# Physics

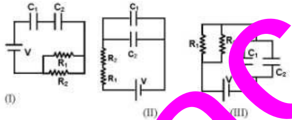
*Time: 2 hours*

**Note:** *The marking Scheme is (+3, −1) for question numbers 1 to 12 , (+5, −1) for question numbers 13 to [illegible] (+5, −2) for question numbers 21 to 32 and (+6, 0) for question numbers 33 to 40.*

1. Given,

$R_1 = 1\Omega$ $C_1 = 2\mu F$

$R_2 = 2\Omega$ $C_2 = 4\mu F$




The time constants (in μS) for the circuits I, II, III are respectively

(A) 18, 8/9, 4 (B) 18, 4, 8/9

(C) 4, 8/9, 18 (D) 8/9, 18, 4

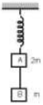
**Sol.** *(D)*

$\tau_1 = 8/9\ \mu S$

$\tau_2 = 18\ \mu S$

$\tau_3 = 4\ \mu S$

2. Two blocks A and B of masses 2m and m, respectively, are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in the figure. The magnitude of acceleration of A and B, immediately after the string is cut, are respectively



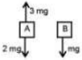

(A) g, g/2 (B) g/2, g

(C) g , g (D) g/2, g/2

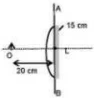
**Sol.** *(B)*

$a_A = g/2$

$a_B = g$




3. A point object is placed at a distance of 20 cm from a thin plano-convex lens of focal length 15 cm. If the plane surface is silvered. The image will form at




(A) 60 cm left of AB (B) 30 cm left of AB

(C) 12 cm left of AB (D) 60 cm right of AB

**Sol.** *(C)*

$-\frac{1}{F} = \frac{2}{f_\ell} + \frac{1}{\infty} \Rightarrow F = -\frac{15}{2}$

$-\frac{2}{15} = \frac{1}{v} - \frac{1}{20}$

$\Rightarrow v = -12$ cm i.e. 12 cm left of AB

4. A biconvex lens of focal length f forms a circular image of sun of radius r in focal plane. Then

(A) $\pi r^2 \propto f$ (B) $\pi r^2 \propto f^2$

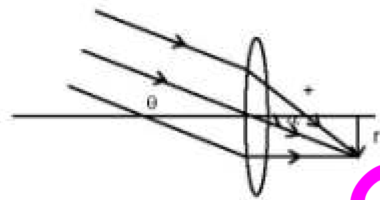
(C) if lower half part is covered by black sheet, then area of the image is equal to $\pi r^2/2$

(D) if f is doubled, intensity will increase

***Sol.*** *(B)*

$r = f \tan \alpha$

Hence, $\pi r^2 \propto f^2$




5. Given a sample of Radium-226 having half-life of 4 days. Find the probability, a nucleus disintegrates after 2 half lives.

(A) 1 (B) 1/2

(C) 1.5 (D) 3/4

***Sol.*** *(B)*

Disintegration of each nuclei is independent of any factor. Hence, each nuclei has same chance of disintegration.

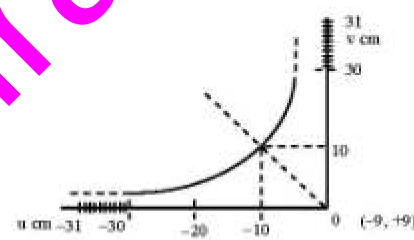
6. Graph of position of image vs position of point object from a convex lens is shown. Then, focal length of the lens is

(A) 0.50 ± 0.05 cm

(B) 0.50 ± 0.10 cm

(C) 5.00 ± 0.05 cm

(D) 5.00 ± 0.10 cm




***Sol.*** *(D)*

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow f = 5\ cm$

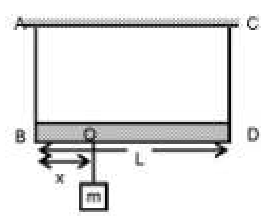
$f = \frac{uv}{u+v}$

$\frac{\Delta f}{f} = \left|\frac{\Delta u}{u}\right| + \left|\frac{\Delta v}{v}\right| + \frac{|\Delta u| + |\Delta v|}{|u| + |v|}$

$\Delta f = 0.1$[illegible] (for f = 5 cm)

