GGSRDN Educational Services Private Limited

9th, 10th, NEET, JEE(Main/Advanced)

अभ्यास ही सबसे बड़ा गुरु है।

CLASS : XII (PHYSICS)

DPP

DAILY PRACTICE PROBLEM

DPP-1 TO 10

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 1

Total Marks : 32

Max. Time : 32 min.

Topics : Kinetic Theory of Gases and Thermodynamics, Motion in Two Dimensions, Newton's Law of Motion, Sound Wave, Projectile Motion, Simple Harmonic Motion

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice Objective ('–1' negative marking) Q.6 to Q.7	(4 marks, 4 min.)	[8, 8]
Comprehension ('–1' negative marking) Q.8 to Q.10	(3 marks, 3 min.)	[9, 9]

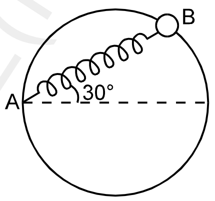
1. One mole of an ideal gas at a temperature T_1 expands slowly according to the law $\frac{p}{V}$ = constant. Its final temperature is T_2. The work done by the gas is

(A) $R(T_2 - T_1)$ (B) $2R(T_2 - T_1)$ (C) $\frac{R}{2}(T_2 - T_1)$ (D) $\frac{2R}{3}(T_2 - T_1)$

2. A particle moves along the parabolic path $y = ax^2$ in such a way that the y-component of the velocity remains constant, say c. The x and y coordinates are in meters. Then acceleration of the particle at x = 1 m is

(A) $ac\hat{k}$ (B) $2ac^2\hat{j}$ (C) $-\frac{c^2}{4a^2}\hat{i}$ (D) $-\frac{c}{2a}\hat{i}$

3. A bead of mass m is attached to one end of a spring of natural length R and spring constant $k = \frac{(\sqrt{3}+1)mg}{R}$. The other end of the spring is fixed at point A on a smooth vertical ring of radius R as shown in figure. The normal reaction at B just after it is released to move is

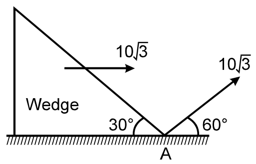


(A) $\frac{mg}{2}$ (B) $\sqrt{3}mg$ (C) $3\sqrt{3}mg$ (D) $\frac{3\sqrt{3}mg}{2}$

4. A sounding body emitting a frequency of 150 Hz is dropped from a height. During its fall under gravity it crosses a balloon moving upwards with a constant velocity of 2m/s one second after it started to fall. The difference in the frequency observed by the man in balloon just before and just after crossing the body will be: (given that -velocity of sound = 300m/s; g = 10m/s^2)

(A) 12 (B) 6 (C) 8 (D) 4

5. A particle is projected at angle 60° with speed $10\sqrt{3}$, from the point 'A' as shown in the fig. At the same time the wedge is made to move with speed $10\sqrt{3}$ towards right as shown in the figure. Then the time after which particle will strike with wedge is (g = 10 m/sec^2) :

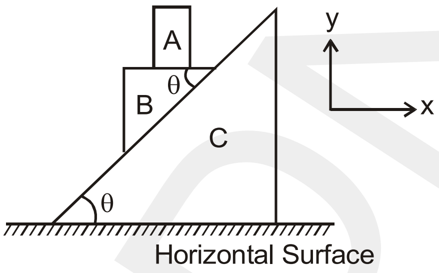


(A) 2 sec (B) $2\sqrt{3}$ sec (C) $\frac{4}{\sqrt{3}}$ sec (D) none of these

6. A particle performing S.H.M. undergoes displacement of $\frac{A}{2}$ (where A = amplitude of S.H.M.) in one second. At t = 0 the particle was located at either extreme position or mean position. The time period of S.H.M. can be : (consider all possible cases)

(A) 12s (B) 2.4 (C) 6s (D) 1.2s

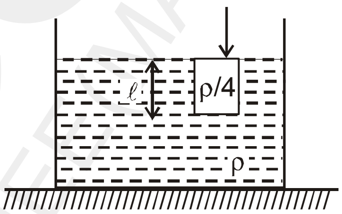
7. In the figure shown all the surface are smooth. All the blocks A, B and C are movable, x-axis is horizontal and y-axis vertical as shown. Just after the system is released from the position as shown.



(A) Acceleration of 'A' relative to ground is in negative y-direction
(B) Acceleration of 'A' relative to B is in positive x-direction
(C) The horizontal acceleration of 'B' relative to ground is in negative x-direction.
(D) The acceleration of 'B' relative to ground along the inclined surface of 'C' is greater than g sin θ.

COMPREHENSION

A large tank of cross-section area A contains liquid of density ρ. A cylinder of density $\rho / 4$ and length ℓ, and cross- section area a (a <<A) is kept in equilibrium by applying an external vertically downward force as shown. The cylinder is just submerged in liquid. At t = 0 the external force is removed instantaneously. Assume that water level in the tank remains constant.



8. The acceleration of cylinder immediately after the external force is removed is

(A) g (B) 2g (C) 3g (D) zero

9. The speed of the cylinder when it reaches its equlibrium position is

(A) $\frac{1}{2}\sqrt{g\ell}$ (B) $\frac{3}{2}\sqrt{g\ell}$ (C) $\sqrt{2g\ell}$ (D) $2\sqrt{g\ell}$

10. After its release at t = 0, the time taken by cylinder to reach its equilibrium position for the first time is

(A) $\frac{\pi}{8}\sqrt{\frac{\ell}{g}}$ (B) $\frac{\pi}{3}\sqrt{\frac{\ell}{g}}$ (C) $\frac{\pi}{4}\sqrt{\frac{\ell}{g}}$ (D) $\frac{\pi}{2}\sqrt{\frac{\ell}{g}}$

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 2

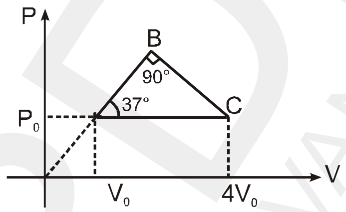
Total Marks : 35

Max. Time : 37 min.

Topics : Kinetic Theory of Gases and Thermodynamics, Simple Harmonic Motion, Circular Motion, Friction, Work, Power and Energy, String Wave

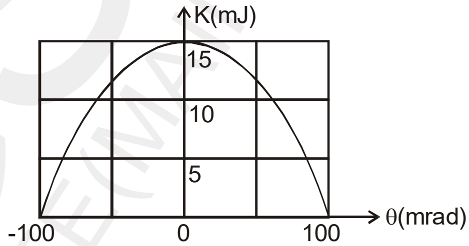
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Multiple choice Objective ('–1' negative marking) Q.7 to Q.9	(3 marks, 3 min.)	[9, 9]
Comprehension ('–1' negative marking) Q.10	(8 marks, 10 min.)	[8, 10]

1. In the figure shown the pressure of the gas in state B is:



(A) $\frac{63}{25}P_0$ (B) $\frac{73}{25}P_0$ (C) $\frac{48}{25}P_0$ (D) none of these

2. Figure shows the kinetic energy K of a simple pendulum versus its angle θ from the vertical. The pendulum bob has mass 0.2 kg. The length of the pendulum is equal to ($g = 10\ m/s^2$).

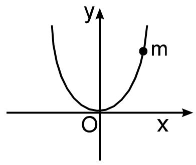


(A) 2.0 m (B) 1.8 m (C) 1.5 m (D) 1.2 m

3. A particle is revolving in a circle increasing its speed uniformly. Which of the following is constant?

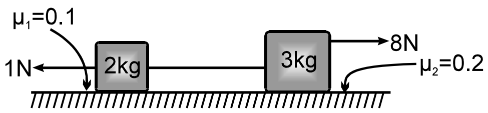
(A) centripetal acceleration (B) tangential acceleration
(C) angular acceleration (D) none of these

4. A bead of mass m is located on a parabolic wire with its axis vertical and vertex at the origin as shown in figure and whose equation is $x^2 = 4ay$. The wire frame is fixed in vertical plane and the bead can slide on it without friction. The bead is released from the point $y = 4a$ on the wire frame from rest. The tangential acceleration of the bead when it reaches the position given by $y = a$ is :



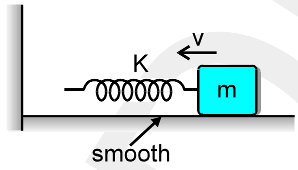
(A) $\frac{g}{2}$ (B) $\frac{\sqrt{3}g}{2}$ (C) $\frac{g}{\sqrt{2}}$ (D) $\frac{g}{\sqrt{5}}$

5. In the shown arrangement if f_1, f_2 and T be the frictional forces on 2 kg block, 3kg block and tension in the string respectively, then their values are:



(A) 2 N, 6 N, 3.2 N (B) 2 N, 6 N, 0 N
(C) 1 N, 6 N, 2 N (D) data insufficient to calculate the required values.

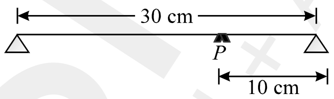
6. A block is attached with a spring and is moving towards a fixed wall with speed v as shown in figure. As the spring reaches the wall, it starts compressing. The work done by the spring on the wall during the process of compression is :



(A) 1/2 mv^2 (B) mv^2 (C) Kmv (D) zero

COMPREHENSION

Figure shows a clamped metal string of length 30 cm and linear mass density 0.1 kg/m. which is taut at a tension of 40 N. A small rider (piece of paper) is placed on string at point *P* as shown. An external vibrating tuning fork is brought near this string and oscillations of rider are carefully observed.



7. At which of the following frequencies of turning fork, rider will not vibrate at all :

(A) $\frac{100}{3}$ Hz (B) 50 Hz (C) 200 Hz (D) None of these

8. At which of the following frequencies the point *P* on string will have maximum oscillation amplitude among all points on string :

(A) $\frac{200}{3}$ Hz (B) 100 Hz (C) 200 Hz (D) None of these

9. Now if the tension in the string is made 160 N, at which of the following frequencies of turning fork, rider will not vibrate at all

(A) $\frac{100}{3}$ Hz (B) 50 Hz (C) 200 Hz (D) None of these

10. In each situation of column-I, the x-coordinate of a particle moving along x-axis is given in terms of time t. (ω is a positive constant). Match the equation of motion given in column-I with the type of motion given in column-II.

Column-I	Column-II
(A) $\sin \omega t - \cos \omega t$	(p) SHM
(B) $\sin^3 \omega t$	(q) Periodic
(C) $\sin \omega t + \sin 3\omega t + \sin 5\omega t$	(r) Periodic but not SHM
(D) $\exp(-\omega^2 t^2)$	(s) Non periodic

PHYSICS DPP
DAILY PRACTICE PROBLEMS

DPP No. 3

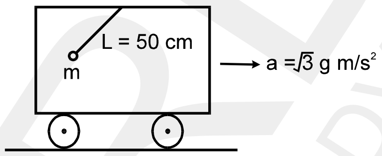
Total Marks : 36

Max. Time : 39 min.

