SECTION – I

Straight Objective Type

This section contains 9 multiple choice questions. Each question has 4 choices(A), (B) , (C) , (D) out of which **ONLY ONE** is correct

Q 23: A radioactive sample S1 having an activity of 5 μ Ci has twice the number of nuclei as another sample S2 which has an activity of 10 μ Ci. The half lives of S1 and S2 can be

(A) 20 years and 5 years, respectively
(B) 20 years and 10 years, respectively
(C) 10 years each
(D) 5 years each

Solution: (A)

$A_1 = \lambda_1[N_1]$

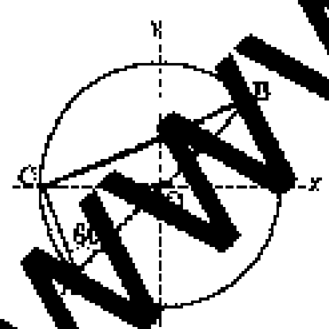
$A_2 = \lambda_2[N_2]$

$\Rightarrow \frac{\lambda_1}{\lambda_2} = \frac{A_1[N_2]}{A_2[N_1]} = \frac{5\times 1}{10\times 2} = \frac{1}{4}$

=> 20 & 4 are the answer

Q 24: Consider a system of three charges $q, \frac{q}{3}$ and $-\frac{2q}{3}$ placed at points A, B and C respectively, as shown in the figure. Take O to be the centre of the circle of radius R and angle CAB = 60^0

Figure :



(A) The electric field at point O is $\frac{q}{8\pi\delta_0 R^2}$ directed along the negative x-axis

(B) The potential energy of the system is Zero

(C) The magnitude of the force between the charges at C and B is $\frac{q^2}{54\pi\delta_0 R^2}$

(D) The potential at point O is $\frac{q}{12\pi\delta_0 R^2}$

Solution: (C)

(i) Elective field at 0 is $= \frac{29/3}{4\pi t_o R^2} = \frac{9}{6\pi t_o R^2}$

L_1 Field due to A & B cancel at 0

(ii) Potential energy of the system $= -\frac{1}{4\pi t_o}\left[\frac{(9/3)^2}{(2R)} - \frac{(29/3)(9/3)}{R} - \frac{(29/3)(9/3)}{\sqrt{3}R}\right] \neq 0$

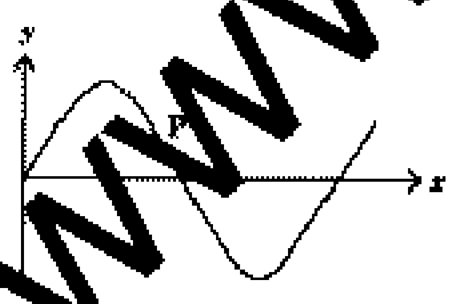
(iii) Force between B & C $= \frac{1}{4\pi t_o}\frac{(-29/3)(9/3)}{(\sqrt{3}R)^2}$

$$= \frac{-9^2}{54\pi t_o R^2}$$

(iv) Potential at 0 is $= -\frac{1}{4\pi t_o}\left[\frac{9/3}{\pi} + \frac{9/3}{R} + \frac{29/3}{R}\right] = 0$

Q 25: A transverse sinusoidal wave moves along a string in the positive x-direction at a speed of 10 cm/s. The wavelength of the wave is 0.5 m and its amplitude is 10 cm. At a particular time t, the snap-shot of wave is shown in figure. The velocity of point P when its displacement is 5 cm is

Figure:



(A) $\frac{\sqrt{3}\pi}{50}\hat{j}\ \ m/s$ (B) $-\frac{\sqrt{3}\pi}{50}\hat{j}\ \ m/s$

(C) $\frac{\sqrt{3}\pi}{50}\hat{i}\ \ m/s$ (D) $-\frac{\sqrt{3}\pi}{50}\hat{i}\ \ m/s$

