GGSRDN
Educational Services Private Limited
9th, 10th, NEET, JEE(Main/Advanced)
अभ्यास ही सबसे बड़ा गुरू है।

CLASS : XII (PHYSICS)

DPP

DAILY PRACTICE PROBLEM

DPP-61 to 82

DPP 71 : **Magnetic Effect of Current and Magnetic Force on Charge/current, Electromagnet Induction, Rotation, Center of Mass, Geometrical Optics, Current Electricity**

DPP 72 : **Magnetic Effect of Current and Magnetic Force on Charge/current, Electromagnet Induction, Rotation, Current Electricity, Fluid, Center of Mass**

DPP 73 : **Rotation, Fluid, Current Electricity, Magnetic Effect of Current and Magnetic Force on Charge/current, Electromagnet Induction**

DPP 74 : **Electromagnet Induction, Rotation, Center of Mass, Magnetic Effect of Current and Magnetic Force on Charge/current**

DPP 75 : **Heat, Center of Mass, Magnetic Effect of Current and Magnetic Force on Charge/current, Rotation, Geometrical Optics**

DPP 76 : **Electromagnet Induction, Geometrical Optics, Center of Mass, Heat, Magnetic Effect of Current and Magnetic Force on Charge/current,**

DPP 77 : **Kinematics, Electromagnet Induction, Magnetic Effect of Current and Magnetic Force on Charge/current, Center of Mass, Rotation**

DPP 78 : **Center of Mass, Electromagnet Induction, Magnetic Effect of Current and Magnetic Force on Charge/current, Rotation**

DPP 79 : **Rotation, Electromagnet Induction, Simple Harmonic Motion**

DPP 80 : **Rotation, Simple Harmonic Motion, Electromagnet Induction, Alternating Current**

DPP 81 : **Fluid, Electromagnet Induction, Rotation, Magnetic Effect of Current and Magnetic Force on Charge/current**

DPP 82 : **Fluid, Electromagnet Induction, Alternating Current, Morden Physics, Rotation, Magnetic Effect of Current and Magnetic Force on Charge/current**

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 61

Total Marks : 27

Max. Time : 28 min.

Topics : Elasticity, Rotation, Heat, Newton's Law of Motion, Work, Power and Energy, Capacitance

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 to Q.4	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–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]

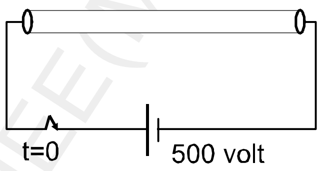
1. Two steel wires, where one has twice diameter and three times the length of the other, are stretched by the same force. The ratio of the elastic strain energy stored in them is

(A) 2 : 3 (B) 3 : 4 (C) 3 : 2 (D) 6 : 1

2. Two men of equal masses stand at opposite ends of the diameter of a turntable disc of a certain mass, moving with constant angular velocity. The two men make their way to the middle of the turntable at equal rates. In doing so

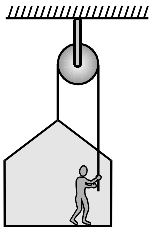
(A) kinetic energy of rotation has increased while angular momentum remains same.
(B) kinetic energy of rotation has decreased while angular momentum remains same.
(C) kinetic energy of rotation has decreased but angular momentum has increased.
(D) both, kinetic energy of rotation and angular momentum have decreased.

3. A straight nicrome wire is initially at room temperature 20ºC. It is connected to an ideal battery of 500 volt. Jusr after switching on, the current detected is 5 amp. Due to heating effect its temperature increases, and is also loosing heat to the environment according to newton's cooling law as $\frac{dQ_{loss}}{dt} = 45(T - 20ºC)$J/sec. At steady state, the current detected is 4.5 amp.



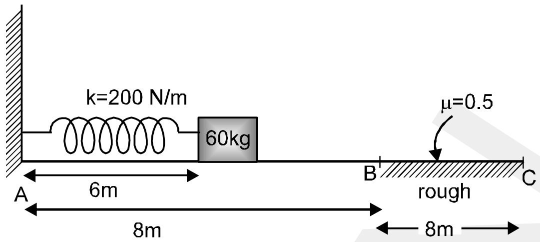
(A) staedy state temperature of the wire is 70 ºC
(B) steady state temperature of the wire is 75.5ºC
(C) temperature co–efficient of resistance of the wire is nearly 2.2×10^{-3} /ºC
(D) temperature co–efficient of resistance of the wire is nearly 1.57×10^{-3} /ºC

4. A painter is applying force himself to raise him and the box with an acceleration of 5 m/s^2 by a massless rope and pulley arrangement as shown in figure. Mass of painter is 100 kg and that of box is 50 kg. If g = 10 m/s^2, then:



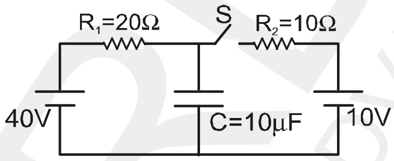
(A) tension in the rope is 1125 N
(B) tension in the rope is 2250 N
(C) force of contact between the painter and the floor is 375 N
(D) none of these

5. A block of mass 60 kg is released from rest when compression in the spring is 2m (natural length of spring is 8m). Surface AB is smooth while surface BC is rough. Block travels x distance before coming to complete rest. Value of x is : [g = 10 m/s^2]



COMPREHENSION

The circuit consists of two resistors (of resistance $R_1 = 20\ \Omega$ and $R_2 = 10\ \Omega$) , a capacitor (of capacitance C = 10μF) and two ideal cells. In the circuit shown the capacitor is in steady state and the switch S is open



6. The current through the resistor R_2 just after the switch S is closed is:

(A) 1 ampere (B) 2 ampere (C) 3 ampere (D) 4 ampere

7. The charge on capacitor in steady state with switch S closed.

(A) 100μC (B) 200μC (C) 300μC (D) 400μC

8. The circuit is in steady state with switch S closed. Now the switch S is opened. Just after the switch S is opened, the current through resistance R_1 is

(A) 1ampere (B) 2 ampere (C) 3 ampere (D) 4 ampere

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PHYSICS DPP
DAILY PRACTICE PROBLEMS

DPP No. 62

Total Marks : 24

Max. Time : 24 min.

