NTA (2)

Sol.



F_3 & F_4 cancel each other

Force on PQ will be $F_1 = I_2 B_1 a$

$= I_2 \frac{\mu_0 I_1}{2\pi a} a$

$= \frac{\mu_0 I_1 I_2}{2\pi}$

Force on RS will be $F_2 = I_2 B_2 a$

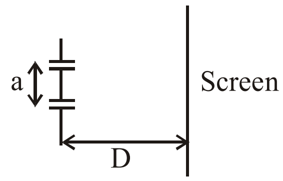
$= I_2 \frac{\mu_0 I_1}{2\pi 2a} a$

$= \frac{\mu_0 I_1 I_2}{4\pi}$

Net force $= F_1 - F_2 = \frac{\mu_0 I_1 I_2}{4\pi}$ repulsion

Option (2)

19. The figure shows a Young's double slit experimental setup. It is observed that when a thin transparent sheet of thickness t and refractive index μ is put in front of one of the slits, the central maximum gest shifted by a distance equal to n fringe widths. If the wavelength of light used is λ, t will be :



(1) $\frac{2D\lambda}{a(\mu-1)}$ (2) $\frac{D\lambda}{a(\mu-1)}$

(3) $\frac{2nD\lambda}{a(\mu-1)}$ (4) $\frac{nD\lambda}{a(\mu-1)}$

Official Ans. by NTA (4)

Answer (Bonus)

Sol. Path difference at central maxima $\Delta x = (\mu - 1)t$, whole pattern will shift by same amount which will be given by

$(\mu - 1)t \frac{D}{d} = n\frac{\lambda D}{d}$, according to the question

$t = \frac{n\lambda}{(\mu - 1)}$

no option is matching, therefore question should be awarded bonus.

$\therefore$ Correct Option should be (Bonus)

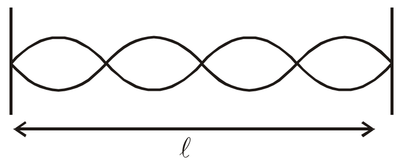
20. A string is clamped at both the ends and it is vibrating in its 4th harmonic. The equation of the stationary wave is $Y = 0.3 \sin(0.157x) \cos(200\pi t)$. The length of the string is : (All quantities are in SI units.)

(1) 20 m (2) 80 m

(3) 60 m (4) 40 m

Official Ans. by NTA (2)

Sol. 4th harmonic



$4\frac{\lambda}{2} = \ell$

$2\lambda = \ell$

From equation $\frac{2\pi}{\lambda} = 0.157$

$\lambda = 40$

$\ell = 2\lambda$

$= 80$ m

Option (2)

21. The following bodies are made to roll up (without slipping) the same inclined plane from a horizontal plane. : (i) a ring of radius R, (ii) a solid cylinder of radius $\frac{R}{2}$ and (iii) a solid sphere of radius $\frac{R}{4}$. If in each case, the speed of the centre of mass at the bottom of the incline is same, the ratio of the maximum heights they climb is :

(1) 4 : 3 : 2 (2) 14 : 15 : 20

(3) 10 : 15 : 7 (4) 2 : 3 : 4

Official Ans. by NTA (3)

Answer (2)

Sol. $\frac{1}{2}\left(m + \frac{I}{R^2}\right)v^2 = mgh$

if radius of gyration is k, then

$h = \frac{\left(1 + \frac{k^2}{R^2}\right)v^2}{2g}$, $\frac{k_{ring}}{R_{ring}} = 1$, $\frac{k_{solid\ cylinder}}{R_{solid\ cylinder}} = \frac{1}{\sqrt{2}}$

$\frac{k_{solid\ sphere}}{R_{solid\ sphere}} = \sqrt{\frac{2}{5}}$

$h_1 : h_2 : h_3 :: (1 + 1) : \left(1 + \frac{1}{2}\right) : \left(1 + \frac{2}{5}\right) :: 20 : 15 : 14$

Therefor **most appropriate option is (2)** athough which in not in correct sequence

22. A stationary horizontal disc is free to rotate about its axis. When a torque is applied on it, its kinetic energy as a function of θ, where θ is the angle by which it has rotated, is given as $k\theta^2$. If its moment of inertia is I then the angular acceleration of the disc is :

(1) $\frac{k}{2I}\theta$ (2) $\frac{k}{I}\theta$ (3) $\frac{k}{4I}\theta$ (4) $\frac{2k}{I}\theta$

Official Ans. by NTA (4)

Sol. Kinetic energy KE = $\frac{1}{2}I\omega^2 = k\theta^2$

$$\Rightarrow \omega^2 = \frac{2k\theta^2}{I} \Rightarrow \omega = \sqrt{\frac{2k}{I}}\,\theta \qquad ....(1)$$

Differentiate (1) wrt time →

$$\frac{d\omega}{dt} = \alpha = \sqrt{\frac{2k}{I}}\left(\frac{d\theta}{dt}\right)$$

$$\Rightarrow \alpha = \sqrt{\frac{2k}{I}}\cdot\sqrt{\frac{2k}{I}}\,\theta \text{ \{by (1)\}}$$

$$\Rightarrow \alpha = \frac{2k}{I}\theta$$

Option (4)

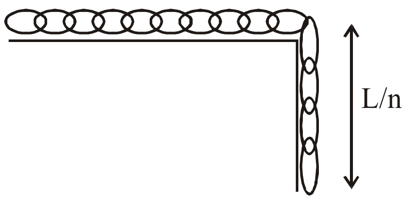
23. A uniform cable of mass 'M' and length 'L' is placed on a horizontal surface such that its $\left(\frac{1}{n}\right)^{th}$ part is hanging below the edge of the surface. To lift the hanging part of the cable upto the surface, the work done should be :