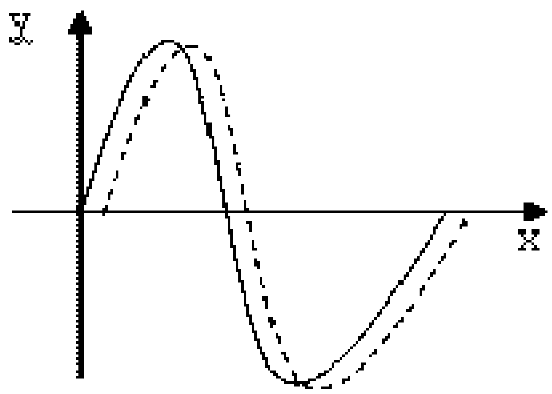
Solution: (A)

$$\gamma_p = \omega\sqrt{\pi^2 - x^2}$$

$$\omega = \frac{2\pi}{T} = 2\pi\frac{V}{\lambda} = 2\pi\frac{10}{0.5\times 100} = \frac{2}{5}\pi$$

$$V_p = \frac{2}{5}\pi\sqrt{10^2 - 5^2} = 2\pi\sqrt{3}m/\mu c$$

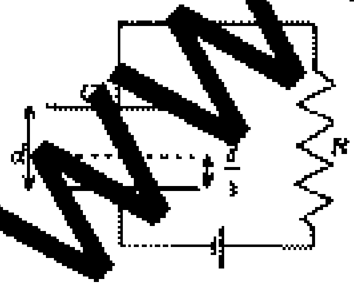
$$= \frac{\pi\sqrt{3}}{50}m/\mu c$$



Hence +ve y education

Q 26: A parallel plate capacitor C with plates of unit area and separation d is filled with a liquid of dielectric constant K = 2. The level of liquid is $\frac{d}{3}$ initially. Suppose the liquid level decreases at a constant speed V, the time constant as a function of time t is

Figure :



(A) $\frac{6\varepsilon_0 R}{5d + 3Vt}$ (B) $\frac{(15d + 9Vt)\varepsilon R}{2d^2 - 3dVt - 9V^2t^2}$

(C) $\frac{6\varepsilon_0 R}{5d - 3Vt}$ (D) $\frac{(15d - 9Vt)\varepsilon R}{2d^2 + 3dVt - 9V^2t^2}$

Solution: (A)

The two capricious can be considered in series

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$= \frac{d_1}{k_1 t_o A} + \frac{d_2}{k_2 t_o A}$$

$$= \frac{(d/3 - vt)}{2t_o A} + \frac{(2d/3 + vt)}{t_o A}$$

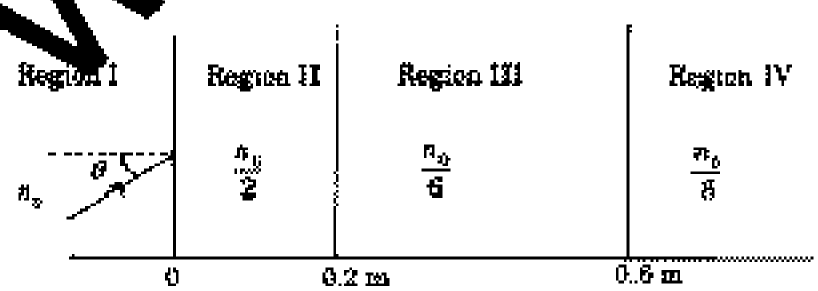
$$= \frac{d/3 - vt + 40/3 + 2vt}{2t_o A}$$

$$\frac{5d/3 + vt}{2t_o A} = \frac{5d + 3vt}{6t_o A}$$

Time constant $= CR = \frac{6t_o R}{5d + 3vt}$

Q 27: A vibrating string of certain length L under a tension T resonates with a mode corresponding to the first overtone (third harmonic) of an air column of length 75 cm inside a tube closed at one end. The string also generates 4 beats per second when excited along with a tuning fork of frequency n. Now when the tension of the string is slightly increased the number of beats reduces to 2 per second. Assuming the velocity of sound in air to be 340 m/s, the frequency n of the tuning fork in Hz is

Figure:



(A) 344 (B) 336 (C) 117.3 (D) 109.3

Solution: (B)

T increase $V_{string} \propto \sqrt{T}$ also increase

Hence, $V_{string} = n + 4$

$V_{stri0ng} = 3V_{o(ad)}$ (3^{rd} Harmonic)

$$= \frac{3c}{4l}$$

$$= \frac{3 \times 340}{4 \times 0.75}$$

= 340

N = 340 – 4 = 336 Mg

Q 28: A light beam is traveling from Region I to Region IV (Refer Figure). The refractive index in Regions I, II, III, and IV are $n_0, \frac{n_0}{2}, \frac{n_0}{6}\ and\ \frac{n_0}{8}$, respectively. The angle of incidence θ for which the beam just misses entering Region IV is