Topics : Simple Harmonic Motion, Circular Motion, Work, Power and Energy, Newton's Law of Motion, Kinetic Theory of Gases and Thermodynamics, Sound Waves, Geometrical Optics

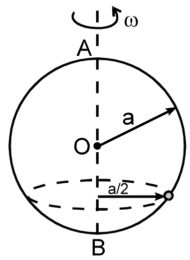
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice Objective ('–1' negative marking) Q.5 to Q.7	(4 marks, 4 min.)	[12, 12]
Subjective Question ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]
Mathch the following (no negative marking) Q.9	(8 marks, 10 min.)	[8, 10]

1. A simple pendulum 50 cm long is suspended from the roof of a cart accelerating in the horizontal direction with constant acceleration $\sqrt{3}$ g m/s^2. The period of small oscillations of the pendulum about its equilibrium position is ($g = \pi^2$ m/s^2) :



(A) 1.0 sec (B) $\sqrt{2}$ sec (C) 1.53 sec (D) 1.68 sec

2. A smooth wire is bent into a vertical circle of radius ***a***. A bead P can slide smoothly on the wire. The circle is rotated about vertical diameter AB as axis with a constant speed ω as shown in figure. The bead P is at rest w.r.t. the wire in the position shown. Then ω^2 is equal to :



(A) $\frac{2g}{a}$ (B) $\frac{2g}{a\sqrt{3}}$

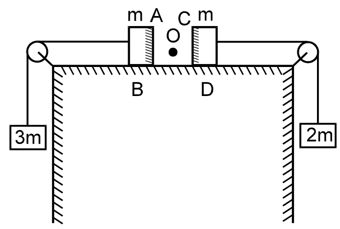
(C) $\frac{g\sqrt{3}}{a}$ (D) $\frac{2a}{g\sqrt{3}}$

3. The potential energy of a particle varies with x according to the relation $U(x) = x^2 - 4x$. The point x = 2 is a point of :

(A) stable equilibrium (B) unstable equilibrium

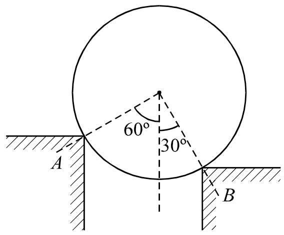
(C) neutral equilibrium (D) none of above

4. Two blocks each of mass m lie on a smooth table. They are attached to two other masses as shown in the figure. The pulleys and strings are light. An object O is kept at rest on the table. The sides AB and CD of the two blocks are made reflecting. The acceleration of two images formed in those two reflecting surfaces w.r.t. each other is :



(A) 5g/6 (B) 5g/3 (C) g/3 (D) 17 g/6

5. A cylinder of mass M and radius R is resting on two corner edges A and B as shown in figure. The normal reaction at the edges A and B are : (Neglect friction)



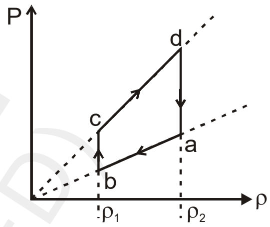
(A) $N_A = \sqrt{2}N_B$

(B) $N_B = \sqrt{3}N_A$

(C) $N_A = \frac{Mg}{2}$

(D) $N_B = \frac{2\sqrt{3}Mg}{5}$

6. An ideal gas undergoes a cyclic process abcda which is shown by pressuredensity curve.



(A) Work done by the gas in the process 'bc' is zero

(B) Work done by the gas in the process 'cd' is negative

(C) Internal energy of the gas at point 'a' is greater than at state 'c'

(D) Net work done by the gas in the cycle is negative.

7. A car moves towards a hill with speed v_c. It blows a horn of frequency f which is heard by an observer following the car with speed v_0. The speed of sound in air is v.

(A) the wavelength of sound reaching the hill is $\frac{v}{f}$

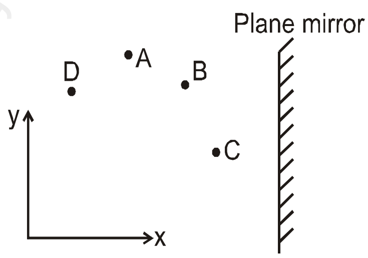
(B) the wavelength of sound reaching the hill is $\frac{v - v_c}{f}$

(C) The wavelength of sound of horn directly reaching the observer is $\frac{v + v_c}{f}$

(D) the beat frequency observed by the observer is $\frac{2v_c(v + v_o)f}{v^2 - v_c^2}$

8. Power delivered to a body varies as $P = 3t^2$. Find out the change in kinetic energy of the body from t = 2 to t = 4 sec.

9. Four particles are moving with different velocities in front of stationary plane mirror (lying in y-z plane). At t = 0, velocity of A is $\vec{v}_A = \hat{i}$, velocity of B is $\vec{v}_B = -\hat{i} + 3\hat{j}$, velocity of C is $\vec{v}_C = 5\hat{i} + 6\hat{j}$, velocity of D is $\vec{v}_D = 3\hat{i} - \hat{j}$. Acceleration of particle A is $\vec{a}_A = 2\hat{i} + \hat{j}$ and acceleration of particle C is $\vec{a}_C = 2t\hat{j}$. The particle B and D move with uniform velocity (Assume no collision to take place till t = 2 seconds). All quantities are in S.I. Units. Relative velocity of image of object A with respect to object A is denoted by $\vec{V}_{A',A}$. Velocity of images relative to corresponding objects are given in column I and their values are given in column II at t = 2 second. Match column I with corresponding values in column II and indicate your answer by darkening appropriate bubbles in the 4 × 4 matrix given in OMR.



Column I	**Column II**
(A) $\vec{V}_{A',A}$	(p) $2\hat{i}$
(B) $\vec{V}_{B',B}$	(q) $-6\hat{i}$
(C) $\vec{V}_{C',C}$	(r) $-12\hat{i} + 4\hat{j}$
(D) $\vec{V}_{D',D}$	(s) $-10\hat{i}$

PHYSICS DPP
DAILY PRACTICE PROBLEMS

DPP No. 4

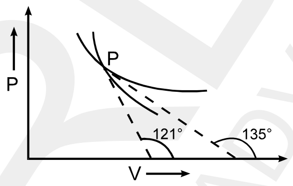
Total Marks : 36

Max. Time : 39 min.

Topics : Kinetic Theory of Gases ,Thermodynamics, Projectile Motion, Friction, Geometrical Optics, String Waves

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks 3 min.)	[9, 9]
Multiple choice Objective ('–1' negative marking) Q.4	(4 marks 4 min.)	[4, 4]
Subjective Question ('–1' negative marking) Q.5	(4 marks 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks 3 min.)	[9, 9]

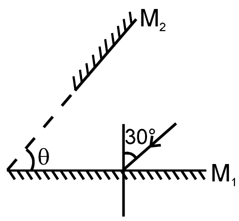
1. A gas undergoes an adiabatic process and an isothermal process. The two processes are plotted on a P-V diagram. The resulting curves intersect at a point P. Tangents are drawn to the two curves at P. These make angles of 135° & 121° with the positive V-axis. If tan 59° = 5/3, the gas is likely to be:



(A) monoatomic (B) diatomic
(C) triatomic (D) a mixture of monoatomic & diatomic gases

2. A particle is projected from a point P (2, 0, 0)m with a velocity 10 m/s making an angle 45° with the horizontal. The plane of projectile motion passes through a horizontal line PQ which makes an angle of 37° with positive x-axis, xy plane is horizontal. The coordinates of the point where the particle will strike the line PQ is: (Take g = 10 m/s²)
(A) (10, 6, 0)m (B) (8, 6, 0)m (C) (10, 8, 0)m (D) (6, 10, 0)m

3. A ray of light is incident at an ∠ of 30° on a plane mirror M_1. Another plane mirror M_2 is inclined at angle θ to M_1. What is the value of angle θ so that light reflected from M_2 is parallel to M_1.



(A) 60° (B) 75° (C) 67.5° (D) none of these

4. A variable force F = 10 t is applied to block B placed on a smooth surface. The coefficient of friction between A & B is 0.5. (t is time in seconds. Initial velocities are zero, A is always on B)

(A) block A starts sliding on B at t = 5 seconds
(B) the heat produced due to friction in first 5 seconds is 312.5J
(C) the heat produced due to friction in first 5 seconds is (625/8) J
(D) acceleration of A at 10 seconds is 5 m/s².

5. A point source S is centered in front of a 70 cm wide plane mirror. A man starts walking from the source along a line parallel to the mirror in a single direction. Maximum distance that can be walked by man without losing sight of the image of the source is _____.

COMPREHENSION

A sinusoidal wave is propagating in negative x–direction in a string stretched along x-axis. A particle of string at x = 2m is found at its mean position and it is moving in positive y direction at t = 1 sec. If the amplitude of the wave, the wavelength and the angular frequency of the wave are 0.1meter, $\pi/4$ meter and 4π rad/sec respectively.

6. The equation of the wave is

(A) $y = 0.1 \sin (4\pi(t - 1) + 8(x - 2))$

(B) $y = 0.1 \sin ((t-1) - (x - 2))$

(C) $y = 0.1 \sin (4\pi(t - 1) - 8(x - 2))$

(D) none of these

7. The speed of particle at x = 2 m and t = 1sec is

(A) 0.2π m/s

(B) 0.6π m/s

(C) 0.4π m/s

(D) 0

8. The instantaneous power transfer through x=2 m and t= 1.125 sec, is

(A) 10 J/s

(B) $\frac{4\pi}{3}$ J/s

(C) $\frac{2\pi}{3}$ J/s

(D) zero

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 5

Total Marks : 39

Max. Time : 44 min.

Topics : Rigid Body Dynamics, Geometical Optics., Calorimetry, Work, Power and Energy , Fluid Mechanics, Kinetic Theory of Gases and thermodynamics

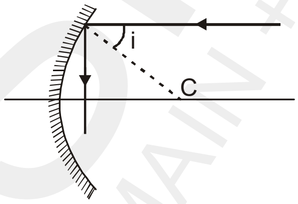
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.2	(3 marks, 3 min.)	[6, 6]
Multiple choice objective ('–1' negative marking) Q.3	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.4 to Q.6	(4 marks, 5 min.)	[12, 15]
Comprehension ('–1' negative marking) Q.7 to Q.9	(3 marks, 3 min.)	[9, 9]
Match the Following (no negative marking) (2 × 4) Q.10	(8 marks, 10 min.)	[8, 10]

1. Moment of inertia of a uniform quarter disc of radius R and mass M about an axis through its centre of mass and perpendicular to its plane is :

(A) $\frac{MR^2}{2} - M\left(\frac{4R}{3\pi}\right)^2$ (B) $\frac{MR^2}{2} - M\left(\sqrt{2}\,\frac{4R}{3\pi}\right)^2$

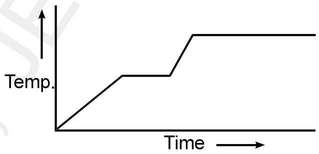
(C) $\frac{MR^2}{2} + M\left(\frac{4R}{3\pi}\right)^2$ (D) $\frac{MR^2}{2} + M\left(\sqrt{2}\,\frac{4R}{3\pi}\right)^2$

2. Angle of incidence of the incident ray for which reflected ray intersect perpendiculaly the principal axis.



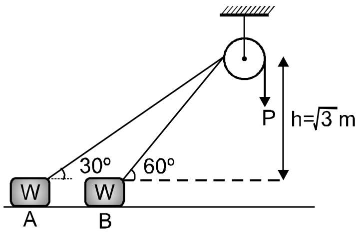
(A) 0° (B) 30° (C) 45° (D) 60°

3. Heat is supplied to a certain homogeneous sample of matter at a uniform rate. Its temperature is plotted against time as shown in the figure. Which of the following conclusions can be drawn? k

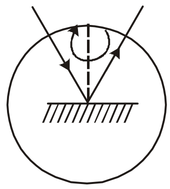


(A) its specific heat capacity is greater in the solid state than in the liquid state.
(B) its specific heat capacity is greater in the liquid state than in the solid state.
(C) its latent heat of vaporization is greater than its latent heat of fusion.
(D) its latent heat of vaporization is smaller than its latent heat of fusion.

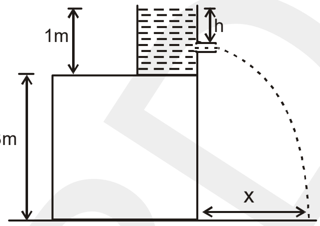
4. A block of weight W is dragged across the horizontal floor from A to B by the constant vertical force P acting at the end of the rope. Calculate the work done on the block by the force P = ($\sqrt{3}$ + 1)N.Assume that block does not lift off the floor. (g = 10 m/s²)



5. A Plane mirror revolves as shown at constant angular velocity making 2 rps about its normal. With what velocity will the light spot move along a spherical screen of radius of 10 m if the mirror is at the centre of curvature of the screen and the light is incident from a fixed direction.



6. A water tank stands on the roof of a building as shown. Find the value of h (in m) for which the horizontal distance 'x' covered by the water is greatest.



COMPREHENSION

A quantity of an ideal monoatomic gas consists of n moles initially at temperature T_1. The pressure and volume are then slowly doubled in such a manner so as to trace out a straight line on a P-V diagram.