The most appropriate answer is 5.00 ± 0.10 cm

7. A massless rod is suspended by two identical strings AB and CD of equal length. A block of mass m is suspended from point O such that BO is equal to 'x'. Further, it is observed that the frequency of 1st harmonic (fundamental frequency) in AB is equal to 2nd harmonic frequency in CD. Then, length of BO is




(A) L/5 (B) 4L/5

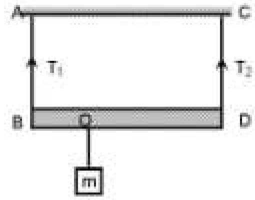
(C) 3L/4 (D) L/4

*Sol.* *(A)*

$$\frac{1}{2\ell}\sqrt{\frac{T_1}{\mu}} = \frac{1}{\ell}\sqrt{\frac{T_2}{\mu}}$$

$T_2 = T_1/4$

For rotational equilibrium, $T_1x = T_2(L - x) \Rightarrow x = L/5$




8. A system of binary stars of masses $m_A$ and $m_B$ are moving in circular orbits of radii $r_A$ and $r_B$ respectively. If $T_A$ and $T_B$ are the time periods of masses $m_A$ and $m_B$ respectively, then

(A) $\frac{T_A}{T_B} = \left(\frac{r_A}{r_B}\right)^{3/2}$ (B) $T_A > T_B$ (if $r_A > r_B$)

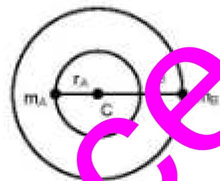
(C) $T_A > T_B$ (if $m_A > m_B$) (D) $T_A = T_B$ [+3, −1]

*Sol.* *(D)*

$$\frac{Gm_Am_B}{(r_A + r_B)^2} = \frac{m_Ar_A4\pi^2}{T_A^2} = \frac{m_Br_B4\pi^2}{T_B^2}$$

$\Rightarrow m_Ar_A = m_Br_B$

$\therefore T_A = T_B$




9. A solid sphere of mass M, radius R and having moment of inertia about an axis passing through the centre of mass as I, is recast into a disc of thickness t, whose moment of inertia about an axis passing through its edge and perpendicular to its plane remains I. Then, radius of the disc will be

(A) $\frac{2R}{\sqrt{15}}$ (B) $R\sqrt{\frac{2}{15}}$

(C) $\frac{4R}{\sqrt{15}}$ (D) $\frac{R}{4}$ [+3, −1]

*Sol.* *(A)*

$$\frac{2}{5}MR^2 = \frac{3}{2}Mr^2$$

$$r = \frac{2R}{\sqrt{15}}$$

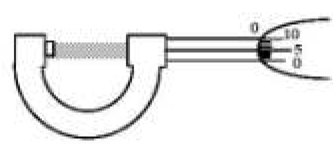
10. A student performs an experiment for determination of $g\left(=\frac{4\pi^2\ell}{T^2}\right)$, $\ell \approx 1$m, and he commits an error of $\Delta\ell$.

For T he takes the time of n oscillations with the stop watch of least count $\Delta T$ and he commits a human error of 0.1 sec. For which of the following data, the measurement of g will be most accurate?

| | $\Delta\ell$ | $\Delta T$ | n | Amplitude of oscillation |
|---|---|---|---|---|
| (A) | 5 mm | 0.2 sec | 10 | 5 mm |
| (B) | 5 mm | 0.2 sec | 20 | 5 mm |
| (C) | 5 mm | 0.1 sec | 20 | 1 mm |
| (D) | 1 mm | 0.1 sec | 50 | 1 mm |

*Sol.* *(D)*

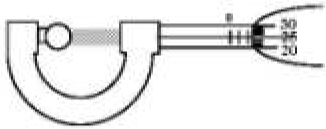
11. The circular divisions of shown screw gauge are 50. It moves 0.5 mm on main scale in one rotation. The diameter of the ball is




(A) 2.25 mm (B) 2.20 mm

(C) 1.20 mm (D) 1.25 mm

**Sol.** *(C)*



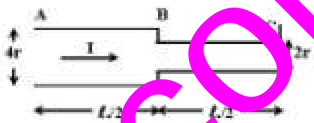

Zero error = $5 \times \frac{0.5}{50} = 0.05$ mm

Actual measurement

$= 2 \times 0.5 \text{ mm} + 25 \times \frac{0.5}{50} - 0.05 \text{ mm}$

= 1 mm + 0.25 mm − 0.05 mm = 1.20 mm

12 Consider a cylindrical element as shown in the figure. Current flowing the through element is I and resistivity of material of the cylinder is ρ. Choose the correct option out the following.