Figure :

(A) $\sin^{-1}\left(\frac{3}{4}\right)$ (B) $\sin^{-1}\left(\frac{1}{8}\right)$ (C) $\sin^{-1}\left(\frac{1}{4}\right)$ (D) $\sin^{-1}\left(\frac{1}{3}\right)$

Solution: (B)

$$n_o \sin\theta = \frac{n_o}{2}\sin\theta_1 = \frac{n_o}{6}\sin\theta_2 = \frac{n_o}{8}\sin 90^o \quad (\mu \sin\theta = const.)$$

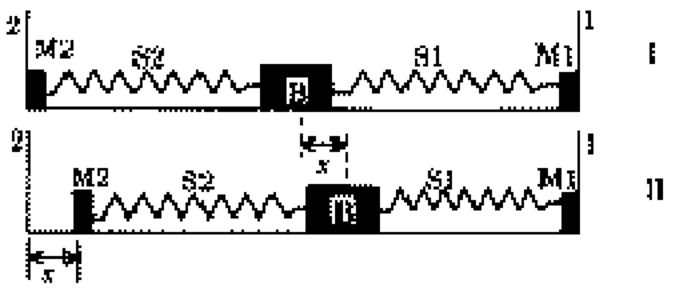
$$\Rightarrow n_o \sin\theta = \frac{n_o}{8}$$

$$\Rightarrow \theta = \sin^{-1}\left(1/8\right)$$

Q 29: A block (B) is attached to two unstretched springs S1 and S2 with spring constants k and 4k, respectively (see figure I). The other ends are attached to identical supports M1 and M2 not attached to the walls. The springs and supports have negligible mass. There is no friction anywhere. The block B is displaced towards wall 1 by a small distance x (figure II) and released. The block returns and moves a maximum distance y towards wall 2.

Displacements x and y are measured with respect to the equilibrium position of the block B. The ratio $\frac{y}{x}$ is

Figure :



(A) 4 (B) 2 (C) $\frac{1}{2}$ (D) $\frac{1}{4}$

Solution: (C)

By conservation of energy

$$\frac{1}{2}Kx^2 = \frac{1}{2}(4K)y^2$$

$$\Rightarrow \frac{y}{x} = \frac{1}{2}$$

Note supports A/1 & A/2 are mailers and do not allow stretching ∴ S_3 does not expand when S_2 contracts.

Q 30: A glass tube of uniform internal radius (r) has a valve separating the two identical ends. Initially, the valve is in a tightly closed position. End 1 has a hemispherical soap bubble of radius r. End 2 has sub-hemispherical soap bubble as shown in figure. Just after opening the valve,

Figure :

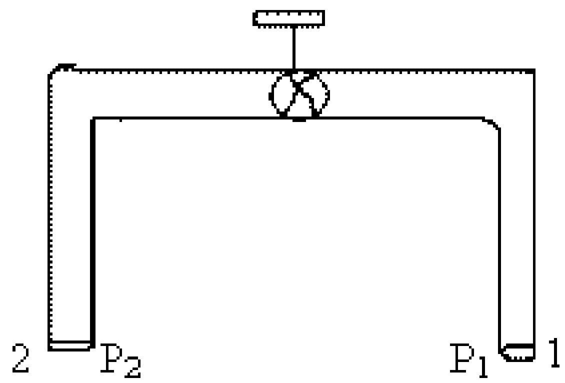
(A) air from end 1 flows towards and 2. No change in the volume of the soap bubbles

(B) air from end 1 flows towards end 2. Volume of the soap bubble at end 1 decreases

(C) no change occurs

(D) air from end 2 flows toward end 1. Volume of the soap bubble at end 1 increases

Solution: (B)



$$P_1 = P_0 + \frac{46}{r_1}$$

$$P_2 = P_0 + \frac{46}{r_2}$$

$r_2 > r_1$ P_0 : atmospheric pressure

$\therefore P_2 < P_1$

Air from 1 goes to 2

And since volume is constant $\therefore$ volume from 1 goes to 2

Q 31: A bob of mass M is suspended by a massless string of length L. The horizontal velocity V at position A is just sufficient to make it reach the point B. The angle θ at which the speed of the bob is half of that at A, satisfies

Figure :