7. For this process, the ratio $\frac{W}{nRT_1}$ is equal to (where W is work done by the gas) :

(A) 1.5 (B) 3 (C) 4.5 (D) 6

8. For the same process, the ratio $\frac{Q}{nRT_1}$ is equal to (where Q is heat supplied to the gas) :

(A) 1.5 (B) 3 (C) 4.5 (D) 6

9. If C is defined as the average molar specific heat for the process then $\frac{C}{R}$ has value

(A) 1.5 (B) 2 (C) 3 (D) 6

10. Consider a system of particles (it may be rigid or non rigid). In the column-I some condition on force and torque is given. Column-II contains the effects on the system. (Letters have usual meaning)

Column-I	Column-II
(A) $\vec{F}_{res} = 0$	(p) $\vec{P}_{system}$ will be constant
(B) $\vec{\tau}_{res} = 0$	(q) $\vec{L}_{system}$ will be constant
(C) External force is absent	(r) total work done by all forces will be zero
(D) No nonconservative force acts.	(s) total mechanical energy will be constant.

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 6

Total Marks : 36

Max. Time : 39 min.

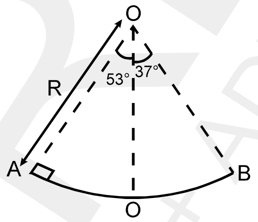
Topics : Centre of Mass, Circular Motion, Geometrical Optics., Kinetic Throry of Gases and Thermodynamics

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Subjective Questions ('–1' negative marking) Q.6	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.7 to Q.9	(3 marks, 3 min.)	[9, 9]
Match the Following (no negative marking) (2 × 4) Q.10	(8 marks, 10 min.)	[8, 10]

1. If a ball is dropped from rest, it bounces from the floor repeatedly. The coefficient of restitution is 0.5 and the speed just before the first bounce is 5ms^{-1}. The total time taken by the ball to come to rest finally is :

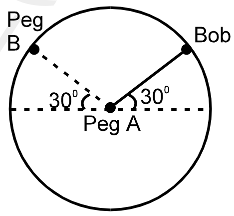
(A) 1.5s (B) 1s (C) 0.5s (D) 0.25s

2. A section of fixed smooth circular track of radius R in vertical plane is shown in the figure. A block is released from position A and leaves the track at B. The radius of curvature of its trajectory when it just leaves the track at B is:



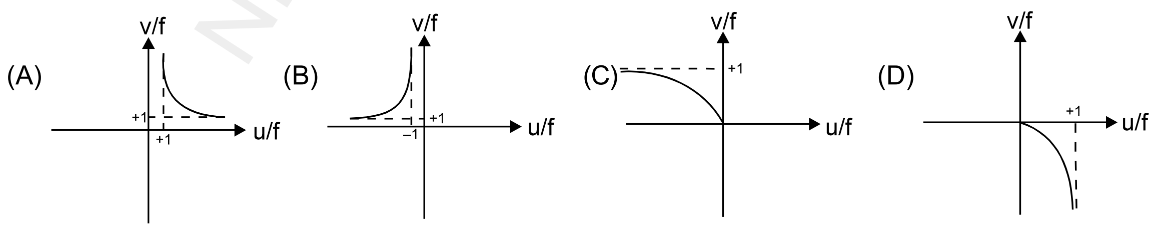
(A) R (B) $\frac{R}{4}$ (C) $\frac{R}{2}$ (D) none of these

3. A bob is attached to one end of a string other end of which is fixed at peg A. The bob is taken to a position where string makes an angle of 30^0 with the horizontal. On the circular path of the bob in vertical plane there is a peg 'B' at a symmetrical position with respect to the position of release as shown in the figure. If V_c and V_a be the minimum tangential velocity in clockwise and anticlockwise directions respectively, given to the bob in order to hit the peg 'B' then ratio $V_c : V_a$ is equal to :



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

4. A virtual erect image in a concave mirror is represented, in the above figures, by



5. A driving mirror on a car is never concave because :

(A) its field of view is too small

(B) the image would be inverted

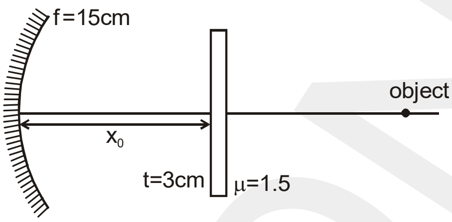
(C) the image would be virtual and therefore useless for the driver

(D) only a plane mirror forms true images.

6. A point object is placed at a distance 20 cm from the focus of a concave mirror of radius of curvature 20 cm. Find the distance (in cm) of the image from the focus.

COMPREHENSION

A point object is placed on principal axis of a concave mirror (of focal length 15 cm) at a distance u = 61 cm from pole. A slab of thickness t = 3 cm and refractive index μ = 1.5 is placed with two sides perpendicular to principal axis, such that its nearest face is x_0 cm from pole. The final image of object is to be considered after refraction by slab, reflection by mirror and final refraction by slab.



7. If x_0 = 30 cm, then the distance of final image from pole is

(A) 19 (B) 21 (C) 23 (D) 24

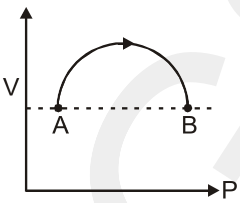
8. If the slab is shifted parallel to itself by 3 cm then the final image

(A) shifts towards left
(B) shifts towards right
(C) may shifts towards left or right
(D) does not shift

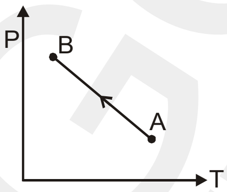
9. If x_0 = 30 cm and the object is given velocity 18 m/s towards left then the speed of image at that instant is

(A) 2 m/s (B) 6 m/s (C) 9 m/s (D) 162 m/s

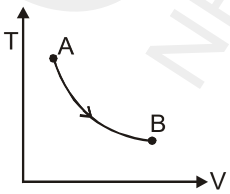
10. A sample of gas goes from state A to state B in four different manners, as shown by the graphs. Let W be the work done by the gas and ΔU be change in internal energy along the path AB. Correctly match the graphs with the statements provided.

(A) 

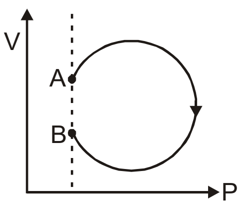
(p) Both W and ΔU are positive

(B) 

(q) Both W and ΔU are negative

(C) 

(r) W is positive whereas ΔU is negative

(D) 

(s) W is negative whereas ΔU is positive

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 7

Total Marks : 36

Max. Time : 39 min.

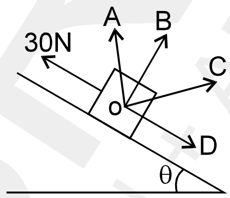
Topics : Simple Harmonic Motion, Friction, Fluid Mechanics, Rigid Body Dynamics, Kinematics, Geometrical Optics

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks 3 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.5 to Q.6	(4 marks 5 min.)	[8, 10]
Comprehension ('–1' negative marking) Q.7 to Q.9	(3 marks 3 min.)	[9, 9]

1. A particle performs S.H.M. on x–axis with amplitude A and time period T. The time taken by the particle to travel a distance A/5 starting from rest is:

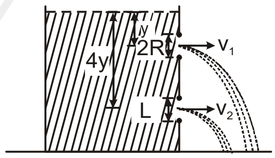
(A) $\frac{T}{20}$ (B) $\frac{T}{2\pi}\cos^{-1}\left(\frac{4}{5}\right)$ (C) $\frac{T}{2\pi}\cos^{-1}\left(\frac{1}{5}\right)$ (D) $\frac{T}{2\pi}\sin^{-1}\left(\frac{1}{5}\right)$

2. A body of mass 10 kg lies on a rough inclined plane of inclination $\theta = \sin^{-1}\frac{3}{5}$ with the horizontal. When a force of 30 N is applied on the block parallel to & upward the plane, the total reaction by the plane on the block is nearly along:



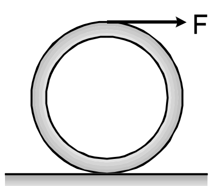
(A) OA (B) OB (C) OC (D) OD

3. A large open tank has two small holes in its vertical wall as shown in figure. One is a square hole of side 'L' at a depth '4y' from the top and the other is a circular hole of radius 'R' at a depth 'y' from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then, 'R' is equal to :



(A) $\frac{L}{\sqrt{2\pi}}$ (B) $2\pi L$ (C) $\sqrt{\frac{2}{\pi}}\,.\,L$ (D) $\frac{L}{2\pi}$

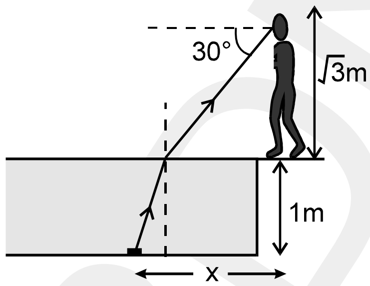
4. A ring of mass m and radius R rolls on a horizontal rough surface without slipping due to an applied force 'F'. The friction force acting on ring is : –



(A) $\frac{F}{3}$ (B) $\frac{2F}{3}$ (C) $\frac{F}{4}$ (D) Zero

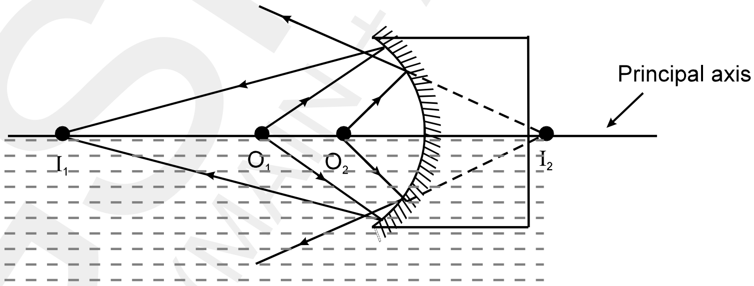
5. A particle is projected from the ground level. It just passes through upper ends of vertical poles A, B, C of height 20 m, 30 m and 20 m respectively. The time taken by the particle to travel from B to C is double of the time taken from A to B. Find the maximum height attained by the particle from the ground level.

6. A man is standing at the edge of a 1m deep swimming pool, completely filled with a liquid of refractive index $\sqrt{3/2}$. The eyes of the man are $\sqrt{3}$ m above the ground. A coin located at the bottom of the pool appears to be at an angle of depression of 30^0 with reference to the eye of man. Then horizontal distance (represented by x in the figure) of the coin from the eye of the man is ____________ mm.



COMPREHENSION

A block with a concave mirror of radius of curvature 1m attached to one of its sides floats, with exactly half of its length immersed in water and the other half exposed to air.



Any ray originating from an object O_1 and O_2 (as shown in figure) floating on the surface of water first gets reflected by the mirror. This then gets refracted by the water surface if the image formed by reflection is real (I_1). If the image is virtual (I_2), then the reflected ray never encounters the air-water interface and hence there is no refraction. The image for the next three questions refers to the final image, formed after both the reflection and refraction (if it occurs at all) has taken place.

7. The final image formed is unique (i.e. only one image is formed) if the point object floats on the surface of water at a distance x in front of the mirror where
(A) x is less than 50 cm
(B) x is less than 1m
(C) x is between 50 cm and 1m
(D) for any value of x

8. There is no refraction of light rays reflected from the mirror if the point object floats on the surface of water at a distance x in front of the mirror where
(A) x is less than 50 cm
(B) x is less than 1m
(C) x is between 50 cm and 1m
(D) for any value of x

9. The final image is not unique (i.e. more than one image for the same object) if the point object is placed a distance 'y' above the surface of water and a distance x in front of the mirror (rays are not paraxial), where y = 20 cm and x is :
(A) less than 50 cm
(B) less than 1m
(C) between 50 cm and 1m
(D) for any value of x

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 8

Total Marks : 32

Max. Time : 34 min.

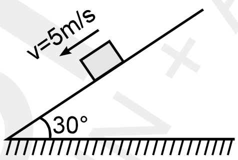
Tpoics : Simple Harmonic Motion, Friction, Rigid Body Dynamics, String Waves, Sound Waves, Geometrical Optics

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Subjective Questions ('–1' negative marking) Q.6 to Q.7	(4 marks, 5 min.)	[8, 10]
Comprehension ('–1' negative marking) Q.8 to Q.10	(3 marks, 3 min.)	[9, 9]

1. A particle is executing SHM according to the equation $x = A\cos\omega t$. Average speed of the particle during the interval $0 \le t \le \frac{\pi}{6\omega}$.