Topics : Heat, Current Electricity, Magnetic Effect of Current and Magnetic Force on Charge/current, Rotation, Kinematics, Center of Mass

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

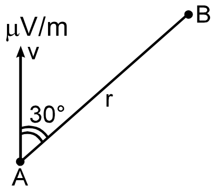
1. A rod of length ℓ and cross section area A has a variable thermal conductivity given by k = α T, where α is a positive constant and T is temperature in kelvin. Two ends of the rod are maintained at temperatures T_1 and T_2 ($T_1 > T_2$). Heat current flowing through the rod will be

(A) $\dfrac{A\,\alpha\,(T_1^2 - T_2^2)}{\ell}$ (B) $\dfrac{A\,\alpha\,(T_1^2 + T_2^2)}{\ell}$ (C) $\dfrac{A\,\alpha\,(T_1^2 + T_2^2)}{3\ell}$ (D) $\dfrac{A\,\alpha\,(T_1^2 - T_2^2)}{2\ell}$

2. A potentiometer wire of length 10 m and resistance 10 ohm is connected in series with an ideal cell of E.M.F. 2 V. If a rheostat having range 0 –10 ohm is used in series with the cell then maximum potential gradient of the wire will be :

(A) 2 V/m (B) 0.2 V/m (C) 2 μV/m (D) 0.2 μV/m

3. A charge particle A of charge q = 2 C has velocity v = 100 m/s . When it passes through point A & has velocity in the direction shown . The strength of magnetic field at point B due to this moving charge is (r = 2 m):



(A) 2.5 μ T (B) 5.0 μ T (C) 2.0 μ T (D) none of these

4. Two like parallel forces P and 3 P are 40 cm apart. If the direction of P is reversed, then the point of application of their resultant shifts through a distance of :

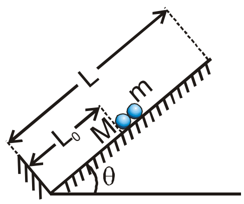
(A) 30 cm (B) 40 cm (C) 50 cm (D) 60 cm

5. The engine of a futuristic nuclear powered car for which power and speed can have fantastic values (say 600 kph) can produce a maximum acceleration of 5 m/s^2 and its brakes can produce a maximum retardation of 10 m/s^2. The minimum time in which a person can reach his workplace, located 1.5 km away from his home using this car is

(A) 5 sec. (B) 10 sec. (C) 15 sec. (D) 30 sec.

COMPREHENSION

Two small balls of same size having masses m and M with a slight separation are released from rest simultaneously on a smooth fixed inclined plane of inclination θ = 53° and length L. There is a fixed wall at the bottom of the incline such that wall is perpendicular to inclined plane as shown. The collision of both balls takes place only after the collision of mass M with wall is over. Initially M is at a distance L_0 = 9 m from the wall. If M comes to stop just after its collision with m answer the following three questions. (All collisions are perfectly elastic and g = 10 m/s^2 and sin 53° = $\frac{4}{5}$)



6. Just after collision of both balls, velocity of ball having mass m up the incline is:

(A) 20 m/s (B) 22 m/s (C) 24 m/s (D) 12 m/s

7. The ratio m : M is :

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

8. The minimum value of L (in meter) so that m does not leave the incline.

(A) 12 (B) 24 (C) 36 (D) 48

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 63

Total Marks : 25

Max. Time : 26 min.

Topics : Heat, Current Electricity, Magnetic Effect of Current and Magnetic Force on Charge/current, Rotation, Kinematics, Center of Mass

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	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. Two identical long, solid cylinders are used to conduct heat from temp T_1 to temp T_2. Originally the cylinder are connected in series and the rate of heat transfer is H. If the cylinders are connected in parallel then the rate of heat transfer would be :

(A) H/4 (B) 2H (C) 4H (D) 8H

2. In a metre bridge experiment null point is obtained at 20 cm from one end of the wire when resistance X is balanced against another resistance Y. If X < Y, then where will be the new position of the null point from the same end, if one decides to balance a resistance of 4X against Y ?

(A) 50 cm (B) 80 cm (C) 40 cm (D) 70 cm

3. An electron (charge – e, mass ' m ') is revolving around a fixed proton in circular path of radius ' r '. The magnetic field at the centre due to electron is:

(A) 0 (B) $\frac{\mu_0 e^2}{8\pi r^2\sqrt{\pi m \epsilon_0 r}}$ (C) $\frac{\mu_0 e}{8\pi r\sqrt{\pi m \epsilon_0 r}}$ (D) $\frac{\mu_0 e}{4\pi r^2\sqrt{\pi m \epsilon_0 r}}$

4. A weightless rod is acted on by upward parallel forces of 2 N and 4 N ends A and B respectively. The total length of the rod AB = 3 m. To keep the rod in equilibrium a force of 6 N should act in the following manner: (A) Downwards at any point between A and B

(B) Downwards at mid point of AB

(C) Downwards at a point C such that AC = 1 m

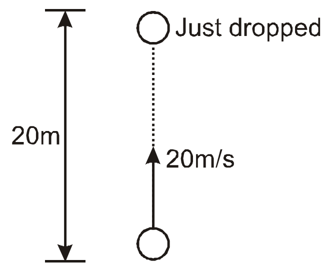
(D) Downwards at a point D such that BD = 1

5. Two cars A and B are travelling towards each other on a single-lane road at 24 m/s and 21 m/s respectively. They notice each other when 180 m apart and apply brakes simultaneously. They just succeed in avoiding collision, both stopping simultaneously at the same position. Assuming constant retardation for each car, the distance travelled by car A while slowing down is

COMPREHENSION

Two identical masses are as shown in figure. One is thrown upwards with velocity 20 m/s and another is just dropped simultaneously. [g = 10 m/s²]

6. The masses collide in air and stick together. After how much time the combined mass will fall to the ground (Calculate the time from the starting when the motion was started).