(1) $\frac{MgL}{n^2}$ (2) $\frac{MgL}{2n^2}$

(3) $\frac{2MgL}{n^2}$ (4) nMgL

Official Ans. by NTA (2)

Sol. Mass of the hanging part = $\frac{M}{n}$



$$h_{COM} = \frac{L}{2n}$$

work done $W = mgh_{COM} = \left(\frac{M}{n}\right)g\left(\frac{L}{2n}\right) = \frac{MgL}{2n^2}$

Option (2)

24. If 'M' is the mass of water that rises in a capillary tube of radius 'r', then mass of water which will rise in a capillary tube of radius '2r' is :

(1) 4M (2) M

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

Official Ans. by NTA (3)

Sol. Height of liquid rise in capillary tube $h = \frac{2T\cos\theta_C}{\rho rg}$

$$\Rightarrow h \propto \frac{1}{r}$$

when radius becomes double height become half

$$\therefore h' = \frac{h}{2}$$

Now, $M = \pi r^2 h \times \rho$

and $M' = \pi (2r)^2 (h/2) \times \rho = 2M$

Option (3)

25. Taking the wavelength of first Balmer line in hydrogen spectrum (n = 3 to n = 2) as 660 nm, the wavelength of the 2nd Balmer line (n = 4 to n = 2) will be :

(1) 889.2 nm (2) 642.7 nm

(3) 488.9 nm (4) 388.9 nm

Official Ans. by NTA (3)

Sol. $$\frac{1}{660} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \frac{5R}{36} \qquad ....(1)$$

$$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = \frac{3R}{16} \qquad ....(2)$$

divide equation (1) with (2)

$$\frac{\lambda}{660} = \frac{5\times16}{36\times3}$$

$$\lambda = \frac{4400}{9} = 488.88 = 488.9 \text{ nm}$$

Option (3)

26. The magnetic field of a plane electromagnetic wave is given by :

$\vec{B} = B_0\hat{i}[\cos(kz-\omega t)] + B_1\hat{j}\cos(kz+\omega t)$ where $B_0 = 3 \times 10^{-5}$ T and $B_1 = 2 \times 10^{-6}$ T. The rms value of the force experienced by a stationary charge Q = 10^{-4} C at z = 0 is closest to :

(1) 0.9 N (2) 0.1 N
(3) 3×10^{-2} N (4) 0.6 N

Official Ans. by NTA (4)

Sol. Maximum Electric field E = (B) (c)

$\vec{E}_0 = (3 \times 10^{-5})c\left(-\hat{j}\right)$

$\vec{E}_1 = (2 \times 10^{-6})c\left(-\hat{i}\right)$

Maximum force

$\vec{F}_{net} = q\vec{E} = qc\left(-3\times10^{-5}\hat{j} - 2\times10^{-6}\hat{i}\right)$

$\vec{F}_{0\,max} = 10^{-4} \times 3 \times 10^{8}\sqrt{(3\times10^{-5})^2+(2\times10^{-6})^2}$

= 0.9N

$F_{rms} = \frac{F_0}{\sqrt{2}} = 0.6$ N (approx)

Option (4)

27. A rectangular coil (Dimension 5 cm × 2.5 cm) with 100 turns, carrying a current of 3 A in the clock-wise direction is kept centered at the origin and in the X-Z plane. A magnetic field of 1 T is applied along X-axis. If the coil is tilted through 45° about Z-axis, then the torque on the coil is :

(1) 0.55 Nm (2) 0.27 Nm
(3) 0.38 Nm (4) 0.42 Nm

Official Ans. by NTA (2)

Sol. $|\vec{\tau}| = |\vec{M}\times\vec{B}|$

$\tau = NI \times A \times B \times \sin 45°$

$\tau = 0.27$ Nm

Option (2)

28. A concave mirror for face viewing has focal length of 0.4 m. The distance at which you hold the mirror from your face in order to see your image upright with a magnification of 5 is :

(1) 1.60 m (2) 0.24 m
(3) 0.16 m (4) 0.32 m

Official Ans. by NTA (4)

Sol. $m = \frac{f}{f-u}$

$5 = \frac{-40}{-40-u}$

u = –32 cm

Option (4)

29. A signal $A\cos\omega t$ is transmitted using $v_0 \sin \omega_0 t$ as carrier wave. The correct amplitude modulated (AM) signal is :

(1) $v_0 \sin\omega_0 t + A\cos\omega t$

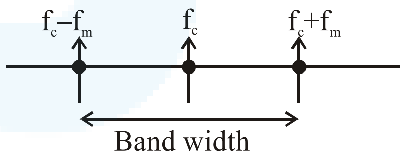
(2) $v_0 \sin\omega_0 t + \frac{A}{2}\sin(\omega_0-\omega)t + \frac{A}{2}\sin(\omega_0+\omega)t$

(3) $(v_0 + A)\cos\omega t \sin\omega_0 t$

(4) $v_0 \sin[\omega_0(1+0.01A\sin\omega t)t]$

Official Ans. by NTA (2)

Sol.



Option (2)

30. For a given gas at 1 atm pressure, rms speed of the molecule is 200 m/s at 127°C. At 2 atm pressure and at 227°C, the rms speed of the molecules will be :

(1) 80 m/s (2) $100\sqrt{5}$ m/s
(3) $80\sqrt{5}$ m/s (4) 100 m/s

Official Ans. by NTA (2)

Sol. $V_{rms} = \sqrt{\frac{3RT}{M_w}} \Rightarrow v_{rms} \propto \sqrt{T}$

Now, $\frac{v}{200} = \sqrt{\frac{500}{400}} \Rightarrow \frac{v}{200} = \frac{\sqrt{5}}{2}$

$\Rightarrow v = 100\sqrt{5}$ m/s

Option (2)