(A) $\frac{\sqrt{3}A\omega}{2}$ (B) $\frac{\sqrt{3}A\omega}{4}$ (C) $\frac{3A\omega}{\pi}$ (D) $\frac{3A\omega}{\pi}\left(2-\sqrt{3}\right)$

2. A particle of mass 5 kg is moving on rough fixed inclined plane (making an angle 30° with horizontal) with constant velocity of 5 m/s as shown in the figure. Find the friction force acting on a body by the inclinedplane. (take g = 10m/s^2)

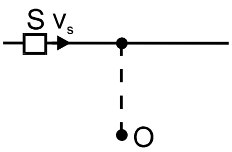


(A) 25 N (B) 20 N
(C) 30 N (D) none of these

3. A sphere rolls without sliding on a rough inclined plane (only mg and contact forces are acting on the body). The angular momentum of the body:
(A) about centre is conserved
(B) is conserved about the point of contact
(C) is conserved about a point whose distance from the inclined plane is greater than the radius of the sphere
(D) is not conserved about any point.

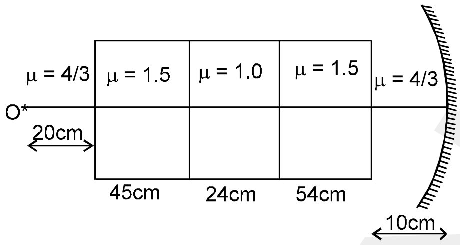
4. A string of length 1.5 m with its two ends clamped is vibrating in fundamental mode. Amplitude at the centre of the string is 4 mm. Distance between the two points having amplitude 2 mm is:
(A) 1 m (B) 75 cm (C) 60 cm (D) 50 cm

5. The source (S) of sound is moving constant velocity v_0 as shown in diagram. An obserever O listens to the sound emmited by the source. The observed frequency of the sound :

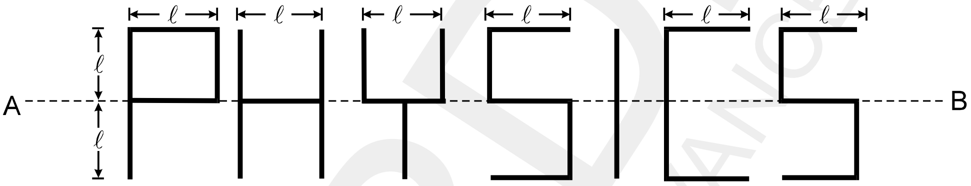


(A) continuously decreases (B) continuously increases
(C) first decreases then increases (D) first increases then decreases.

6. A composite slab consisting of different media is placed infront of a concave mirror of radius of curvature 150 cm. The whole arrangement is placed in water. An object O is placed at a distance 20 cm from the slab. The R.I. of different media are given in the diagram. Find the position of the final image formed by the system.

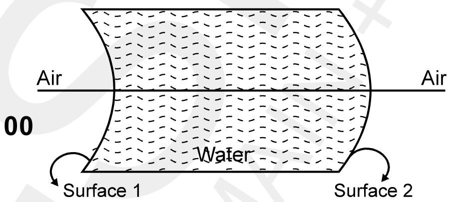


7. Find out the moment of inertia of the following structure (written as PHYSICS) about axis AB made of thin uniform rods of mass per unit length λ.



COMPREHENSION

All objects referred to the subsequent problems lie on the principle axis.



8. If light is incident on surface 1 from left, the image formed after the first refraction is definitely :
(A) Real for a real object
(B) Virtual for a real object
(C) Real for a virtual object
(D) Virtual for a virtual object

9. In above question if the object is real, then the final image formed after two refractions :
(A) may be real
(B) may be virtual
(C) must be virtual
(D) both A and B

10. If light is incident on surface 2 from right then which of the following is true for image formed after a single refraction.
(A) Real object will result in a real image
(B) Virtual object will result in a virtual image
(C) Real object will result in a virtual image
(D) Virtual object will result in a Real image

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 9

Total Marks : 30

Max. Time : 32 min.

Topics : Rigid Body Dynamics, Relative Motion, Sound Waves, Geometrical Optics

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.2	(3 marks, 3 min.)	[6, 6]
Multiple choice objective ('–1' negative marking) Q.3	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.4 to Q.5	(4 marks, 5 min.)	[8, 10]
Comprehension ('–1' negative marking) Q.6 to Q.9	(3 marks, 3 min.)	[12, 12]

1. A uniform disk of mass 300kg is rotating freely about a vertical axis through its centre with constant angular velocity ω. A boy of mass 30kg starts from the centre and moves along a radius to the edge of the disk. The angular velocity of the disk now is

(A) $\frac{\omega_0}{6}$ (B) $\frac{\omega_0}{5}$ (C) $\frac{4\omega_0}{5}$ (D) $\frac{5\omega_0}{6}$

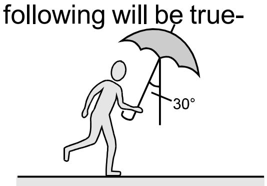
2. A man is holding an umbrella at angle 30° with vertical with lower end towards himself, which is appropriate angle to protect him from rain for his horizontal velocity 10 m/s. Then which of the following will be true-

(A) rain is falling at angle 30° with vertical, towards the man

(B) rain may be falling at angle 30° with vertical, away from the man

(C) rain is falling vertically

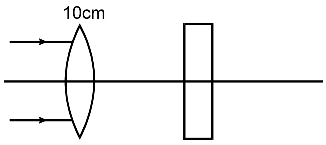
(D) none of these



3. In Resonance tube experiment, if 400 Hz tuning fork is used, the first resonance occurs when length of air column in the tube is 19 cm. If the 400 Hz. tuning fork is replaced by 1600 Hz tuning fork then to get resonance, the water level in the tube should be further lowered by (take end correction = 1 cm)

(A) 5 cm (B) 10 cm (C) 15 cm (D) 20 cm

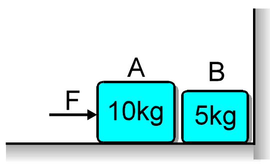
4 A parallel beam of light is incident on a lens of focal length 10 cm. A parallel slab of refractive index 1.5 and thickness 3 cm is placed on the other side of the lens. Find the distance of the final image from the lens.



5. A small object stuck on the surface of a glass sphere (n = 1.5) is viewed from the diametrically opposite position. Find transverse magnification.

COMPREHENSION

Two bodies A and B of masses 10 kg and 5 kg are placed very slightly separated as shown in figure. The coefficient of friction between the floor and the blocks is μ = 0.4. Block A is pushed by an external force F. The value of F can be changed. When the welding between block A and ground breaks, block A will start pressing block B and when welding of B also breaks, block B will start pressing the vertical wall –



6. If F = 20 N, with how much force does block A presses the block B

(A) 10 N (B) 20 N (C) 30 N (D) Zero

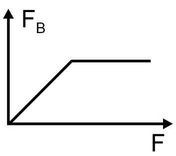
7. What should be the minimum value of F, so that block B can press the vertical wall

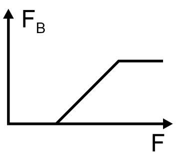
(A) 20 N (B) 40 N (C) 60 N (D) 80 N

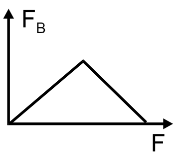
8. If F = 50 N, the friction force (shear force) acting between block B and ground will be :

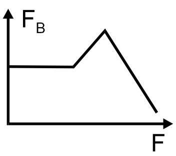
(A) 10 N (B) 20 N (C) 30 N (D) None

9. The force of friction acting on B varies with the applied force F according to curve :

(A) 

(B) 

(C) 

(D) 

PHYSICS

DPP
DAILY PRACTICE PROBLEMS

DPP No. 10

Total Marks : 31

Max. Time : 32 min.

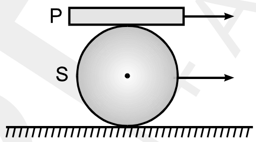
Topics : Sound Waves, Rigid Body Dynamics, Projectile Motion, Geometrical Optics, Simple Harmonic Motion

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.8 to Q.10	(3 marks, 3 min.)	[9,9]

1. A stationary observer receives sonic oscillations from two tuning forks, one of which approaches and the other recedes with same speed. As this takes place the observer hears the beat frequency of 2 Hz. Find the speed of each tuning fork, if their oscillation frequency is 680 Hz and the velocity of sound in air is 340 m/s. [Use g = 10 m/s^2]

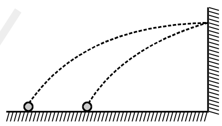
(A) 1 m/s (B) 2 m/s (C) 0.5 m/s (D) 1.5 m/s

2. A plank P is placed on a solid cylinder S, which rolls on a horizontal surface. The two are of equal mass. There is no slipping at any of the surfaces in contact. The ratio of the kinetic energy of P to the kinetic energy of S is:



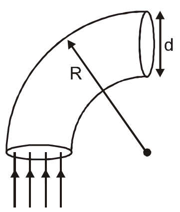
(A) 1: 1 (B) 2: 1 (C) 8: 3 (D) 1: 4

3. A stone is projected from ground and hits a smooth vertical wall after 1 sec. and again falls back on the ground. The time taken by stone to reach the ground after the collision is 3 secs. The maximum height reached by the same stone if the vertical wall were not to be present is. (g = 10 m/s^2)



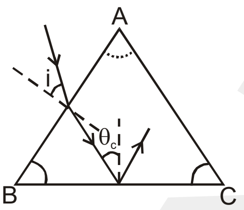
(A) 10 m (B) 12.5 m (C) 15 m (D) 20 m

4. A cylinde rical optical fibre (quarter circular shape) of refractive index n = 2 and diameter d = 4mm is surrounded by air. A light beam is sent into the fibre along its axis as shown in figure. Then the smallest outer radius R (as shown in figure) for which m



(A) 2mm (B) 4mm (C) 8 mm (D) 6 mm

5. A light is incident on face AB of an equilateral glass prism ABC. After refraction at AB, the ray is incident on face BC at the angle slightly greater than critical angle so that it gets reflected from face BC and finally emerges out from face AC. Net deviation angle of the ray is 112° anticlockwise. The angle of incidence 'i' has value :



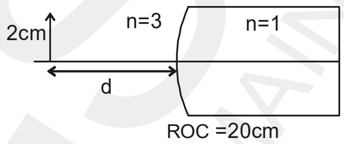
(A) 22° (B) 24° (C) 26° (D) 28°

6. In a compound microscope
(A) the objective has a shorter focal length
(B) the objective has a shorter aperture
(C) (A) and (B)
(D) the aperture of objective and eyepiece are same.

7. A particle initially at rest experiences a force F = a sin(ωt) where a and ω are positive constants. The direction of force is always towards positive x-axis. State with reason or explanation or derivation whether the particle will change its direction of velocity or not.

COMPREHENSION

An extended object of size 2 cm is placed at a distance of d (cm) in medium (refractive index n = 3) from pole, on the principal axis of a spherical curved surface.The medium on the other side of refracting surface is air (refractive index n = 1).