(A) Power loss in first half is four times the power loss in second half.

(B) Voltage drop in first half is twice of voltage drop in second half.

(C) Current density in both halves are equal.

(D) Electric field in both halves is equal.

**Sol.** *(B)*

$\frac{R_1}{R_2} = \frac{A_1}{A_2} = \frac{4}{1}$

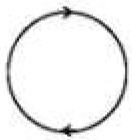
$\frac{P_1}{P_2} = \frac{I^2R_1}{I^2R_2} = \frac{4}{1}$

$\frac{V_1}{V_2} = \frac{IR_1}{IR_2} = \frac{4}{1}$

$\frac{J_1}{J_2} = \frac{1}{4}$

***More than One Choice may be correct .(+5, −1)***

13. In the given diagram, a line of force of a particular force field is shown. Out of the following options, it can never represent



(A) an electrostatic field

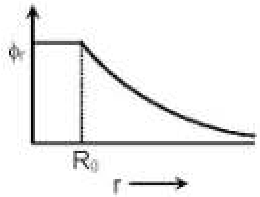
(B) a magnetostatic field

(C) a gravitational field of a mass at rest

(D) an induced electric field

**Sol.** *(A), (C)*

14. The electrostatic potential ($\phi_r$) of a spherical symmetric system, kept at origin, is shown in the adjacent figure, and given as




$\phi_r = \frac{q}{4\pi \epsilon_0 r} \qquad (r \geq R_0)$

$\phi_r = \frac{q}{4\pi \epsilon_0 R_0} \qquad (r \leq R_0)$

Which of the following option(s) is/are correct?

(A) For spherical region $r \leq R_0$, total electrostatic energy stored is zero.

(B) Within $r = 2R_0$, total charge is q.

(C) There will be no charge anywhere except at $r = R_0$.

(D) Electric field is discontinuous at $r = R_0$.

**Sol.** *(A), (B), (C), (D)*

The potential shown is for charged spherical conductor.

15. A solid cylinder of mass m and radius r is rolling on a rough inclined plane of inclination $\theta$. The coefficient of friction between the cylinder and incline is $\mu$. Then

(A) frictional force is always $\mu mg \cos\theta$
(B) friction is a dissipative force
(C) by decreasing $\theta$, frictional force decreases
(D) friction opposes translation and supports rotation.

***Sol.*** *(C), (D)*

16. Function $x = A\sin^2\omega t + B\cos^2\omega t + C\sin\omega t\cos\omega t$ represents SHM

(A) for any value of A, B and C (except C = 0)
(B) if $A = -B$; $C = 2B$, amplitude $= |B\sqrt{2}|$
(C) if $A = B$; $C = 0$
(D) if $A = B$; $C = 2B$, amplitude $= |B|$

***Sol.*** *(A), (B), (D)*

$$x = \frac{A}{2}(1-\cos 2\omega t) + \frac{B}{2}(1+\cos 2\omega t) + \frac{C}{2}\sin 2\omega t$$

For A = 0, B = 0

$$x = \frac{C}{2}\sin 2\omega t$$

For $A = -B$ and $C = 2B$

$x = B\cos 2\omega t + B\sin 2\omega t$

Amplitude $= |B\sqrt{2}|$

For A = B; C = 0

x = A,

Hence this is not correct option

For A = B, C = 2B

$x = B + B\sin 2\omega t$

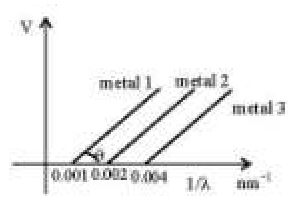
It is also represents SHM.

17. In a dark room with ambient temperature $T_0$, a black body is kept at a temperature T. Keeping the temperature of the black body constant (at T), sunrays are allowed to fall on the black body through a hole in the roof of the dark room. Assuming that there is no change in the ambient temperature of the room, which of the following statement(s) is/are correct?