(A) (1+ $\sqrt{2}$) second (B) 2$\sqrt{2}$ second

(C) (2+ $\sqrt{2}$) second (D) none of these

7. In the above problem, to what maximum height (from ground) will the combined mass rise .

(A) 25 m (B) 18 m (C) 15 m (D) 20 m

8. If collision between them is elastic, find the time interval between their striking with ground.

(A) zero (B) 2 sec (C) 1 sec (D) 3 sec

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 64

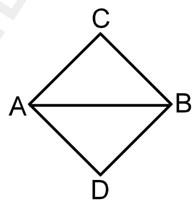
Total Marks : 26

Max. Time : 28 min.

Topics : Heat, Magnetic Effect of Current and Magnetic Force on Charge/current, Rotation, Current Electricity, Center of Mass

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

1. Two identical rectangular rods of metal are welded end to end in series between temperature 0°C and 100°C and 10 J of heat is conducted (in steady state process) through the rod in 2.00 min. If 5 such rods are taken and joined as shown in figure maintaining the same temperature difference between A and B, then the time in which 20 J heat will flow through the rods is :



(A) 30 sec. (B) 2 min. (C) 1 min. (D) 20 sec.

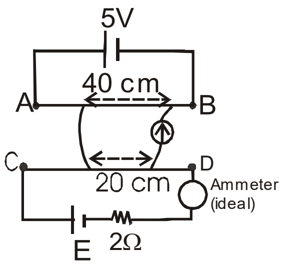
2. An α particle is moving along a circle of radius R with a constant angular velocity ω. Point A lies in the same plane at a distance 2R from the centre. Point A records magnetic field produced by α particle. If the minimum time interval between two successive times at which A records zero magnetic field is 't', the angular speed ω, in terms of t is -

(A) $\frac{2\pi}{t}$ (B) $\frac{2\pi}{3t}$ (C) $\frac{\pi}{3t}$ (D) $\frac{\pi}{t}$

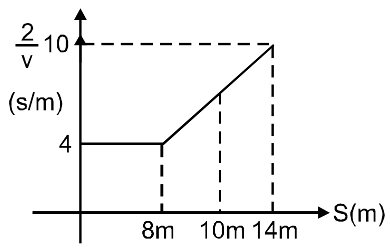
3. When a person throws a meter stick it is found that the centre of the stick is moving with speed 10 m/s and left end of stick with speed 20 m/s. Both points move vertically upwards at that moment. Then angular speed of the stick is:

(A) 20 rad/ sec (B) 10 rad/sec (C) 30 rad/sec (D) none of these

4. AB and CD are two uniform resistance wires of lengths 100 cm and 80 cm respectively . The connections are shown in the figure. The cell of emf 5 V is ideal while the other cell of emf E has internal resistance 2 Ω. A length of 20 cm of wire CD is balanced by 40 cm of wire AB. Find the emf E in volt, if the reading of the ideal ammeter is 2 A. The other connecting wires have negligible resistance.

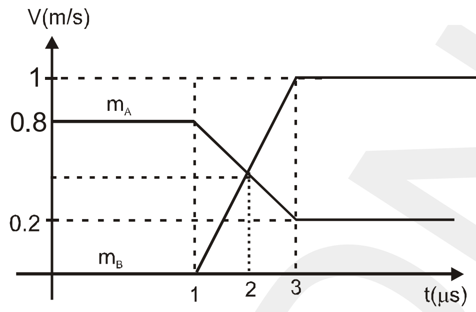


5. Figure shows $\frac{2}{v}$ v/s s curve for a particle of mass 2 kg moving in a straight line. If the time (in seconds) taken by the particle to achive a displacement of 10 m is t. (v = velocity, s = displacement), then find the value of (t – 20).



COMPREHENSION

There are two blocks A and B placed on a smooth surface. Block A has mass 10 kg and it is moving with velocity 0.8 m/s towards stationary B of unknown mass. At the time of collision, their velocities are given by the following graph :



6. Coefficient of restitution of the collision is

(A) 1.5 (B) 1 (C) 0.5 (D) 0.8

7. Impulse of deformation is :

(A) 1 Ns (B) 3 Ns (C) 6 Ns (D) 5 Ns

8. Maximum deformation potential energy is:

(A) 1.2 J (B) 3.2 J (C) 2.0 J (D) 1.6 J

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 65

Total Marks : 26

Max. Time : 27 min.

Topics : Center of Mass, Magnetic Effect of Current and Magnetic Force on Charge/current, Gravitation, Heat, Rotation

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 Questions ('–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 man of mass M stands at one end of a plank of length L which lies at rest on a frictionless horizontal surface . The man walks to the other end of the plank. If the mass of the plank is M/3, the distance that the man moves relative to the ground is

(A) 3 L/4 (B) 4 L/5 (C) L/4 (D) none of these

2. A particle is moving with velocity $\vec{v} = \hat{i} + 3\hat{j}$ and it produces an electric field at a point given by $\vec{E} = 2\hat{k}$. It will produce magnetic field at that point equal to (all quantities are in S.I. units and speed of light is c)