8. For d = 20 cm, the distance of the image from the pole is
(A) 2 cm (B) 3 cm (C) 4 cm (D) 5 cm

9. For d = 20 cm, The size of image is

(A) $\frac{1}{6}$ cm (B) $\frac{2}{15}$ cm (C) $\frac{6}{5}$ cm (D) $\frac{3}{2}$ cm

10. For all nonzero and finite values of d (the object is placed to the left of pole as shown), the nature of image formed always is
(A) Image is real and erect
(B) Image is real and inverted
(C) Image is virtual and erect
(D) None of these

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CLASS : XII (PHYSICS)

DPP

DAILY PRACTICE PROBLEM

DPP-1 TO 10

Solutions

Answers Key

DPP NO. - 1

1. (C) **2.** (C) **3.** (D) **4.** (A)
5. (A) **6.**(A)(B)(C)(D) **7.** (A)(B)(C)(D)
8. (C) **9.** (B) **10.** (C)

DPP NO. - 2

1. (B) **2.** (C) **3.** (C) **4.** (C)
5. (C) **6.** (D) **7.** (C) **8.** (D)
9. (C) **10.** (A) p,q (B) q,r (C) q,r (D) s

DPP NO. - 3

1. (A) **2.** (B) **3.** (A) **4.** (D)
5. (BC **6.** (ABD) **7.** (BC) **8.** 56 J
9. (A) s, (B) p, (C) s, (D) q

DPP NO. - 4

1. (A) **2.** (A) **3.** (A) **4.** (A,D)
5. 70 cm **6.** (A) **7.** (C) **8.** (D)

DPP NO. - 5

1. (B) **2.** (C) **3.** (AC) **4.** 4 **5.** zero
6. 1 **7.** (A) **8.** (D) **9.** (B)
10. (A) p (B) q (C) p,q (D) s

DPP NO. - 6

1. (A) **2.** (C) **3.** (C) **4.** (D) **5.** (A)
6. 5 cm **7.** (B) **8.** (D) **9.** (A)
10. (A) s (B) q (C) r (D) q

DPP NO. - 7

1. (B) **2.** (A) **3.** (C) **4.** (D) **5.** $\frac{125}{4}$ m
6. d = 4000 mm **7.** (D) **8.** (A) **9.** (D)

DPP NO. - 8

1. (D) **2.** (A) **3.** (C) **4.** (A) **5.** (A)
6. On the object itself **7.** $13\lambda\ell^3$
8. (B) **9.** (D) **10.** (D)

DPP NO. - 9

1. (D) **2.** (B) **3.** (A,C) **4** 11 cm
5. 3 **6.** (D) **7.** (C) **8.** (A)
9. (B)

DPP NO. - 10

1. (C) **2.** (C) **3.** (D) **4.** (C)
5. (C) **6.** (C) **7.** Will not change
8. (C) **9.** (C) **10.** (C)

Hints & Solutions

DPP NO. - 1

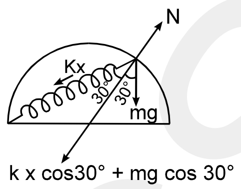
2. $y = ax^2 \qquad \frac{dy}{dt} = c = 2ax\,\frac{dx}{dt}$

$$\frac{d^2y}{dt^2} = 0 = 2a\left(\frac{dx}{dt}\right)^2 + 2ax\,\frac{d^2x}{dt^2}$$

$$\frac{d^2x}{dt^2} = -\left(\frac{dx}{dt}\right)^2\frac{1}{x} = -\left(\frac{c}{2ax}\right)^2\frac{1}{x} = -\frac{c^2}{4a^2x^3}$$

$$= -\frac{c^2}{4a^2}$$

3. **(D)** The extension is spring is $x = 2R\cos 30° - R = \left(\sqrt{3}-1\right)R$



Applying Newton's second law to the bead normal to circular ring at point B

$N = k\left(\sqrt{3}-1\right)R\ \cos 30° + mg\cos 30°$

$$= \frac{\left(\sqrt{3}+1\right)}{R}\,mg\left(\sqrt{3}-1\right)R\cos 30° + mg\cos 30°$$

$$N = \frac{3\sqrt{3}\,mg}{2}.$$

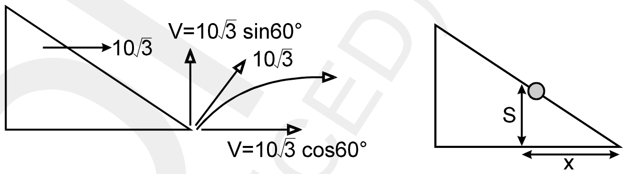
4. $f = f_0\left(\frac{v \pm v_0}{v \pm v_s}\right)$

when approaching : $f_a = 150\left[\frac{300+2}{300-10}\right]$

when receding : $f_r = 150\left[\frac{300-2}{300+10}\right]$

$\Rightarrow\ f_a - f_r \cong 12$ Hence (A).

5. Suppose particle strikes wedge at height 'S' after time t. $S = 15t - \frac{1}{2}10\,t^2 = 15t - 5\,t^2$. During this time distance travelled by particle in horizontal direction = $5\sqrt{3}\,t$. Also wedge has travelled travelled extra distance



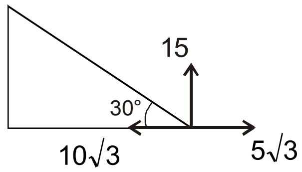
$$x = \frac{S}{\tan 30°} = \frac{15t - 5t^2}{1/\sqrt{3}}$$

Total distance travelled by wedge in time $t = 10\sqrt{3}\,t$.

$= 5\sqrt{3}\,t + \sqrt{3}\,(15 - 5t^2) \quad \Rightarrow t = 2$ sec.

Alternate Sol.

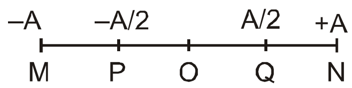
(by Relative Motion)



$$T = \frac{2u\sin 30°}{g\cos 30°} = \frac{2\times 10\sqrt{3}}{10}\times\frac{1}{\sqrt{3}} = 2 \text{ sec.}$$

$\Rightarrow\ t = 2$ sec.

6. It T be the time period ; time to go from O to Q is $\frac{T}{12}$ and from M to P is $\frac{T}{6}$.



The displacement is $\frac{A}{2}$ when particle goes from O to Q, from O to N to Q, from O to N to O to P, and so on

$\therefore\ t = \frac{T}{12}$ or $t = \frac{T}{4} + \frac{T}{6} = \frac{5T}{12}$

or $t = \frac{T}{2} + \frac{T}{12} = \frac{7T}{12}$

Hence possible time period T is

$T = 12\ s \quad or \quad T = \frac{12 \times 1}{5} = 2.4\ s$

$or \quad T = \frac{12 \times 1}{7}\ s$

similarly displacement is $\frac{A}{2}$ when particle goes from M to P or M to N to P

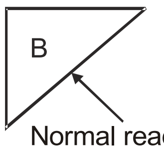
Hence the possible time period T is

$T = 1 \times 6 = 6\ s \quad or \quad T = \frac{6 \times 1}{5}\ s = 1.2\ s$

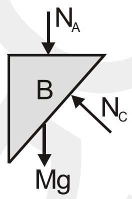
Ans. T = 1.2 s, 6s, 2.4s, 12s

7. There is no horizontal force on block A, therefore it does not move in x-direction, whereas there is net downward force (mg – N) is acting on it, making its acceleration along negative y-direction.

Block B moves downward as well as in negative x-direction. Downward acceleration of A and B will be equal due to constrain, thus w.r.t. B, A moves in positive x-direction.

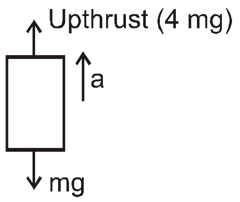


Due to the component of normal exterted by C on B, it moves in negative x-direction.



The force acting vertically downward on block B are mg and N_A(normal reaction due to block A). Hence the component of net force on block B along the inclined surface of B is greater than mg sinθ. Therefore the acceleration of 'B' relative to ground directed along the inclined surface of 'C' is greater than g sin θ.

8.



9. The density of liquid is four times that of cylinder, hence in equlibrium postion one fourth of the cylinder is submerged.

So as the cylinder is released from initial postion, it moves by $\frac{3\ell}{4}$ to reach its equlibrium position. The upward motion in this time is SHM. Therefore required velocity is $v_{max} = \omega A.\ \omega = \sqrt{\frac{4g}{\ell}}$ and $A = \frac{3\ell}{4}$. Therefore

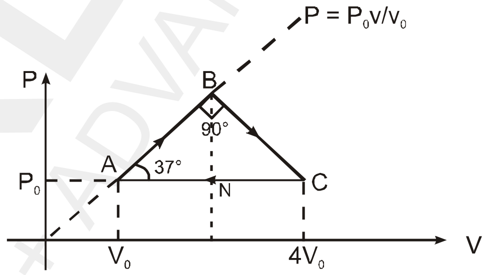
$v_{max} = \frac{3}{2}\sqrt{g\ell}$

10. The require time is one fourth of time period of SHM.

Therefore $t = \frac{\pi}{2\omega} = \frac{\pi}{4}\sqrt{\frac{\ell}{g}}$

DPP NO. - 2

1.



$AN = 3v_0 \cos^2 37^o$

$P_B = \frac{P_0}{v_0}\left(v_0 + 3v_0 \times \frac{16}{25}\right)$

$= \left(1 + \frac{48}{25}\right) = P_0(73/25)$ **Ans.** (B)

2. $\frac{1}{2} m V_m^2 = 15 \times 10^{-3}$

$V_m = \sqrt{0.150}\ m/s$

$A\omega = \sqrt{0.150}\ m/s$

$L\, q_m \cdot \sqrt{\frac{g}{L}} = \sqrt{0.150}\ m/s$

$\sqrt{gL} = \frac{\sqrt{0.150}}{100 \times 10^{-3}} \Rightarrow L = \frac{0.150}{0.1} = 1.5\ m$

3. Angular acceleration $(\alpha) = \frac{a_t}{r}$

Since, $\left|\vec{a}_t\right| = \frac{d\left|\vec{v}\right|}{dt}$ = constant

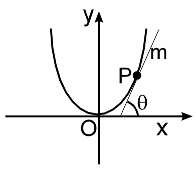
∴ magnitude of α is constant

Also its direction is always constant (perpendicular to the plane of circular motion).

whereas, direction of a_t changes continuously $\vec{a}_t$ is not constant.

4. $x^2 = 4ay$

Differentiating w.r.t. y, we get



$$\frac{dy}{dx} = \frac{x}{2a}$$

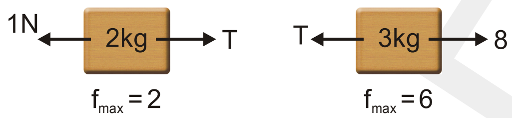
$\therefore$ At (2a, a), $\frac{dy}{dx} = 1$

$\Rightarrow$ hence $\theta = 45°$

the component of weight along tangential direction is mg sin θ.

hence tangential acceleration is g sin $\theta = \frac{g}{\sqrt{2}}$

5. **(C)** FBD



Net force without friction on system is '7N' in right side so first maximum friction will come on 3 kg block.

So f_2 = 1 N, f_3 = 6 N, T = 2N

6. *As point of application of force is not moving, therefore work done by the force is zero.*

9. Wave velocity in string is

$$v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{40}{0.1}} = 20 \text{ m/s}$$

Fundamental frequency of string oscillations is

$$n_0 = \frac{v}{2e} = \frac{20}{0.6} = \frac{100}{3} \text{ Hz}$$

Thus string will be in resonance with a turning fork of frequency.

$$n_f = \frac{100}{3} \text{ Hz}, \frac{200}{3} \text{ Hz}, 100 \text{ Hz}, \frac{400}{3} \text{ Hz}, \ldots .$$

Here rider will not oscillate at all only if it is at a node of stationary wave in all other cases of resonance and non-resonance it will vibrate at the frequency of tuning fork. At a distance $\frac{l}{3}$ from one end node will appear at 3rd, 6th, 9th or similar higher Harmonics i.e. at frequencies 100 Hz, 200 Hz, ... If string is divided in odd no. of segments, these segments can never resonate simultaneously hence at the location of rider, antinode is never obtained at any frequency.

10. (A) p,q (B) q,r (C) q,r (D) s

(A) $x = \sqrt{2}\left(\frac{1}{\sqrt{2}}\sin\omega t - \frac{1}{\sqrt{2}}\cos\omega t\right)$

$\Rightarrow x = \sqrt{2}\sin\left(\omega t - \frac{\pi}{4}\right)$ is periodic with SHM.

(B) $x = \sin^3\omega t$ can not be written as $x = A\sin(\omega' t + \phi)$ so it is not SHM but periodic motion.

(C) Linear combination of different periodic function is also periodic function.

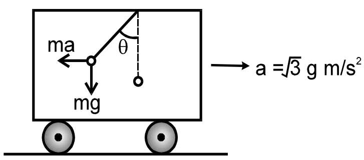
$\frac{d^2x}{dt^2}$ is not directly proportional to x i.e. this motion is not SHM

(D) x continuously decreases with time. So x is not periodic function.