(A) The quantity of radiation absorbed by the black body in unit time will increase.
(B) Since emissivity = absorptivity, hence the quantity of radiation emitted by black body in unit time will increase.
(C) Black body radiates more energy in unit time in the visible spectrum.
(D) The reflected energy in unit time by the black body remains same.

***Sol.*** *(A), (B), (C), (D)*

18. The graph between $1/\lambda$ and stopping potential (V) of three metals having work functions $\phi_1$, $\phi_2$ and $\phi_3$ in an experiment of photo-electric effect is plotted as shown in the figure. Which of the following statement(s) is/are correct? [Here $\lambda$ is the wavelength of the incident ray].




(A) Ratio of work functions $\phi_1 : \phi_2 : \phi_3 = 1 : 2 : 4$
(B) Ratio of work functions $\phi_1 : \phi_2 : \phi_3 = 4 : 2 : 1$
(C) $\tan\theta$ is directly proportional to hc/e, where h is Planck's constant and c is the speed of light.
(D) The violet colour light can eject photoelectrons from metals 2 and 3.

***Sol.*** *(A), (C)*

$$\frac{hc}{\lambda} - \phi = eV$$

$$V = \frac{hc}{e\lambda} - \frac{\phi}{e}$$

For plate 1: $\frac{\phi_1}{hc} = 0.001$  plate 2 $\frac{\phi_2}{hc} = 0.002$  plate 3 $\frac{\phi_3}{hc} = 0.004$

$\phi_1 : \phi_2 : \phi_3 = 1 : 2 : 4$

For plate 2, threshold wavelength

$$\lambda = \frac{hc}{\phi_2} = \frac{hc}{0.002\,hc} = \frac{1000}{2} = 500 \text{ nm}$$

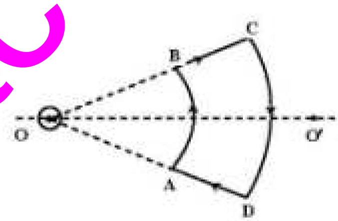
For plate 3, threshold wavelength

$$\lambda = \frac{hc}{\phi_3} = \frac{hc}{0.004hc} = \frac{1000}{4} = 250 \text{nm}$$

Since violet colour light $\lambda$ is 400 nm, so $\lambda_{violet} < \lambda_{threshold}$ for plate 2

So, violet colour light will eject photo-electrons from plate 2 and not from plate 3.

19. An infinite current carrying wire passes through point O and in perpendicular to the plane containing a current carrying loop ABCD as shown in the figure. Choose the correct option (s).




(A) Net force on the loop is zero.

(B) Net torque on the loop is zero.

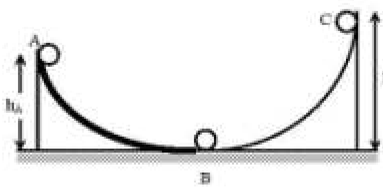
(C) As seen from O, the loop rotates clockwise.

(D) As seen from O, the loop rotates anticlockwise.

***Sol.*** *(A), (C)*

Magnetic force on wire BC would be perpendicular to the plane of the loop along the outward direction and on wire DA the magnetic force would be along the inward normal, so net force on the wire loop is zero and torque on the loop would be along the clockwise sense as seen from O.

20. A ball moves over a fixed track as shown in the figure. From A to B the ball rolls without slipping. Surface BC is frictionless. $K_A$, $K_B$ and $K_C$ are kinetic energies of the ball at A, B and C, respectively. Then




(A) $h_A > h_C$; $K_B > K_C$

(B) $h_A > h_C$; $K_C > K_A$

(C) $h_A = h_C$; $K_B = K_C$

(D) $h_A < h_C$; $K_B > K_C$

***Sol.*** *(A), (B), (D)*

$E_A = mgh_A + K_A$

$E_B = K_B$

$E_c = mgh_c + K_c$

Using conservation of energy

$E_A = E_B = E_C$

$K_B > K_C$

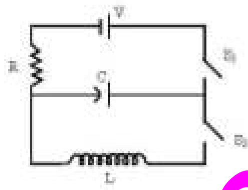
$K_B > K_A$

$Mg(h_A - h_C) + (K_A - K_C) = 0$

$$\Rightarrow h_A - h_C = \frac{K_C - K_A}{Mg}$$

***Comprehension –I**

The capacitor of capacitance C can be charged (with the help of a resistance R) by a voltage source V, by closing switch $S_1$ while keeping switch $S_2$ open. The capacitor can be connected in series with an inductor 'L' by closing switch $S_2$ and opening $S_1$.