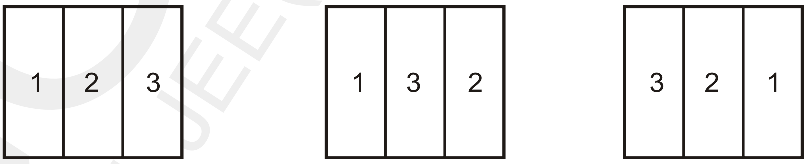
(A) $\frac{6\hat{i} - 2\hat{j}}{c^2}$ (B) $\frac{6\hat{i} + 2\hat{j}}{c^2}$

(C) zero (D) can not be determined from the given data

3. Maximum height reached by a rocket fired with a speed equal to 50% of the escape velocity from earth's surface is:

(A) R/2 (B) 16R/9 (C) R/3 (D) R/8

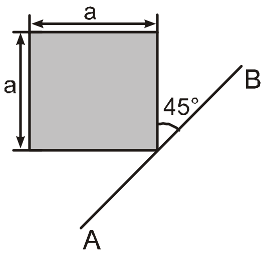
4. Figure shows three different arrangements of materials 1, 2 and 3 (identical in shape) to form a wall. The thermal conductivities are K_1, K_2 and K_3 respectively and $K_1 > K_2 > K_3$. The left side of the wall is 20°C higher than the right side.



(I) (II) (III)

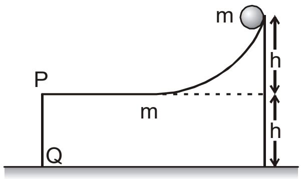
(A) In steady state, rate of energy conduction through the wall III is greatest.
(B) In steady state, rate of energy conduction through all the walls (I), (II) and (III) are same.
(C) In steady state, temperature difference across material 1 is greatest in wall II.
(D) In steady state, temperature difference across material 1 is same in all the walls.

5. Find the moment of inertia (in kg.m^2) of a thin uniform square sheet of mass M = 3kg and side a = 2m about the axis AB which is in the plane of sheet :



COMPREHENSION

A small ball (uniform solid sphere) of mass m is released from the top of a wedge of the same mass m. The wedge is free to move on a smooth horizontal surface. The ball rolls without sliding on the wedge. The required height of the wedge are mentioned in the figure.



6. The speed of the wedge when the ball is just going to leave the wedge at point 'P' of the wedge is

(A) $\sqrt{\frac{5gh}{9}}$ (B) $\sqrt{gh}$ (C) $\sqrt{\frac{5gh}{6}}$ (D) None of these

7. The total kinetic energy of the ball just before it falls on the ground

(A) 2 mgh (B) mgh (C) $\frac{13}{18}$ mgh (D) None of these

8. The horizontal separation between the ball and the edge 'PQ' of wedge just before the ball falls on the ground is

(A) $\frac{3\sqrt{10}}{2}h$ (B) $\frac{2\sqrt{10}}{3}h$ (C) 2 h (D) None of these

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 66

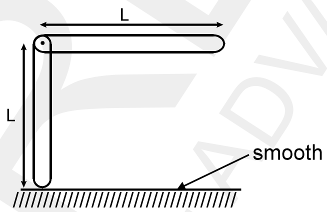
Total Marks : 26

Max. Time : 27 min.

Topics : Center of Mass, Magnetic Effect of Current and Magnetic Force on Charge/current, Gravitation, Heat, Rotation

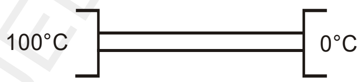
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.4	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.5	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking)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

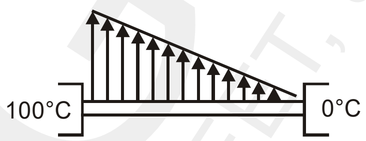
1. Two identical rods are joined at one of their ends by a pin. Joint is smooth and rods are free to rotate about the joint. Rods are released in vertical plane on a smooth surface as shown in the figure. The displacement of the joint from its initial position to the final position is (i.e. when the rods lie straight on the ground) :

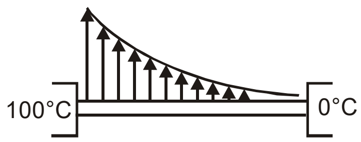


(A) $\frac{L}{4}$ (B) $\frac{\sqrt{17}}{4}L$ (C) $\frac{\sqrt{5}L}{2}$ (D) none of these

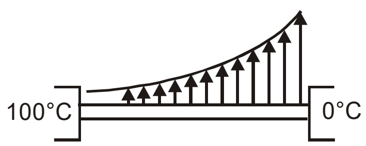
2. A conducting cylindrical rod of uniform cross-sectional area is kept between two large chambers which are at temperatures 100°C and 0°C respectively. The conductivity of the rod increases with x, where x is distance from 100°C end. The temperature profile of the rod in steady-state will be as :



(A)


(B)


(C)


(D)


3. Two observers moving with different velocities see that a point charge produces same magnetic field at the same point A. Their relative velocity must be parallel to $\vec{r}$, where $\vec{r}$ is the position vector of point A with respect to point charge. This statement is :

(A) true

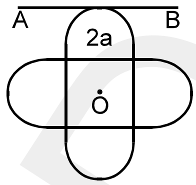
(B) false

(C) nothing can be said

(D) true only if the charge is moving perpendicular to the $\vec{r}$

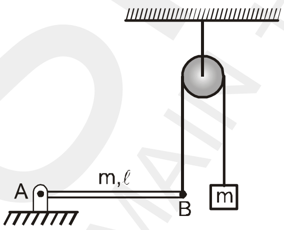
4. Suppose the earth suddenly shrinks in size, still remaining spherical and mass unchanged (All gravitational forces pass through the centre of the earth).
(A) The days will become shorter.
(B) The kinetic energy of rotation about its own axis will increase
(C) The duration of the year will increase.
(D) The magnitude of angular momentum about its axis will increase.