(A) $\theta = \frac{\pi}{4}$ (B) $\frac{\pi}{4} < \theta < \frac{\pi}{2}$ (C) $\frac{\pi}{2} < \theta < \frac{3\pi}{4}$ (D) $\frac{3\pi}{4} < \theta < \pi$

Solution: (D)

By conservation of energy

$$\frac{1}{2}mv_o^2 = \frac{1}{2}mv^2 + mgl(1-\cos\theta) ----(1)$$

$$Also,\ mg(2l) = \frac{1}{2}mv_o^2 - \frac{1}{2}mv_{top}^2 \qquad (given) ----(2)$$

Since the v_o is just sufficient

$$\frac{mv_{top}^2}{gl} = T + mg \qquad T = 0$$

$$\Rightarrow v_{top} = \sqrt{gl}$$

From (1) equation

$$\frac{1}{2}m\left(v_o^2 - \frac{v_o^2}{4}\right) = mgl(1-\cos\theta)$$

$$\frac{3v_o^2}{8} = gl(1-\cos\theta)$$

$$v_o^2 = \frac{8gl}{3}(1-\cos\theta)$$

From (2) equation

$$mg(2l) = \frac{1}{2}mv_o^2 - \frac{1}{2}m(gl)$$

$$v_o = \sqrt{5gl}$$

$$\Rightarrow 5gl = \frac{8gl}{3}(1-\cos\theta)$$

$$\Rightarrow \cos\theta = \frac{7}{8}$$

$$\therefore \frac{3\pi}{4} < \theta < \pi$$

SECTION - II

Reasoning Type

This section contains 4 reasoning type questions. Each question has 4 choices

(A) , (B) , (C) , (D), out of which **ONLY ONE** is correct

Q 32: STATEMENT-1

For practical purposes, the earth is used as a reference at zero potential in electrical circuits.

And

STATEMENT-2

The electrical potential of a sphere of radius R with charge Q uniformly distributed on the surface is given by $\frac{Q}{4\pi\varepsilon_0 R}$.

(A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
(C) STATEMENT-1 is True, STATEMENT-2 is False
(D) STATEMENT-1 is False, STATEMENT-2 is True

Solution: (B)

Statement 1 is true since earth is used as a reference at zero potential to measure potential difference which is independent of the reference

Statement 2 is true since the electric potential of a spherical shell is $\frac{Q}{4\pi t_o R}$ But statement 2 sloes not

explanation statement 1

Q 33: STATEMENT-1

The sensitivity of a moving coil galvanometer is increased by placing a suitable magnetic material as a core inside the coil.

And

STATEMENT-2

Soft iron has a high magnetic permeability and cannot be easily magnetized or demagnetized.

(A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is NOT a correct explanation for STATEMENT-1

(C) STATEMENT-1 is True, STATEMENT-2 is False
(D) STATEMENT-1 is False, STATEMENT-2 is True

Solution: Statement 1 is true since the sensitivity of the moving will galvanometer increases by placing magnetic material.

Statement 2 there is ambiguity & zero cases wises

Case 1: cannot be early permanently migrated / demagnetized soft iron has magnetic permeability and can not be easily permanently magnetized . Hence it is the corrupt explanation of statement 1. Answer is a

Case 2: can not be easily magnetized / demagnetized during galvanometers operation. They are it does not act as a good electro magnet which is false. Answer is C

Q 34: STATEMENT-1

For an observer looking out through the window of a fast moving train the nearby objects appear to move in the opposite direction to the train, while the distant objects appear to be stationary.

and

STATEMENT-2

If the observer and the object are moving at velocities V_1 and V_2 respectively with reference to a laboratory frame, the velocity of the object with respect to the observer is $V_2 - V_1$.

(A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
(C) STATEMENT-1 is True, STATEMENT-2 is False
(D) STATEMENT-1 is False, STATEMENT-2 is True

Solution: (B) Statement 1 is true since when we obscure from a train we all comparing the angular velocity which is more for nearer objects.