DPP NO. - 3

1. With respect to the cart, equilibrium position of the pendulum is shown.

If displaced by small angle θ from this position, then it will execute SHM about this equilibrium position, time period of which is given by :



$$T = 2\pi\sqrt{\frac{L}{g_{eff}}} \quad ; \quad g_{eff} = \sqrt{g^2 + (\sqrt{3}g)^2}$$

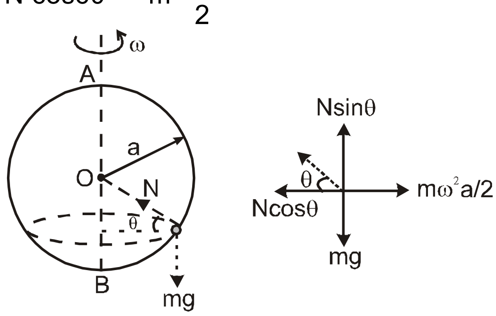
$\Rightarrow g_{eff} = 2g \qquad \Rightarrow T = 1.0$ second

2. As ; $\cos\theta = \frac{a}{2a}$

$\theta = 60°$

$\therefore$ N sin60° = mg

$$N\cos 60° = m\frac{\omega^2 a}{2}$$



w.r.t. wire

$$\therefore \tan 60° = \frac{2g}{\omega^2 a}$$

$$\omega^2 = \frac{2g}{a\sqrt{3}}$$

3. $U(x) = x^2 - 4x$

F = 0

$$\frac{dU(x)}{dx} = 0$$

$2x - 4 = 0 \quad x = 2$

$$\frac{d^2U}{dx^2} = 2 > 0$$

i.e. U is minimum hence x = 2 is a point of stable equilibrium.

4. Acceleration of block AB = $\frac{3mg}{3m+m} = \frac{3}{4}g$;

acceleration of block CD = $\frac{2mg}{2m+m} = \frac{2g}{3}$

Acceleration of image in mirror AB
= 2 acceleration of mirror

$$= 2.\left(\frac{-3g}{4}\right) = \frac{-3}{2}g$$

Acceleration of image in mirror CD = $2.\left(\frac{2g}{3}\right)$

$$= \frac{4g}{3}$$

$\therefore$ Acceleration of the two image w.r.t. each other

$$= \frac{4g}{3} - \left(\frac{-3g}{2}\right) = \frac{17g}{6}.$$

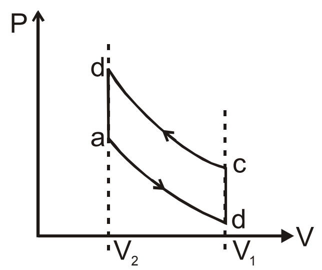
5. For equilibrium $N_A \cos 60° + N_B \cos 30° = Mg$
and $N_a \sin 60° = N_B \sin 30°$

On solving $N_B = \sqrt{3}\ N_A$; $N_A = \frac{Mg}{2}$

6. $r = \frac{\rho}{M_0}RT \Rightarrow \frac{P}{\rho} = \frac{R}{M_0}T$

Slope of the curve α Temperature
Hence cd and ab are isothermal processes.

$$\rho \propto \frac{1}{V}$$



Equivalent PV diagram.

i.e. bc and da are constant volume process
(A) and (B) are true.
Temp. in cd process is greater than ab.
Net work done by the gas in the cycle is negative, as is clear by the PV-diagram.

$$\rho = \frac{\rho}{M_0}RT$$

$$\Rightarrow \frac{P}{\rho} = \frac{R}{M_0}T$$

7. Frequency of horn directly heard by observer

$$\frac{v+v_0}{v+v_c}f$$

Frequency of echo = $\frac{v}{v+v_c}f$

Frequency of echo of horn as heard by observer.

$$\frac{v}{v-v_c}f.\left(\frac{v+v_0}{v}\right)$$

Frquency of Beats :

$$= (v+v_0)f\left\{\frac{1}{v-v_c} - \frac{1}{v+v_c}\right\}$$

$$= \frac{2v_c(v+v_0)}{(v^2-v_c^2)}f$$

8. Applying work energy theorem to body
ΔKE = work done by forces delivering power P

$$= \int_{t=2}^{4} P dt = \int_{2}^{4} 3t^2\, dt = 56\text{ J}$$

Ans. 56 J

9. (A) s, (B) p, (C) s, (D) q

$\vec{v}_A = \hat{i} + \vec{a}t = \hat{i} + (2\hat{i}+\hat{j})(2)$

$= 5\hat{i} + 2\hat{j}$

$\vec{v}_{A'} = -5\hat{i} + 2\hat{j}$

$\vec{v}_{A',A} = \vec{v}_{A'} - \vec{v}_A = -10\hat{i}$

$\vec{v}_B = (-\hat{i}+3\hat{j})$, $\vec{v}_{B'} = \hat{i}+3\hat{j}$ so $\vec{v}_{B',B} = 2\hat{i}$

For particle C (कण C के लिए)

$$\frac{dv_y}{dt} = 2t$$

$\Rightarrow v_y - 6 = t^2 \qquad \Rightarrow v_y = 6 + 4 = 10$

$\vec{v}_C = 5\hat{i} + 10\hat{j}$, $\vec{v}_{C'} = -5\hat{i} + 10\hat{j}$

so $\vec{v}_{C',C} = -10\hat{i}$

$\vec{v}_D = 3\hat{i} - \hat{j}$, $\vec{v}_{D'} = -3\hat{i} - \hat{j}$, $\vec{v}_{D',D} = -6\hat{i}$

DPP NO. - 4

1. **(A)**
The slope of isothermal curve at point of intersection

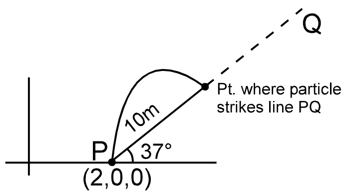
is $\frac{dP}{dV} = -\frac{P}{V}$ = tan 135° ...(1)

The slope of adiabatic curve at point of intersection is

$\frac{dP}{dV} = -\frac{\gamma P}{V}$ = tan 121° ....(2)

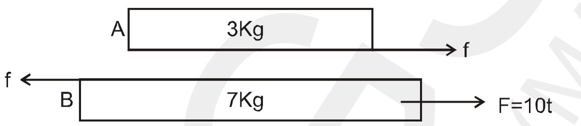
from (1) and (2)
γ =tan 59° = 1.66 = 5/3
$\therefore$ gas is monoatomic

2. Range = 10 m.
For point where particle strikes line PQ

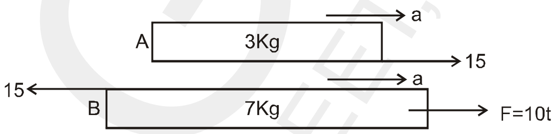


$\therefore$ x coordinate = 10 cos 37° + 2 = 10m
y coordinate = 10 sin 37° = 6m
z coordinate = 0m

4.



$f_{max} = \mu \times 3g$
= 0.5 × 30 = 15 N
block A starts sliding when friction force becomes max. i.e. f_{max} = 15
at that instant (F.B. D.)



both will move with same acceleration
So 15 = 3a $\Rightarrow$ a = 5m/s²
F – 15 = 7a
10t – 15 = 7 × 5
10t = 50
$\Rightarrow$ t = 5 sec
Work done by friction in 5 seconds

$W = \int F.ds$

$= \int 10t.ds$ $\left(a = \frac{F}{m} = \frac{10t}{10} = t\right)$

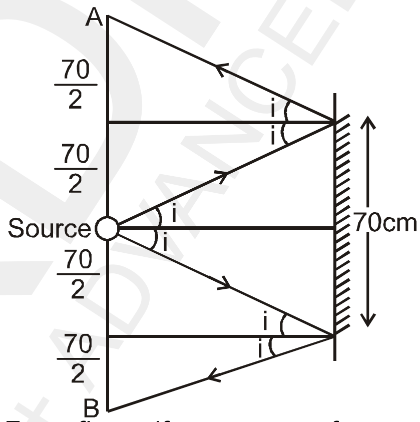
$= \int_0^5 10t.Vdt$ (ds = vdt)

$= \int_0^5 10t.\frac{t^2}{2}dt$ $\left(V = \int adt = \int tdt = \frac{t^2}{2}\right)$

$= \int_0^5 5t^3dt$

$= 5\left[\frac{t^4}{4}\right]_0^5 = \frac{5}{4}[625 - 0] = \frac{625 \times 5}{4}$

5.



From figure if man moves from source to point A

$\left(\frac{70}{2} + \frac{70}{2} = 70cm\right)$. Then he can see image

If man moves from source to point B

$\left(\frac{70}{2} + \frac{70}{2} = 70cm\right)$. then he can not loose sight of image.

6. The equation of wave moving in negative x-direction, assuming origin of position at x = 2 and origin of time (i.e. initial time) at t = 1 sec.
y = 0.1 sin (4πt + 8x)
Shifting the origin of position to left by 2m, that is, to x = 0. Also shifting the origin of time backwards by 1 sec, that is to t = 0 sec.
y = 0.1 sin [(4πt + 8(x – 2)]

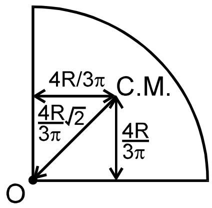
7. As given the particle at x = 2 is at mean position at t = 1 sec.
$\therefore$ its velocity v = ωA = 4π × 0.1 = 0.4 π m/s.

8. Time period of oscillation $T = \frac{2\pi}{\omega} = \frac{2\pi}{4\pi} = \frac{1}{2}$ sec.

Hence at t = 1.125 sec, that is, at $\frac{T}{4}$ seconds after t = 1 second, the particle is at rest at extreme position. Hence instantaneous power at x = 2 at t = 1.125 sec is zero.

DPP NO. - 5

1.



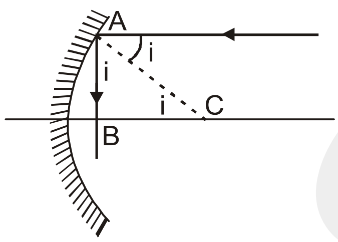
M.I. about 'O' is $\frac{MR^2}{2}$

By parallel-axis theorem : $\frac{MR^2}{2}$

$= I_{cm} + M\left(\frac{4R}{3\pi}.\sqrt{2}\right)^2$

$\Rightarrow I_{cm} = \frac{MR^2}{2} - M\left(\sqrt{2}.\frac{4R}{3\pi}\right)^2 \; 1$

2.



In the figure i + i = 90°

∴ i = 45°

3. Slope of graph is greater in the solid state i.e., temperature is rising faster, hence lower heat capacity.

The transition from solid to liquid state takes lesser time, hence latent heat is smaller.

4. W = Px

$= P\left[\frac{h}{\sin 30^o} - \frac{h}{\sin 60^o}\right]$

$= 2Ph\left[1 - \frac{1}{\sqrt{3}}\right] = \frac{2[\sqrt{3}-1]}{\sqrt{3}}Ph$

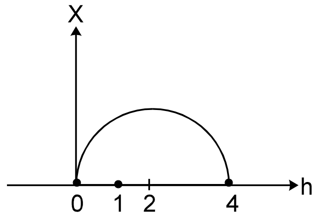
$= \frac{2(\sqrt{3}-1)(\sqrt{3}+1)(\sqrt{3})}{\sqrt{3}}$

= 4 J **Ans.**

5. Angular speed of reflected light = 0 rps

There is no change in angular of incidence due to rotation of mirror. **Ans.** zero

6.



$V_{efflux} = \sqrt{2gh}$

time of fall $t = \sqrt{\frac{(4-h)2}{g}}$

$x = V_{efflux}\, t = 2\sqrt{h(4-h)}$

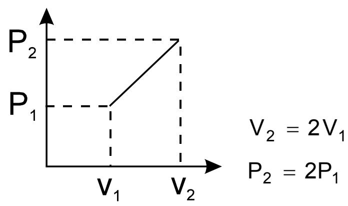
the roots of x are (0,4) and the maximum of x is at h = 2.

The permitted value of h is 0 to 1 clearly h = 1 will give the maximum value of x in this interval.