5. A symmetric lamina of mass M consists of a square shape with a semicircular section over each of the edge of the square as in figure. The side of the square is $2a$. The moment of inertia of the lamina about an axis through its centre of mass and perpendicular to the plane is $1.6\ Ma^2$. The moment of inertia of the lamina about the tangent AB in the plane of lamina is ________________.



COMPREHENSION

Uniform rod AB is hinged at the end A in a horizontal position as shown in the figure (the hinge is frictionless, that is, it does not exert any friction force on the rod). The other end of the rod is connected to a block through a massless string as shown. The pulley is smooth and massless. Masses of the block and the rod are same and are equal to 'm'.



6. Then just after release of block from this position, the tension in the thread is

(A) $\frac{mg}{8}$ (B) $\frac{5mg}{8}$ (C) $\frac{11mg}{8}$ (D) $\frac{3mg}{8}$

7. Then just after release of block from this position, the angular acceleration of the rod is

(A) $\frac{g}{8\ell}$ (B) $\frac{5g}{8\ell}$ (C) $\frac{11g}{8\ell}$ (D) $\frac{3g}{8\ell}$

8. Then just after release of block from this position, the magnitude of reaction exerted by hinge on the rod is

(A) $\frac{3mg}{16}$ (B) $\frac{5mg}{16}$ (C) $\frac{9mg}{16}$ (D) $\frac{7mg}{16}$

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 67

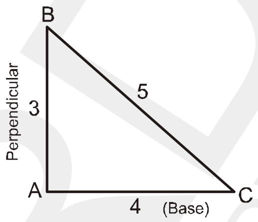
Total Marks : 24

Max. Time : 24 min.

Topics : Rotation, Center of Mass, Heat, Magnetic Effect of Current and Magnetic Force on Charge/ current, Gravitation, Rotation

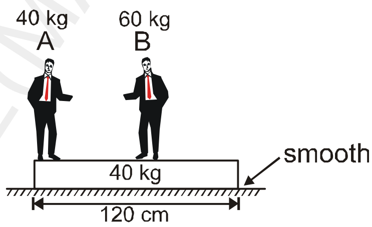
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. Moment of inertia of uniform triangular plate about axis passing through sides AB, AC, BC are I_P, I_B & I_H respectively & about an axis perpendicular to the plane and passing through point C is I_C. Then :



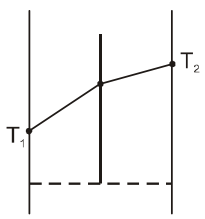
(A) $I_C > I_P > I_B > I_H$ (B) $I_H > I_B > I_C > I_P$
(C) $I_P > I_H > I_B > I_C$ (D) none of these

2. Two men 'A' and 'B' are standing on a plank. 'B' is at the middle of the plank and 'A' is at the left end of the plank. System is initially at rest and masses are as shown in figure. 'A' and 'B' start moving such that the position of 'B' remains fixed with respect to ground then'A' meets 'B'. Then the point where A meets B is located at :



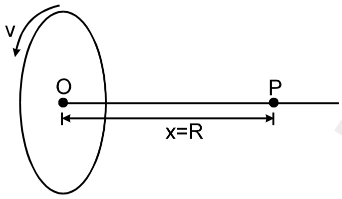
(A) the middle of the plank (B) 30 cm from the left end of the plank
(C) the right end of the plank (D) None of these

3. The wall of a house is made of two different materials of same thickness. The temperature of the outer wall is T_2 and that of inner wall is $T_1 < T_2$. The temperature variation inside the wall as shown in the figure. Then :



(A) thermal conductivity of inner wall is greater than that of outer.
(B) thermal conductivity of outer wall is greater than that of inner
(C) thermal conductivities of the two are equal
(D) no conclusion can be drawn about thermal conductivities

4. A uniformly charged ring of radius R is rotated about its axis with constant linear speed v of each of its particles. The ratio of electric field to magnetic field at a point P on the axis of the ring distant x = R from centre of ring is (c is speed of light)



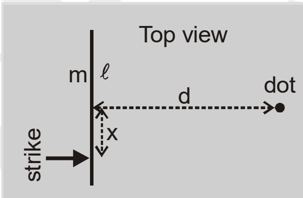
(A) $\frac{c^2}{v}$ (B) $\frac{v^2}{c}$ (C) $\frac{c}{v}$ (D) $\frac{v}{c}$

5. A satellite is revolving around earth in a circular orbit. At some instant the speed of the satellite is increased $\sqrt{2}$ times its orbital speed keeping its direction unchanged. Then, the new path of the satellite is :

(A) circular (B) straight line (C) elliptical (D) parabolic

COMPREHENSION

A thin uniform rod of length ℓ and mass m lies on a frictionless fixed horizontal surface. It is struck with a quick horizontal blow (directed perpendicular to the rod) at a distance x from the center of rod. A dot is painted on the horizontal surface at a distance d from the initial position of the center of the rod.



6. Let v be the speed of centre of mass and ω be the angular speed of the rod just after the blow. Then the value of $\frac{\omega}{v}$ is :

(A) $\frac{x}{\ell^2}$ (B) $\frac{3x}{\ell^2}$ (C) $\frac{4x}{\ell^2}$ (D) $\frac{12x}{\ell^2}$

7. For the rod to make one complete revolution by the time the center reaches the dot, the value of x (in terms of ℓ and d) should be :

(A) $\frac{\pi\ell^2}{2d}$ (B) $\frac{\pi\ell^2}{3d}$ (C) $\frac{\pi\ell^2}{6d}$ (D) $\frac{\pi\ell^2}{12d}$

8. For x as asked in previous question to exist, the minimum value of d (in terms of ℓ) should be :

(A) $\frac{\pi\ell}{2}$ (B) $\frac{\pi\ell}{3}$ (C) $\frac{\pi\ell}{4}$ (D) $\frac{\pi\ell}{6}$

PHYSICS
DPP
DAILY PRACTICE PROBLEMS

DPP No. 68

Total Marks : 33

Max. Time : 36 min.