Statement 1 is true by definition of relative velocity

But it is wrong explanation of statement 2

Q 35: STATEMENT-1

It is easier to pull a heavy object than to push it on a level ground.

and

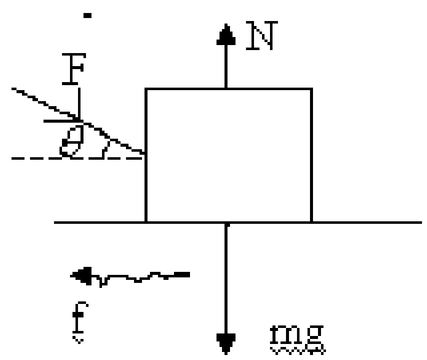
STATEMENT-2

The magnitude of frictional force depends on the nature of the two surface in contact.

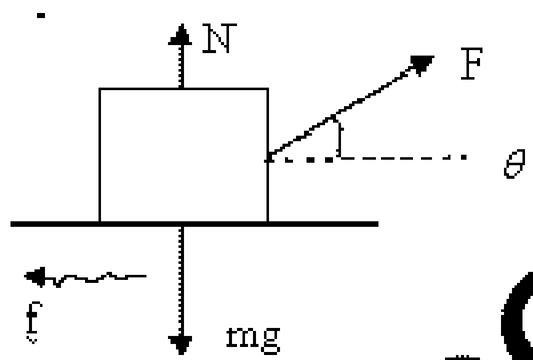
(A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
(C) STATEMENT-1 is True, STATEMENT-2 is False
(D) STATEMENT-1 is False, STATEMENT-2 is True

Solution: (B)

Statement 1 is true (by observation & explained also)



$N = mg + F \sin \theta$



$N = mg - F \sin \theta$

Since N > N^1 => f > f^1 => it is easier to pull than to push

Statement 2 is also true but it is not the correct explanation

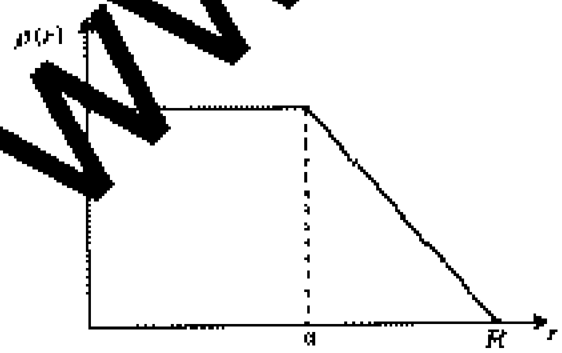
SECTION – II

Linked Comprehension Type

This section contains 2 paragraphs. Based upon each paragraph , 3 multiple choice questions have to be answered. Each question has 4 choices (A) , (B) , (C) ,(D) ,out of which **ONLY ONE** is correct

Q 36-38: The nuclear charge (Ze) is non-uniformly distributed within a nucleus of radius R. The charge density ρ (r) [charge per unit volume] is dependent only on the radial distance r from the centre of the nucleus as shown in figure. The electric field is only along the radial direction.

Figure :



Q 36: The electric field at r =R is

(A) independent of a (B) directly proportional to a

(C) directly proportional to a^2 (D) inversely proportional to a

Q 37: For a = 0, the value of d (maximum value of ρ as shown in the figure) is

(A) $\frac{3Ze}{4\pi R^3}$ (B) $\frac{3Ze}{\pi R^3}$ (C) $\frac{4Ze}{3\pi R^3}$ (D) $\frac{Ze}{3\pi R^3}$

Q 38: The electric field within the nucleus is generally observed to be linearly dependent on r. This implies

(A) a = 0 (B) $a = \frac{R}{2}$ (C) a = R (D) $a = \frac{2R}{3}$

Solution: (A) The electric field at r = R depends on total nuclear change inside $r = R$ which is correct irrespective of P

Solution: (B)