21. Initially, the capacitor was uncharged. Now, switch $S_1$ is closed and $S_2$ is kept open. If time constant of this circuit is $\tau$, then

(A) after time interval $\tau$, charge on the capacitor is $CV/2$

(B) after time interval $2\tau$, charge on the capacitor is $CV(1-e^{-2})$

(C) the work done by the voltage source will be half of the heat dissipated when the capacitor is fully charged.

(D) after time interval $2\tau$, charge on the capacitor is $CV(1-e^{-1})$

***Sol.*** ***(B)***

$Q = Q_0(1 - e^{-t/\tau})$

$Q = CV(1 - e^{-t/\tau})$ after time interval $2\tau$.

22. After the capacitor gets fully charged, $S_1$ is opened and $S_2$ is closed so that the inductor is connected in series with the capacitor. Then,

(A) at $t = 0$, energy stored in the circuit is purely in the form of magnetic energy

(B) at any time $t > 0$, current in the circuit is in the same direction

(C) at $t > 0$, there is no exchange of energy between the inductor and capacitor

(D) at any time $t > 0$, instantaneous current in the circuit may $V\sqrt{\frac{C}{L}}$

***Sol.*** ***(D)***

$q = Q_0 \cos \omega t$

$i = -\frac{dq}{dt} = Q_0\omega \sin \omega t$

$\Rightarrow i_{max} = VC\omega = V\sqrt{\frac{C}{L}}$

23. If the total charge stored in the LC circuit is $Q_0$, then for $t \geq 0$

(A) the charge on the capacitor is $Q = Q_0 \cos\left(\frac{\pi}{2} + \frac{t}{\sqrt{LC}}\right)$

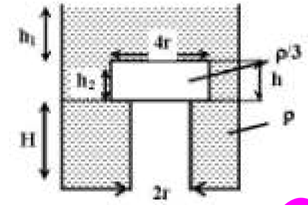
(B) the charge on the capacitor is $Q = Q_0 \cos\left(\frac{\pi}{2} - \frac{t}{\sqrt{LC}}\right)$

(C) the charge on the capacitor is $Q = -LC\frac{d^2Q}{dt^2}$

(D) the charge on the capacitor is $Q = -\frac{1}{\sqrt{LC}}\frac{d^2Q}{dt^2}$

***Sol.*** ***(C)***

## Comprehension-II

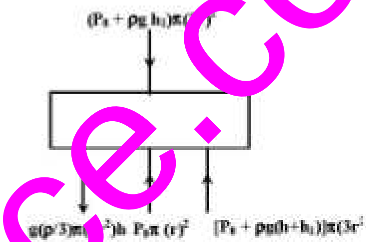



A wooden cylinder of diameter 4r, height h and density ρ/3 is kept on a hole of diameter 2r of a tank, filled with water of density ρ as shown in the figure. The height of the base of cylinder from the base of tank is H.

24. If level of liquid starts decreasing slowly when the level of liquid is at a height $h_1$ above the cylinder, the block just starts moving up. Then, value of $h_1$ is

(A) 2h/3 (B) 5h/4
(C) 5h/3 (D) 5h/2

*Sol.* *(C)*



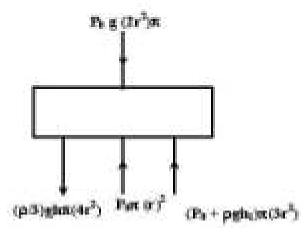

$$[P_0 + \rho g h_1]\pi(4r^2) + \frac{\rho}{3}\pi 4r^2 hg = [P_0 + \rho g(h_1 + h_2)]\pi(3r^2) + P_0\pi r^2$$

$h_1 = 5h/3$

25. Let the cylinder is prevented from moving up, by applying a force and water level is further decreased. Then, height of water level ($h_2$ in figure) for which the cylinder remains in original position without application of force is