Topics : Heat, Emf, Rotation, Center of Mass, Visosity, Geometrical Optics, Current Electricity

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]
Match the Following (no negative marking) (2 × 4) Q.8	(8 marks, 10 min.)	[8,10]
Assertion and Reason (no negative marking) Q. 9	(3 marks, 3 min.)	[3, 3]

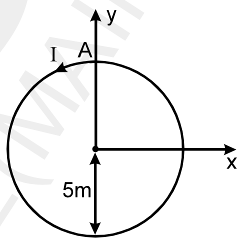
1. A simple microscope has a focal length of 5 cm. The magnification at the least distance of distinct vision is-

(A) 1 (B) 5 (C) 4 (D) 6

2. Two identical solid spheres have the same temperature. One of the sphere is cut into two identical pieces. The intact sphere radiates an energy Q during a given small time interval. During the same interval, the two hemispheres radiate a total energy Q'. The ratio Q'/Q is equal to :

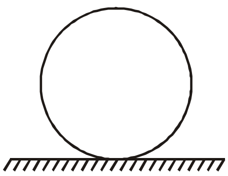
(A) 2.0 (B) 4.0 (C) $\frac{2}{3}$ (D) 1.5

3. A ring of radius 5 m is lying in the x-y plane and is carrying current of 1 A in anti-clockwise sense. If a uniform magnetic field $\vec{B} = 3\hat{i} + 4\hat{j}$ is switched on, then the co-ordinates of point about which the loop will lift up is:



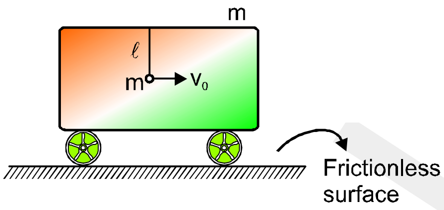
(A) (3, 4) (B) (4, 3)
(C) (3, 0) (D) (0, 3)

4. A ring of radius R rolls without slipping on a rough horizontal surface with a constant velocity. The radius of curvature of the path followed by any particle of the ring at the highest point of its path will be :



(A) (B) 2 R
(C) 4 R (D) none of these

5. A small bob of mass 'm' is suspended by a massless string from a cart of the same mass 'm' as shown in the figure.The friction between the cart and horizontal ground is negligible. The bob is given a velocity V_0 in horizontal direction as shown. The maximum height attained by the bob is,



(A) $\frac{2V_0^2}{g}$ (B) $\frac{V_0^2}{g}$ (C) $\frac{V_0^2}{4g}$ (D) $\frac{V_0^2}{2g}$

6. Two identical spherical drops of water are falling (vvertically downwards) through air with a steady velocity of 5 cm/sec. If both the drops coalesce (combine) to form a new spherical drop, the terminal velocity of the new drop will be- (neglect bouyant force on the drops.)

(A) 5 × 2 cm/sec (B) 5 × $\sqrt{2}$ cm/sec (C) 5 × (4) $^{1/3}$ cm/sec (D) $\frac{5}{\sqrt{2}}$ cm/sec.

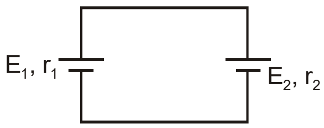
7. A steel wire of length l has a magnetic moment M. It is then bent into a semicircular arc. What is the new magnetic moment ?

8. In each situation of column-I a statement regarding a point object and its image is given. In column-II four optical instruments are given which form the image of that object. Match the statement in column-I with the optical instruments in column-II.

Column-I	Column-II
(A) Real image of a real point object may be formed by	(p) concave mirror
(B) Virtual image of a real point object may be formed by	(q) convex mirror
(C) Real image of a virtual point object may be formed by	(r) convex lens (surrounded by air)
(D) Virtual image of a virtual point object may be formed by	(s) concave lens (surrounded by air)

9. **STATEMENT-1 :** Two cells of unequal emf E_1 and E_2 having internal resistances r_1 and r_2 are connected as shown in figure. Then the potential difference across any cell cannot be zero.

STATEMENT-2 : If two cells having nonzero internal resistance and unequal emf are connected across each other as shown, then the current in the circuit cannot be zero.



(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.

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 69

Total Marks : 36

Max. Time : 41 min.

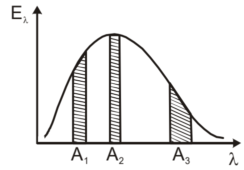
Topics : Heat, Rotation, Magnetic Effect of Current and Magnetic Force on Charge/current, Center of Mass, Geometrical Optics, Current Electricity

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 Questions ('–1' negative marking) Q.5 to Q.Q.7	(4 marks, 5 min.)	[12,15]
Match the Following (no negative marking) (2 × 4) Q.8	(8 marks, 10 min.)	[8, 10]
Assertion and Reason (no negative marking) Q. 9	(3 marks, 3 min.)	[3,3]

1. In a compound microscope, the intermediate image is -
(A) virtual, erect and magnified
(B) real, erect and magnified
(C) real, inverted and magnified
(D) virtual, erect and reduced

2. The resolving power of a telescope is more when its objective lens has
(A) greater focal length
(B) smaller focal length
(C) greater diameter
(D) smaller diameter

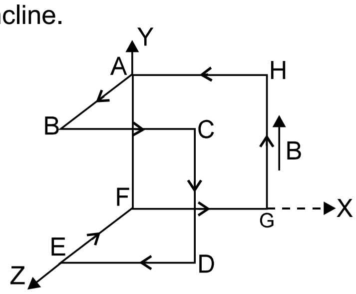
3. Three separate segments of equal area A_1, A_2 and A_3 are shown in the energy distribution curve of a blackbody radiation. If n_1, n_2 and n_3 are number of photons emitted per unit time corresponding to each area segment respectively then :