Net charge = Ze $= \int \rho^{dv}$

$= \int \rho^{4dr}$ *(radial symmetry)*

$= \int \rho^{(4\pi r^2)dr}$

$= 4\pi \int \rho^{r^2 dr}$

Also, $\frac{\rho}{d} + \frac{r}{R} = 1$

$\Rightarrow \rho = d - \frac{rd}{R}$

$\Rightarrow Ze = 4\pi \int_0^R \left(dr^2 - \frac{r^3 d}{R} \right)^{dr}$

$= 4\pi \left[\frac{dR^3}{3} - \frac{d}{R}\frac{R^4}{4} \right]$

$$\frac{4\pi}{12}dR^3 = \frac{\pi}{3}dR^3$$

$$\Rightarrow d = \frac{3Ze}{\pi R^3}$$

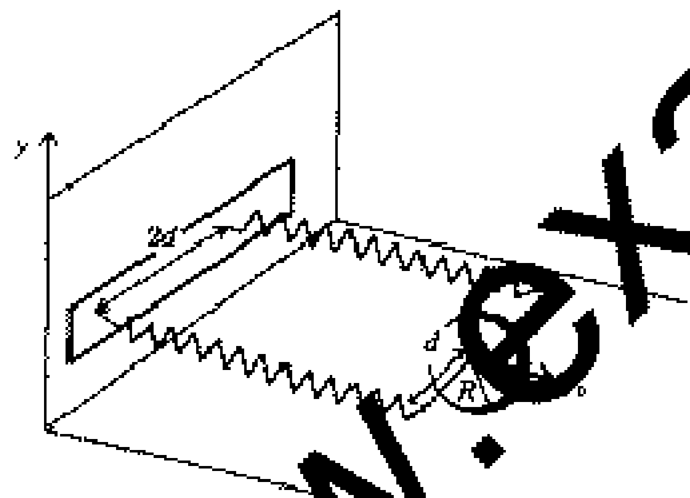
Solution: (C) We know that for a uniformly charged sphere

$$E_r = \frac{\rho r}{3\epsilon_0} \qquad 0 \le r \le R$$

Hence we can conclude a = R for ρ to be cones

Q 39-41: A uniform thin cylindrical disk of mass M and radius R is attached to two identical massless springs of spring constant k which are fixed to the wall as shown in the figure. The springs are attached to the axle of the disk symmetrically on either side at a distance d from its centre. The axle is massless and both the springs and the axle are in a horizontal plane. The unstretched length of each spring is L. The disk is initially at its equilibrium position with its centre of mass (CM) at a distance L from the wall. The disk rolls without slipping with velocity $\vec{V}_0 = V_0\hat{i}$. The coefficient of friction is μ.

Figure :



ω

Q 39: The net external force acting on the disk when its centre of mass is at displacement x with respect to its equilibrium position is

(A) $-kx$ (B) $-2kx$ (C) $-\frac{2kx}{3}$ (D) $-\frac{4kx}{3}$

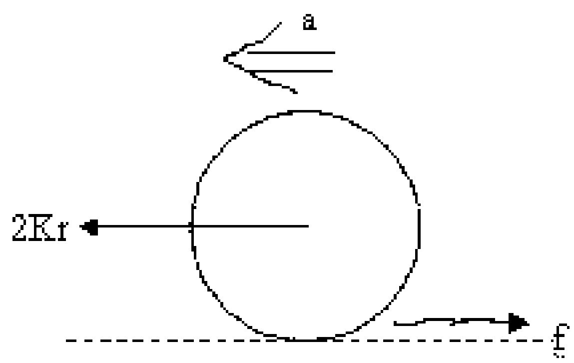
Q 40: The centre of mass of the disk undergoes simple harmonic motion with angular frequency ω equal to

(A) $\sqrt{\frac{k}{M}}$ (B) $\sqrt{\frac{2k}{M}}$ (C) $\sqrt{\frac{2k}{3M}}$ (D) $\sqrt{\frac{4k}{3M}}$

Q 41: The maximum value of V_0 for which the disk will roll without slipping is

(A) $\mu g\sqrt{\frac{M}{k}}$ (B) $\mu g\sqrt{\frac{M}{2k}}$ (C) $\mu g\sqrt{\frac{3M}{k}}$ (D) $\mu g\sqrt{\frac{5M}{2k}}$

Solution: (D)



By Newton's law:

$2Kx - f = ma$ (1)

$fr = \propto I_{cm}$ (2)

$I_{cm} = \frac{1}{2}mr^2$ (3)

$a = r\propto$ (4)

$\therefore fr = \frac{1}{2}mr\frac{a}{r}$

$\Rightarrow f = \frac{1}{2}ma$

$\Rightarrow 2Kr = ma + \frac{ma}{2}$

$\Rightarrow \frac{4Kr}{3m} = a$

=> Net fraternal force $= \frac{4Kr}{3}$ (–r direction as assumed)

Solution: (D)

$$m\frac{d^2x}{dt^2}+\frac{4kx}{3}=0$$ (Equation of SHM)

$$\therefore \omega=\sqrt{\frac{4k}{3m}}$$

Solution: (C)