Aliter Solution:

If the column of water itself were from ground upto a height of 4m, h = 2m would give the maximum range x. Farther the hole is from this midpoint, lower the range. Here the nearest point possible to this midpoint is the base of the container. Hence h = 1m.

7. W = Area under the curve = $\frac{3}{2}P_1V_1$



and $P_1V_1 = nRT_1$

Therefore $\frac{w}{nRT_1} = \frac{\frac{3}{2}.P_1V_1}{P_1V_1}$

8. Q = dU + W

$dU = nC_v dT$

For final state $P_2V_2 = 2P_1\ 2V_1$

$= 4P_1V_1 = nR(4T_1)$

Hence final temp. is $4T_1$

$dU = n.\frac{3}{2}R.3T_1 = \frac{9}{2}nRT_1$

$Q = \frac{3}{2}.nRT_1 + \frac{9}{2}nRT_1 = 6nRT_1$

$\frac{Q}{nRT_1} = 6$

9. $nC\,\Delta T = Q \Rightarrow nC\Delta T = 6n\,RT_1$

$dT = 4T_1 - T_1 = 3T_1$

$n \cdot C \cdot 3T_1 = 6nRT_1$

$\frac{C}{R} = 2$

10. (A) p (B) q (C) p,q (D) s

(A) If resultant force is zero,

$\vec{P}_{system}$ will be constant.

(B) If resultant torque is zero,

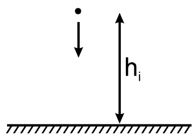
$\vec{L}_{system}$ will be constant.

(C) If external forces are absent, both $\vec{P}_{system}$ and $\vec{L}_{system}$ will be constant.

(D) If no non conservative force acts, total mechanical energy of system will be constant.

DPP NO. - 6

1.



$v = 0 + gt$

$\Rightarrow$ t = 0.5 sec

After first collision :

Speed becomes 5 (0.5) = 2.5 m/s

$t_1 = 2\,(0.25) = 0.5$

$t_2 = 2\,(0.125) = 0.25$

$t_3 = 0.125$ and so on

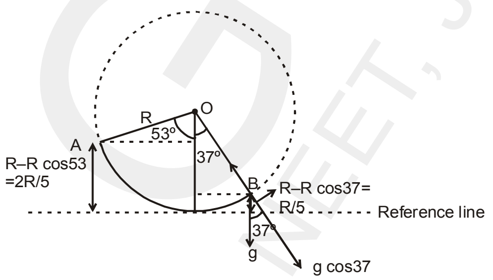
[where t_i is the time taken to complete the i^{th} to and fro motion after collision]

Total time = 0.5 + [0.5 + 0.25 + 0.125 + ...]

$= 0.5 + \frac{0.5}{1-0.5}$ (Since above is a G.P. with a = 0.5 and r = 0.5)

= 0.5 + 1 = 1.5 sec.

2.



By energy conservation between A & B

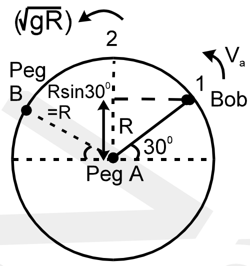
$$\Rightarrow \ Mg\frac{2R}{5} + 0 = \frac{MgR}{5} + \frac{1}{2}MV^2$$

$$V = \sqrt{\frac{2gR}{5}}$$

Now, radius of curvature r

$$= \frac{V_\perp^2}{a_r} = \frac{2gR/5}{g\cos 37} = \frac{R}{2}$$

3. (C) For anti-clockwise motion, speed at the highest point should be $\sqrt{gR}$. Conserving energy at (1) & (2) :



$$\frac{1}{2}mv_a^2$$

$$= mg\frac{R}{2} + \frac{1}{2}m(gR)$$

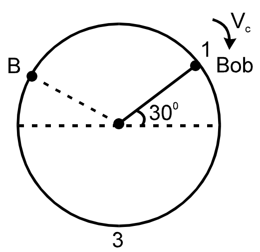
$\Rightarrow v_a^2 = gR + gR = 2gR$

$\Rightarrow v_a = \sqrt{2gR}$

For clock-wise motion, the bob must have atleast that much speed initially, so that the string must not become loose any where until it reaches the peg B.

At the initial position :

$$T + mg\cos 60^0 = \frac{mv_c^2}{R} \quad ;$$



V_C being the initial speed in clockwise direction.

For $V_{C\,min}$: Put T = 0 ;

$$\Rightarrow \ V_C = \sqrt{\frac{gR}{2}}$$

$$\Rightarrow \ V_C/V_a = \frac{\sqrt{\frac{gR}{2}}}{\sqrt{2gR}} = \frac{1}{2}$$

$\Rightarrow V_C : V_a = 1 : 2$ **Ans.**

6. Using newton's formula

$xy = f^2$

$\Rightarrow 20\,y = (10)^2$

$\Rightarrow$ y = 5 cm.

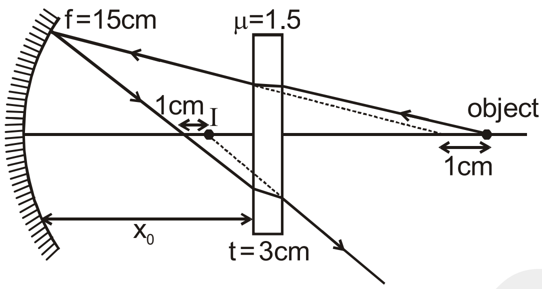
Sol. 7 to 9

The shift due to slab is $t\left(1-\frac{1}{\mu}\right)=3\left(1-\frac{1}{1.5}\right)$

= 1cm towards left. Hence the object appears to mirror at a distance 61 – 1 = 60 cm.

From mirror formula $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$ we get

v =20 cm.

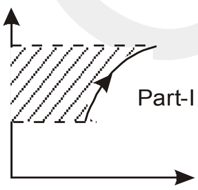


Hence the mirror forms the image at v = 20 cms towards right. The slab again causes a shift of 1cm towards right. hence the final image is formed at a distance of 21 cm from pole.
Shifting of slab towards left does no cause any change to position of final image .
The slab only causes apparent shift, but does not cause any change to velocity of image. Hence the velocity of image is only due to mirror. The object appears at a distance u= 60 cm from mirror and mirror forms its image at v=20 cm. Hence the velocity of image is

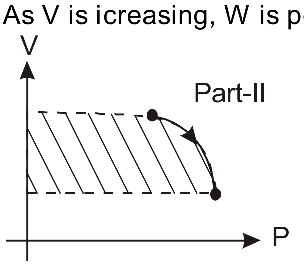
$= -\left(\frac{v}{u}\right)^2 \times$ velocity of object$=-\left(\frac{20}{60}\right)^2\times 18$

= 2 m/s towards right

10. (A) s (B) q (C) r (D) q
in (A), V is on vertical axis.



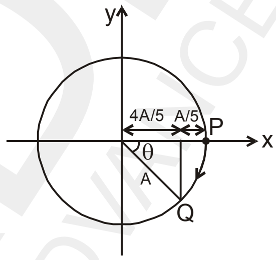
As V is icreasing, W is positive.



V is decreasing, W is negative.
As negative work in part-II is greater than positive work in part-I, net work during the process is negative.
Using PV = nRT and as $V_{remains}$ same for initial and final points of the process, it is obvious that final temp. is greater than initial temperature as pressure has increased. Therefore dU is positive.
Hence option (S) is connected with (A).
Similar arguments can be applied to other graphs.

DPP NO. - 7

1. Particle is starting from rest, i.e. from one of its extreme position.



As particle moves a distance $\frac{A}{5}$, we can represent it on a circle as shown.

$\cos\theta = \frac{4A/5}{A} = \frac{4}{5}$

$\theta = \cos^{-1}\left(\frac{4}{5}\right)$

$\omega t = \cos^{-1}\left(\frac{4}{5}\right)$

$t = \frac{1}{\omega}\cos^{-1}\left(\frac{4}{5}\right)$

$= \frac{T}{2\pi}\cos^{-1}\left(\frac{4}{5}\right)$

Method :

As starts from rest i.e. from extreme position x = A sin (ωt + φ)

At t = 0 ; x = A

$\Rightarrow \phi = \frac{\pi}{2}$

$\therefore A - \frac{A}{5} = A\cos\omega t$

$\frac{4}{5} = \cos\omega t$

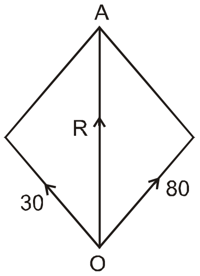
$\Rightarrow \omega t = \cos^{-1}\frac{4}{5}$

$t = \frac{T}{2\pi}\cos^{-1}\left(\frac{4}{5}\right)$

2. Frictional force along the in upward direction

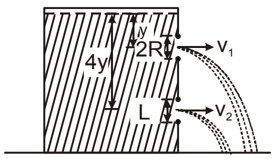
$= 10\ g\ \sin\theta - 30 = 30$ Nt

$N = \log \cos\theta = 80$ Nt



Direction of R is along OA.

3. Let v_1 and v_2 be the velocity of efflux from square and circular hole respectively. S_1 and S_2 be cross-section areas of square and circular holes.



$v_1 = \sqrt{8gy}$ and $v_2 = \sqrt{2g(y)}$

The volume of water coming out of square and circular hole per second is

$Q_1 = v_1S_1 = \sqrt{8gy}\ L^2$; $Q_2 = v_2S_2 = \sqrt{2gy}\ \pi R^2$

$\because\ Q_1 = Q_2$

$\therefore\ R = \sqrt{\frac{2}{\pi}}\ .\ L$

4. **(D)** $F + f = ma$ .... (1)

Also ; $FR - fR = I\ \frac{a}{R}$

$F - f = ma$ .... (2)

$[I = mR^2]$

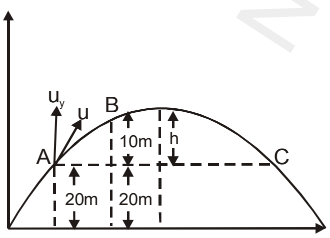
From (1) & (2)

$f = 0.$

5. $t_{AB} = t$

$t_{BC} = 2t$

So, for ABC part,



Time of flight,

$t_{AC} = 3t = \frac{2u_y}{g}$

$\Rightarrow\ u_y = \frac{3}{2}gt$

Also, $10 = u_yt - \frac{1}{2}gt^2 = gt^2$

$\Rightarrow\ t = 1s$

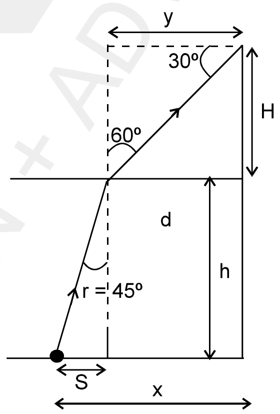
$\therefore\ u_y = 15$ m/s

$\therefore\ h = \frac{u_y^2}{2g} = \frac{225}{20} = \frac{45}{4}$ m.

$\therefore$ Maximum height attained $= 20 + \frac{45}{4}$

$= \frac{125}{4}$ m.

6. **Ans. d = 4000 mm**



$\sin 60° = \sqrt{\frac{3}{2}}\ \sin r \Rightarrow r = 45°$

$\therefore\ S = h = 1$ m

$y = H \tan 60° = 3$m

$\therefore\ x = S + y = 4m = 4000$ mm

7. There is only one point image corresponding to a point object, as long as the object lies on the water surface (principal axis of the mirror). Any object lying at some distance from the princpal axis results in multiple image points.

8. If light rays diverge outward (forming a virtual image behind the mirror) after reflection, there is no refraction at water surface after reflection. This is the case when the object lies between the focus and the pole.

DPP NO. - 8

1. average speed $\bar{v} = \dfrac{\int_0^t \frac{dx}{dt}.dt}{t} = \dfrac{\int_0^t dx}{t}$

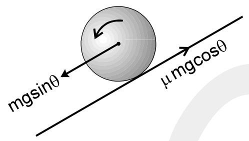
$= \dfrac{x(t)-x(0)}{t} = \dfrac{A(\cos\pi/6-1)}{\pi/6\omega} = \dfrac{3A\omega}{\pi}\left(\sqrt{3}-2\right)$

since particle does not change it's direction in the given interval , average speed

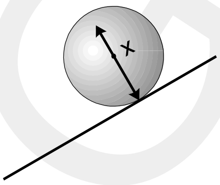
$= |\bar{v}| = \dfrac{3A\omega}{\pi}\left(2-\sqrt{3}\right)$

2. Since the block slides down the incline with uniform velocity, net force on it must be zero. Hence mg sinθ must balance the frictional force 'f' on the block.
Therefore f = mg sinθ = 5 × 10 × ½ = 25 N.