(A) $n_2 > n_1 > n_3$
(B) $n_3 > n_1 > n_2$
(C) $n_1 = n_2 = n_3$
(D) $n_3 > n_2 > n_1$

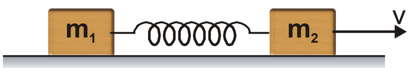
4. Which of the following statements is/are true
(A) work done by kinetic friction on an object may be positive.
(B) A rigid body rolls up an inclined plane without sliding. The friction force on it will be up the incline. (only contact force and gravitational force is acting)
(C) A rigid body rolls down an inclined plane without sliding. The friction force on it will be up the incline. (only contact force and gravitational force is acting)
(D) A rigid body is left from rest and having no angular velocity from the top of a rough inclined plane. It moves down the plane with slipping. The friction force on it will be up the incline.

5. The given fig. shows a coil bent with AB=BC=CD=DE=EF=FG=GH=HA = 1 m and carrying current 1 A. There exists in space a vertical uniform magnetic field of 2 T in the y-direction. Then find out the torque (in vector form) on the loop.



6. A bar magnet or magnetic moment M is aligned parallel to the direction of a uniform magnetic field B. What is the work done to turn the magnet, so as to align its magnetic moment (i) opposite to the field direction and (ii) normal to the field direction ?

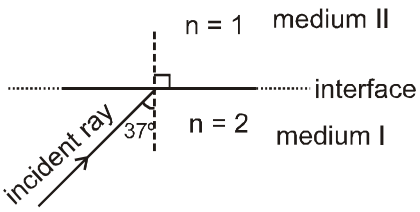
7. Two blocks of mass m_1 and m_2 are connected with an ideal spring on a smooth horizontal surface as shown in figure. At t = 0 m_1 is at rest and m_2 is moving with a velocity v towards right. At this time spring is in its natural length. Prove that if $m_1 < m_2$ block of mass m_2 will never come to rest.



8. Match the Column if deviation in the Column–II is the magnitude of total deviation (between incident ray and finally refracted or reflected ray) to lie between 0° and 180°. Here n represents refractive index of medium.

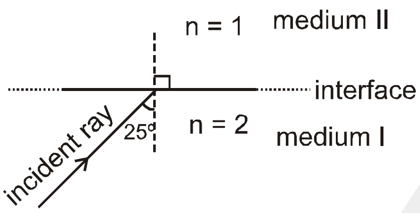
Column–I | **Column–II**

(A)



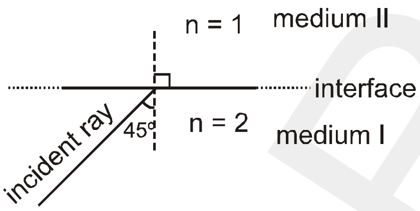
(p) deviation in the light ray is greater than 90°

(B)



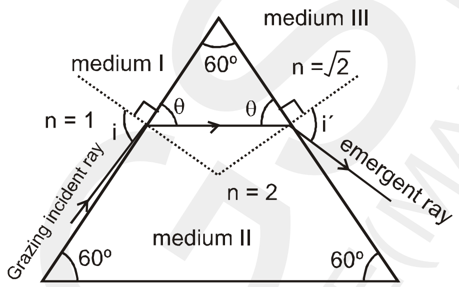
(q) deviation in the light ray is less than 90°

(C)



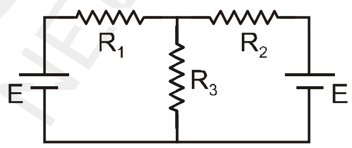
(r) deviation in the light ray is equal to 90°

(D)

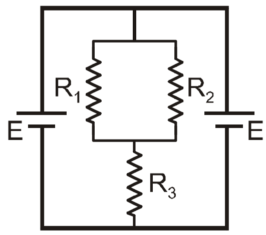


(s) Speed of finally reflected or refracted light is same as speed of incident light.

9. **STATEMENT-1 :** For calculation of current in resistors of resistance R_1, R_2 and R_3 in the circuit shown in figure 1, the circuit can be redrawn as shown in figure 2 (this means that circuit shown in figure 2 is equivalent to circuit shown in figure 1). All the cells shown are ideal and identical.



(fig.1)



(fig.2)

STATEMENT-2 : Whenever potential difference across two resistors is same, both resistors can be assumed as a combination of two resistors in parallel.

(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

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 70

Total Marks : 36

Max. Time : 42 min.

Topics : Heat, Magnetic Effect of Current and Magnetic Force on Charge/current, Rotation, Center of Mass, Geometrical Optics, Current, Electricity

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('–1' negative marking) Q.4 to Q.7	(4 marks, 5 min.)	[16, 20]
Match the Following (no negative marking) (2 × 4) Q.8	(8 marks, 10 min.)	[8, 10]
Assertion and Reason (no negative marking) Q. 9	(3 marks, 3 min.)	[3 , 3]

1. A Galileo telescope has an objective of focal length 100 cm & magnifying power 50. The distance between the two lenses in normal adjustment will be

(A) 150 cm (B) 100 cm (C) 98 cm (D) 200 cm

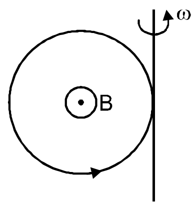
2. Let the wavelength at which the the spectral emissive power of a black body (at a temperature T) is maximum, be denoted by λ_{max} .As the temperature of the body is increased by 1 K , λ_{max} decreases by 1 percent .The temperature T of the black body is

(A) 100K (B) 200K (C) 400K (D) 288K

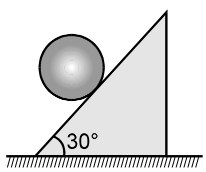
3. In the above question, the emissive power of the black body at temperature T is :

(A) 17 Watt/m^2 (B) 12 Watt/m^2 (C) 6 Watt/m^2 (D) 24 Watt/m^2

4. A current carrying ring, carrying current $\frac{2}{\pi}$ Amp., radius 1m, mass $\frac{2}{3}$ kg and having 10 windings is free to rotate about its tangential vertical axis. A uniform magnetic field of 1 tesla is applied perpendicular to its plane. How much minimum angular velocity (in rad/sec.) should be given to the ring in the direction shown, so that it can rotate 270º in that direction. Write your answer in nearest single digit in rad/sec.