By conversation of energy

$$\frac{1}{2}mv_o^2+\frac{1}{R}Iw^2=\frac{1}{2}(2K)x^2$$

$$\therefore x=v_o\sqrt{\frac{3m}{4K}}$$

Also $f=\frac{ma}{2}(for\ rolling)$

$$f\max\geq\frac{ma}{2}(for\ \ rolling)$$

$$\Rightarrow \mu mg\geq\frac{ma}{2}$$

$$\frac{m}{2}\left(\frac{4Kx}{3}\right)$$

$$\Rightarrow x\leq\frac{3}{2}\mu g$$

$$\Rightarrow v_o\sqrt{\frac{3m}{4K}}\leq\frac{3}{2}\mu g$$

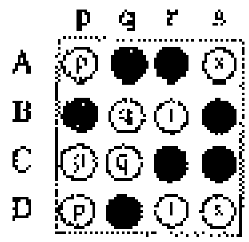
$$\Rightarrow v_o\leq\mu g\sqrt{\frac{3m}{K}}$$

SECTION IV

Matrix Match Type

This section contains 3 questions. Each questions contains statements given in two columns, which have to be matched . Statements in **Column I** are labelled as A, B, Cand D whereas statements in **COLUMN II** are labelled as p, q, r and s . The answers to these questions have to be appropriately bubbled as illustrated in the following example .

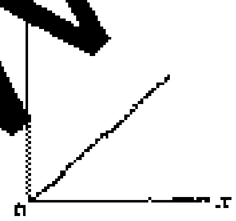
If the correct matches are A-q,B-p,C-r,D-q,then the correctly bubbled matrix will look like the following

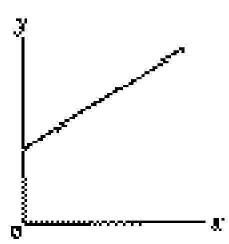


Q 42: **Column I** gives a list of possible set of parameters measured in some experiments. The variations of the parameters in the form of graphs are shown in **Column II**. Match the set of parameters given in **Column I** with the graphs given in **Column II**. Indicate your answer by darkening the appropriate bubbles of the 4 X 4 matrix given in the **ORS**.

(A) Potential energy of a simple pendulum (y axis) as a function of displacement (x axis)
(B) Displacement (y axis) as a function of time (x axis) for a one dimensional motion at zero or constant acceleration when the body is moving along the positive x-direction
(C) Range of a projectile (y axis) as a function of its velocity (x axis) when projected at a fixed angle
(D) The square of the time period (y axis) of a simple pendulum as a function of its length (x axis)

(P) 

(Q) 

(R) 

(S) 

Solution:

A – P, S

B – Q, R ,S

C – S

D – Q

(i) Potential energy of simple Pendulum $\propto$ (displacement from mean position)[illegible]

$\therefore$ Both p and s can be correct depending on the displacement of mean p[illegible]sition

(ii) Displacement $\propto t^2$ (for constant θ)

$\propto t$ (for a = 0)

At t = 0, displacement may be non-[illegible]

$\therefore$ q, r, s are correct

(iii) Range v/s velocity

$$R = \frac{u \sin 2\theta}{g}$$

$\therefore R \propto u$ (starts from origin)

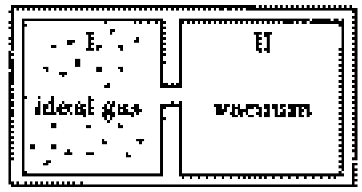
=> s is co[illegible]

(iv) $t^2 = ($[illegible] g (starts from origin)

$\therefore$ q is correct.

Q 43.[illegible] **Column I** contains a list of processes involving expansion of an ideal gas. **Match** this with **Column II** describing the thermodynamic change during this process. Indicate your answer by darkening the appropriate bubbles of the 4 X 4 matrix given in the **ORS**.

(A) An insulated container has two chambers separated by a valve. Chamber I contains an ideal gas and the chamber II has vacuum. The valve is opened.



(B) An ideal monoatomic gas expands to twice its original volume such that its pressure $P \propto \frac{1}{V^2}$, where V is the volume of the gas

(C) An ideal monoatomic gas expands to twice its original volume such that its pressure $P \propto \frac{1}{V^{4/3}}$, where V is its volume

(D) An ideal monoatomic gas expands such that its pressure P and volume V follows the behavior shown in the graph

(p) The temperature of the gas decreases

(q) The temperature of the gas increases or remains constant

(r) The gas loses heat

(s) The gas gains heat

Solution:

A – P

B – P, R

C – P, S

D – P, S

(i) The process is adiabatic $TV^{\gamma-1}$ = const.