(A) h/3 (B) 4h/9
(C) 2h/3 (D) h

***Sol.*** *(B)*




$$P_0\pi(4r^2) + \frac{\rho}{3}\pi 4r^2 hg = (P_0 + \rho g h_2)\pi(3r^2) + P_0\pi r^2$$

$h_1 = 4h/9$

26. If height $h_2$ of water level is further decreased, then

(A) cylinder will not move up and remains at its original position.
(B) for $h_2$ = h/3, cylinder again starts moving up
(C) for $h_2$ = h/4, cylinder again starts moving up
(D) for $h_2$ = h/5 cylinder again starts moving up

*Sol.* *(A)*

For $h_2$ < 4h/9 cylinder does not moves up

27. Two waves $y_1 = A\cos(0.5\,\pi x - 100\,\pi t)$ and $y_2 = A\cos(0.46\,\pi x - 92\,\pi t)$ are travelling in a pipe placed along x-axis. Find the number of times intensity is maximum in time interval of 1 sec.

(A) 4 (B) 6
(C) 8 (D) 10

**Sol.** *(A)*

$|f_1 - f_2| = 4\ s^{-1}$

28. Find wave velocity of louder sound

(A) 100 m/s (B) 192 m/s

(C) 200 m/s (D) 96 m/s

**Sol.** *(C)*

$v_1 = v_2 = 200$ m/s

29. Find the number of times $y_1 + y_2 = 0$ at $x = 0$ in 1 sec

(A) 100 (B) 46

(C) 192 (D) 96

**Sol.** *(D)*

$y_1 + y_2 = A\cos 100\pi t + A\cos 92\pi t = 0$

$\cos 100\pi t = -\cos 92\pi t$

$100\pi t = (2n+1)\pi - 92\pi t$

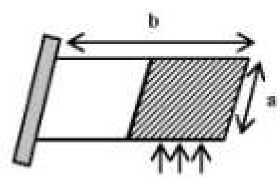
$t = \dfrac{(2n+1)}{192}$

$\Delta t = t_{n+1} - t_n = \dfrac{2}{192}$

***Questions 30-32 could not be retrieved due to large length of comprehension.***

33. There is a rectangular plate of mass M kg of dimensions (a × b). The plate is held in horizontal position by striking n small balls each of mass m per unit area per unit time. These are striking in the shaded half region of the plate. The balls are colliding elastically with velocity v. What is v?

It is given n = 100, M = 3 kg, m = 0.01 kg; b = 2 m; a = 1m; g = 10 m/s$^2$.




**Sol.** Torque about hinge side

$a \times \dfrac{b}{2} n(2mv) \times \dfrac{3b}{4} = Mg\dfrac{b}{2}$

$v = \dfrac{2}{3}\dfrac{Mg}{abnm} = \dfrac{2}{3} \times \dfrac{3 \times 10}{2 \times 100 \times 0.01} = 10$ m/s

34. In an insulated vessel, 0.05 kg steam at 373 K and 0.45 kg of ice at 253 K are mixed. Then, find the final temperature of the mixture.

Given, $L_{fusion} = 80$ cal/g = 336 J/g, $L_{vaporization} = 540$ cal/g = 2268 J/g,

$S_{ice} = 2100$ J/kg K = 0.5 cal/gK and $S_{water} = 4200$ J/kg K = 1 cal /gK

**Sol.** $\Sigma \Delta Q = 0$

Heat lost by steam to convert into 0°C water

$H_L = 0.05 \times 540 + 0.05 \times 10 \times 1$

$= 27 + 5 = 32$ kcal

Heat required by ice to change into 0°C water

$H_g = 0.45 \times \dfrac{1}{2} \times 20 + 0.45 \times 80 = 4.5 + 36.00 = 40.5$ kcal

Thus, final temperature of mixture is 0°C.

35. In hydrogen-like atom (z = 11), $n^{th}$ line of Lyman series has wavelength λ equal to the de-Broglie's wavelength of electron in the level from which it originated. What is the value of n?