3. **(C)** Angular momentum will be conserved if the net torque is zero .
Now for the sphere to move down:
mg sinθ > μ mg cosθ



Let x be the perpendicular distance of the point (as shown in figure) about which torque remains zero.
for τ = 0 ; x > R as shown



Note: As mgsinθ > μmgcosθ, the point should be inside the sphere.

4. $\lambda = 2\ell = 3m$
Equation of standing wave
y = 2A sin kx cos ωt
y = A as amplitude is 2A.
A = 2A sin kx

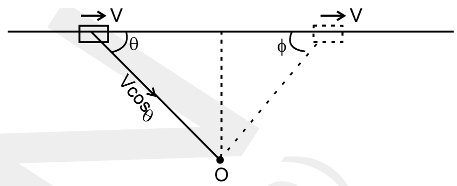
$\dfrac{2\pi}{\lambda}\ x = \dfrac{\pi}{6}$

$\Rightarrow x_1 = \dfrac{1}{4}m$

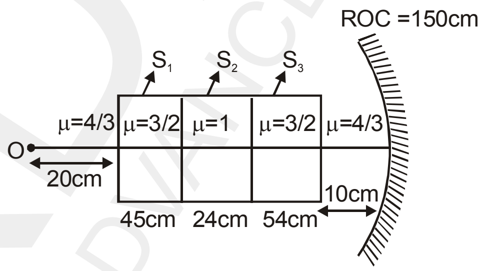
and $\dfrac{2\pi}{\lambda}\ .\ x = \dfrac{5\pi}{6}$

$\Rightarrow x_2 = 1.25\ m \Rightarrow x_2 - x_1 = 1m$

5. From figure , the velocity of approach (Vcosθ) decrease as the source comes closer (as θ increases).And the velocity of separation also increases as ϕ will decrease.
Hence the frequency of sound as heared by the observed decreases continuously .



6.



Apparent shift in the object O dut to three slabes S_1,S_2 and S_3 with respect to the medium of μ = $\dfrac{4}{3}$ is given by :

Shift

$= 45\left(1-\dfrac{1}{\frac{3/2}{4/3}}\right) + 24\left(1-\dfrac{1}{\frac{1}{4/3}}\right) + 54\left(1-\dfrac{1}{\frac{3/2}{4/3}}\right)$

Shift = $45\left(1-\dfrac{8}{9}\right) + 24\left(1-\dfrac{4}{3}\right) + 54\left(1-\dfrac{8}{9}\right)$.

Shift = 5 + (–8) + 6 = 3 cm

∴ U_{net} = 150 cm and ROC = 150 cm.

Hence image will be formed on the object itself.

7. The moment of inertia of all seven rods parallel to AB and not lying on AB is the moment of inertia of all five rods lying on AB = 0
The moment of inertia of all 18 rods perpendicular to AB is = $18\ (\lambda\ell)\ \dfrac{\ell^2}{3} = 6\ \lambda\ell^3$

Hence net MI of rod about
AB = $7\ \lambda\ell^3 + 6\ \lambda\ell^3 = \mathbf{13\ \lambda\ell^3}$ **Ans.**

8. $\frac{\mu_2}{v} = \frac{\mu_1}{u} + \left(\frac{\mu_2 - \mu_1}{R}\right)$

$(\mu_2 - \mu_1)$ is +ve and R is – ve if u is –ve, v will always be –ve

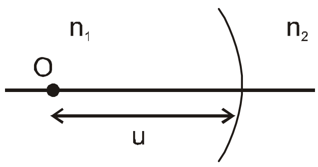
i.e. for real object image is always virtual.

Sol. 9. to 10.

Consider object on left side of spherical surface seperating two media.

If real object is in rarer media i.e., $n_1 < n_2$

Then $\frac{n_2}{v} = \frac{n_2 - n_1}{(-u)} + \frac{n_1}{(-R)} = -ve$



Hence image shall be virtual for a real object lying on concave side with rarer media ....(1)

If real object is in denser media i.e., $n_1 > n_2$

$\frac{n_2}{v} = \frac{-(n_1 - n_2)}{(-u)} + \frac{n_1}{(-R)} = \frac{n_1 - n_2}{u} - \frac{n_1}{R}$

$\therefore$ Image is real if $\frac{n_1 - n_2}{u} > \frac{n_1}{R}$ or u

$< \frac{(n_1 - n_2)R}{n_1}$ .... (2)

and image is virtual if $u > \left(\frac{n_1 - n_2}{n_1}\right)R$ .... (3)

From statements 1, 2 and 3 we can easily conclude the answers.

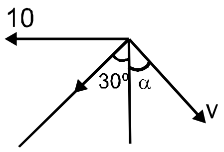
DPP NO. - 9

1. As $\Sigma\tau = 0$, angular momentum remains conseved :

$\therefore \quad L = \left(0 + \frac{300R^2}{2}\right)\omega_0 = \left(\frac{300R^2}{2} + 30R^2\right).\omega$

$\Rightarrow$ 150 ω_0 = 180 ω $\Rightarrow$ $\omega = 5/6\ \omega_0$ **Ans.**

2.



Let v = velo. of rain

Possible values of α are

$-30° < \alpha < 90°$.

3. For first resonance with 400 Hz tuning fork

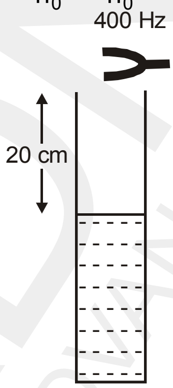
$\ell_{eq} = \frac{V}{4f_0} = \frac{V}{4(400)} = (19 + 1) = 20$ cm

If we use 1600 Hz tuning fork

$\frac{V}{4f_0} = \frac{V}{4 \times (1600)} = \frac{20}{4} = 5$ cm

for Resonance

$\ell_{eq} = \frac{V}{4f_0}, \frac{3V}{4f_0}, \frac{5V}{4f_0}, \frac{7V}{4f_0}, ...$



1 cm + ℓ = 5 cm , 15 cm , 25 cm , 35 cm , 45 cm .....

ℓ = 4 cm , 14 cm , 24 cm , 34 cm , 44 cm .....

water level should be further lowered by

24 – 19 = 5 cm $\Rightarrow$ 34 – 19 = 15 cm

4 As rays are parallel to the principal axis, image is created by lens at the focus.

By placing of glass-slab,

Shift = $\left(1 - \frac{1}{\mu}\right).t$

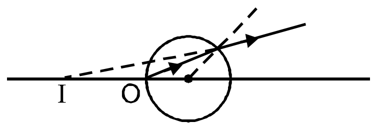
$= \left(1 - \frac{1}{1.5}\right) 3 = 1$ cm.

Irrespective of separation,

Image is shifted to the right by 1 cm.

Total distance from lens 10 + 1 = **11 cm Ans.**

5.



$\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$

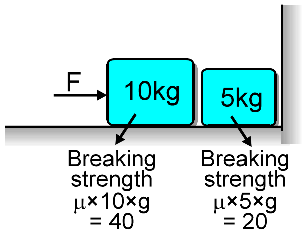
$\frac{1}{v} - \frac{1.5}{-2R} = \frac{1 - 1.5}{-R}$

$\Rightarrow$ v = –4R

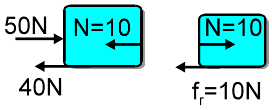
$m = \frac{n_1 v}{n_2 u} = \frac{1.5 \times (-4R)}{1 \times -(2R)}$

m = 3.

6. If F = 20 N, 10 kg block will not move and it would not press 5 kg block So N = 0.

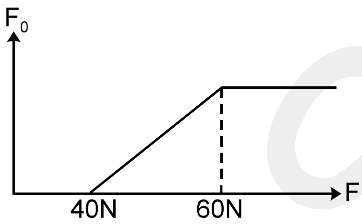


8. If F = 50 N, force on 5 kg block = 10 N



So friction force = 10 N

9. Until the 10 kg block is sticked with ground (... F = 40 N),
No force will be flet by 5 kg block. After F = 40 N, the friction
force on 5 kg increases, till F = 60 N, and after that, the kinetic friction start acting on 5 kg block,



which will be constant (20N)

DPP NO. - 10

1. (C) $\left[\left(\frac{v}{v-v_s}\right)-\left(\frac{v}{v+v_s}\right)\right]f_0 = 2\text{ Hz}$

$v_s = 0.5$ m/s

2. Let velocity of c.m. of sphere be v. The velocity of the plank = 2v.

Kinetic energy of plank = $\frac{1}{2} \times m \times (2v)^2 = 2mv^2$

Kinetic energy of cylinder = $\frac{1}{2}mv^2$

$+ \frac{1}{2} + \left(\frac{1}{2}mR^2\omega^2\right)$

$= \frac{1}{2}mv^2\left(1+\frac{1}{2}\right) = \frac{3}{2}.\frac{1}{2}mv^2$

$\therefore \frac{\text{K.E. of plank}}{\text{K.E. of sphere}} = \frac{2mv^2}{\frac{3}{4}mv^2} = \frac{8}{3}$.

3. Time of flight of projectile depends on vertical component of velocity and not on the horizontal component. Collision of the stone with the vertical wall changes only the horizontal component of velocity of stone.
Thus the total time of flight in absence of wall is also T = 1 + 3 = 4sec

$\therefore \frac{2u_y}{g} = 4$

or $u_y = 20$ m/s

or $H_{max} = \frac{u_y^2}{2g} = \frac{400}{20} = 20$ metres.

4.

$\theta_{min} > C$
$\sin\theta_{min} > \sin C$

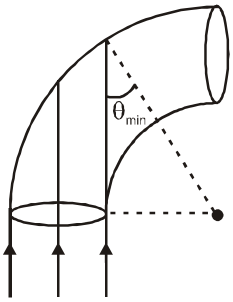
$\frac{R-d}{R} > \frac{1}{n}$

$\Rightarrow$ R n – dn > R

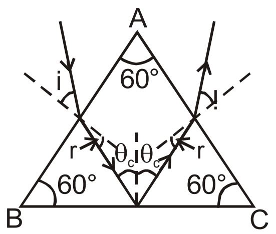
$\Rightarrow R > \frac{nd}{n-1}$

$R > \frac{2\,.\,4mm}{2-1}$

R > 8 mm



5.



Total Deviation = (i – r) + (180 – 2θ_c) + (i – r) = 112°
as r = 60 – θ_c
2i – 120 + 2θ_c + 180 – 2θ_c = 112°
$\Rightarrow$ 2i = 52°, i = 26°

7. F = a sin ωt

$m\frac{dv}{dt} = a \sin \omega t \quad \Rightarrow \frac{dv}{dt} = \frac{a}{m}\sin \omega t \sin \omega t$

$\int_0^v dv = \int_0^t \sin \omega t.dt$

$v = \frac{a}{\omega m} - \frac{a}{\omega m}\cos \omega t = \frac{a}{\omega m}[1 - \cos \omega t]$

since cos ωt ≤ 1
hence direction of velocity will not change.

Ans. Will not change

8. From formula for refraction at curved surface

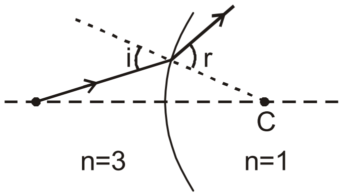
$$\frac{n^2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R} \qquad v = -4 \text{ cm}$$

$\therefore$ image is formed in denser medium at a distance 4 cm from pole.

9. Size of image = $\frac{v}{u} \times \frac{n_1}{n_2}$ × size of object

$= \frac{4}{20} \times \frac{3}{1} \times 2 = \frac{6}{5}$ cm.

10.



40 cm from pole in the medium of refractive index 1, virtual, erect and 4 cm in size.

A ray incident from object O is in denser medium and is refracted into rarer medium.

$\therefore$ r > i Hence always virtual image is formed.