=> V increase & T decrease

∴ p is correct

(ii) PV^2 = const.

$$C = C_v + P\frac{dv}{\propto T}$$

PV^1 = const. = K & PV = RT => KV^{1-n} = RT

$$C = C_v + \frac{K}{V^n}\frac{dV}{\propto T}$$

$$= C_v + \frac{K}{V^n}\frac{RV^n}{K(1-n)}$$

$$= \frac{R}{\nu - 1} + \frac{R}{1 - n}$$

Hence $C = \frac{R}{\nu - 1} - R = R\left(\frac{1}{\nu - 1} - 1\right)$

$$= R\left(\frac{2-\nu}{\nu - 1}\right) = \frac{R}{2}$$

VT = const since PV^2 = const

∴ v increases => T decreases

As T decreases & C is + ve

$$\Rightarrow Q = C\Delta T < O$$

=> Gas loses heat

∴ P, r are correct

(C) $PV^{4/3}$ = const

=> $TV^{1/3}$ = const

$$\Rightarrow V \propto \frac{1}{T^3}$$

∴ of V increases => T decreases => P is correct

$$C = \frac{R}{\gamma - 1} + \frac{R}{1 - n}$$

$$= \frac{R}{5/3 - 1} + \frac{R}{1 - 4/3}$$

$$= \frac{3R}{2} - 3R$$

$= -\frac{3R}{2}$

$Q = C\Delta T \qquad \Delta T < O \;\&\; C < O$

$\Rightarrow Q > O$

=> s is correct

(D) $P_2 V_2 > P_1 V_1$ (from figure)

=> $T_2 > T_1$ since PV/T = const

∴ q is correct

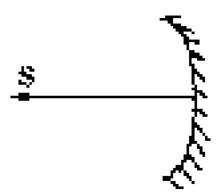
Work Dons = Area under the graph $\geq O$

As $T \uparrow \Rightarrow \Delta U > O$

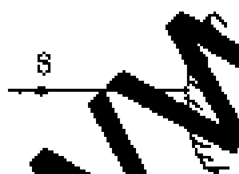
=> Q>O

Hence s i\s correct.

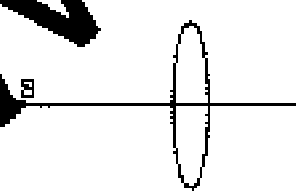
Q 44: An optical component and an object S placed along its optic axis are given in **Column I**. The distance between the object and the component can be varied. The properties of images are given in **Column II**. Match all the properties of images from **Column II** with the appropriate components given in **Column I**. Indicate your answer by darkening the appropriate bubbles of the 4 x 4 matrix given in the ORS.



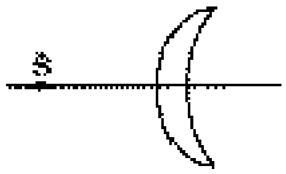
(A)



(B)



(C)



(D)

(p) Real image
(q) Virtual image
(r) Magnified image
(s) Image at infinity

Solution:

A – P, Q, R, S

B – Q

C – P, Q, R, S

D – P, Q, R, S

(i) Concave mirror $\frac{1}{v} + \frac{1}{u} = \frac{1}{|f|}$ $f \geq O$

$\Rightarrow v = \frac{u \times f}{u - f}$

When u = f

=> image at infinity

$M = \frac{f}{u - f}$ $\rightarrow$ can be greater than 1

It can form

Real image u > f

Virtual image u < f

p, q, r, s correct

(ii) Convex Mirror Always forms virtual image

$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$ $f > O$

$$v = -\frac{uf}{u+f}$$

$\therefore$ for real object u > 0 & f > 0

$\therefore v \neq \infty$

$\therefore$ for real object v < 0 $\therefore$ Virtual image

$$M = \left|\frac{v}{u}\right| = \left|\frac{f}{u+f}\right| < 1$$

$\therefore$ M < 1

$\therefore$ No magnification

(iii) Convex lens : $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

Same as first

(iv) Convexo Concave lens

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

Since $R_2 > R_1$ $\therefore f > 0$

$\therefore$ it behaves as convex lens same as c