***Sol.***

$$\frac{1}{\lambda} = Rz^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

$$\frac{1}{\lambda} = R(11)^2\left(\frac{1}{1} - \frac{1}{n^2}\right)$$

$$\lambda = \frac{h}{\rho} = \frac{h}{mv}$$

$$\lambda = \frac{hr}{mvr} = \frac{rh2\pi}{nh} = \frac{2\pi r}{n}.$$

$$\lambda = \frac{2\pi r}{n} = \frac{\pi(0.529\times10^{-10})n^2}{(n)(11)}$$

$$\therefore \frac{1}{\lambda} = \frac{11}{2\pi(0.529\times10^{-10})n} = \frac{11}{(2\pi)(0.529\times10^{-10})n} = 1.1\times10^7\,(11)^2\left(1-\frac{1}{n^2}\right)$$

$$= \frac{1}{(2\pi)(0.529\times10^{-10})(1.1\times10^7)(11)} = n - \frac{1}{n}$$

$$n - \frac{1}{n} = 25$$

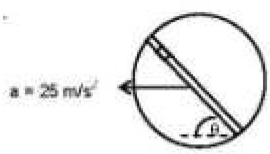
$$n^2 - 1 = 25\,n$$

$$n^2 - 25\,n - 1 = 0$$

$$n = 25$$

Hence answer = 24

36. A circular disc with a groove along its diameter is placed horizontally. A block of mass 1 kg is placed as shown. The co-efficient of friction between the block and all surfaces of groove in contact is μ = 2/5. The disc has an acceleration of 25 m/s². Find the acceleration of the block with respect to disc.



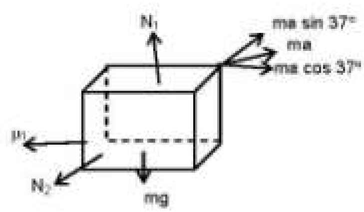

cos θ = 4/5
sin θ = 3/5

***Sol.***

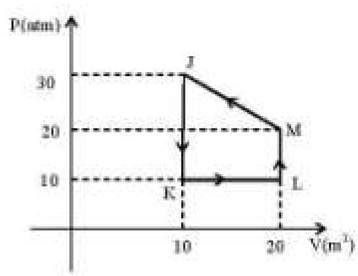
$N_1 = mg$

$N_2 = m\,a\,\sin 37°$

$$a_{bd} = \frac{ma\cos37° - \mu N_2 - \mu N_1}{m} = 10\,m/s^2.$$




37. Heat given to process is positive, match the following option of column I with the corresponding option of column II




| **Column I** | **Column II** |
|---|---|
| (A) JK | (P) ΔW > 0 |
| (B) KL | (Q) ΔQ < 0 |
| (C) LM | (R) ΔW < 0 |
| (D) MJ | (S) ΔQ > 0 |

***Sol.*** *(A)→(Q), (B)→(P), (S), (C)→(S), (D)→(Q), (R)*

38. **Match the following Columns**

| Column I | Column II |
|---|---|
| (A) Nuclear fusion | (P) Converts some matter into energy |
| (B) Nuclear fission | (Q) Generally possible for nuclei with low atomic number |
| (C) β-decay | (R) Generally possible for nuclei with higher atomic number |
| (D) Exothermic nuclear reaction | (S) Essentially proceeds by weak nuclear forces |

***Sol.*** *(A)→(P), (Q), (B)→(P), (R), (C)→(S), (P), (D)→(P), (Q), (R)*

39 **Match the following Columns**

| Column I | Column II |
|---|---|
| (A) Dielectric ring uniformly charged | (P) Time independent electrostatic field out of system |
| (B) Dielectric ring uniformly charged rotating with angular velocity ω | (Q) Magnetic field |
| (C) Constant current in ring $i_0$ | (R) Induced electric field |
| (D) $i = i_0 \cos \omega t$ | (S) Magnetic moment |

***Sol.*** *(A)→(P), (B)→(Q), (S), (C)→(Q), (S), (D)→(Q), (R), (S)*

40. A simple telescope used to view distant objects has eyepiece and objective lens of focal lengths $f_e$ and $f_0$, respectively. Then

| Column I | Column II |
|---|---|
| (A) Intensity of light received by lens | (P) Radius of aperture (R) |
| (B) Angular magnification | (Q) Dispersion of lens |
| (C) Length of telescope | (R) focal length $f_0$, $f_e$ |
| (D) Sharpness of image | (S) spherical aberration |

***Sol.*** *(A)→(P), (B)→(R), (C)→(R), (D)→(P), (Q), (S)*