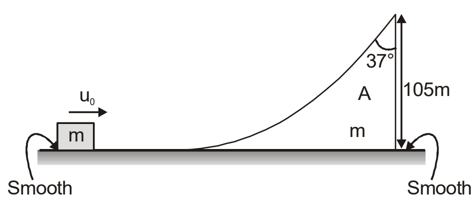


5. A uniform disc of mass 2 kg and radius 50 mm rolls from rest on a fixed rough incline. If the length of incline is 1 m the time taken by the disc to arrive at bottom equals _______.



6. Horizontal and vertical components of earth's magnetic field at a place are 0.22 tesla and 0.38 tesla respectively. Find the resultant intensity of earth's magnetic field.

7 A special wedge of mass m is kept on a smooth horizontal surface as shown in figure. Another smooth block of mass m is projected towards the wedge with a horizontal velocity u_0 which then climbs up the wedge and leaves the wedge at the top most point. After this when block of mass m falls on horizontal surface distance between block and wedge is 'x'. If the maximum height attained by the mass m from ground is 125m then find x.

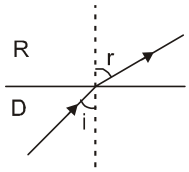


8. **Match the Column :**

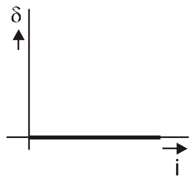
For light passing from different surfaces shown, graph between deviation (δ) versus angle of incidence (i) is drawn. Choose appropriate graph.

Column–I **Column–II**

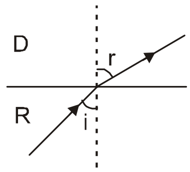
(A) Light goes from denser to rarear medium through plane surface



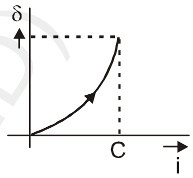
(p)



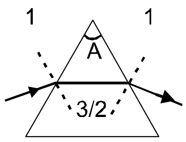
(B) Light goes from rarear to denser medium through plane surface



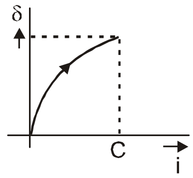
(q)



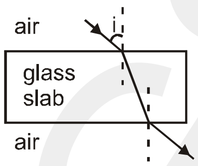
(C) Light goes through prism placed in air



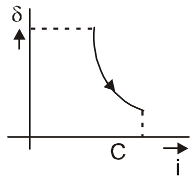
(r)



(D) Light pass through slab placed in air



(s)



9. **Statement–1:** If potential difference between two points is non zero in an electric circuit, electric current between those two points may be zero.

Statement–2: Current always flows from high potential to low potential

(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

PHYSICS DPP
DAILY PRACTICE PROBLEMS

DPP No. 71

Total Marks : 29

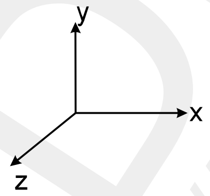
Max. Time : 31 min.

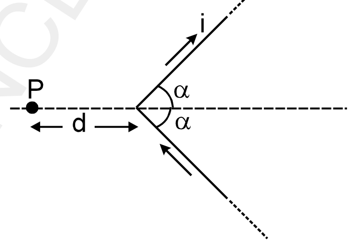
Topics : Magnetic Effect of Current and Magnetic Force on Charge/current, Electromagnet Induction, Rotation, Center of Mass, Geometrical Optics, Current Electricity

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. The direction of the field B at P is :

The V shaped wire is in x-y plane.



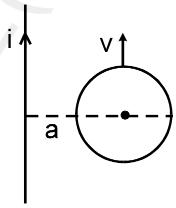


(A) along + x-axis
(B) along + z-axis
(C) along (–x)–axis
(D) along + y-axis

2. If the magnetic field at 'P' can be written as K tan $\left(\frac{\alpha}{2}\right)$ then K is :
[Refer to the figure of above question]

(A) $\frac{\mu_0 I}{4\pi d}$ (B) $\frac{\mu_0 I}{2\pi d}$ (C) $\frac{\mu_0 I}{\pi d}$ (D) $\frac{2\mu_0 I}{\pi d}$

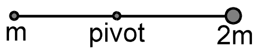
3. A circular loop of radius r is moved with a velocity v as shown in the diagram. The work needed to maintain its velocity constant is :



(A) $\frac{\mu_0 i v r}{2\pi a}$ (B) $\frac{\mu_0 i v r}{2\pi(a+r)}$ (C) $\frac{\mu_0 i v r}{2\pi}\ell n\left(\frac{2r+a}{a}\right)$ (D) zero

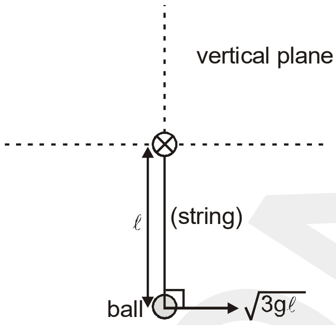
4. The magnifying power of a simple microscope can be increased if an eyepiece of :
(A) shorter focal length is used
(B) longer focal length is used
(C) shorter diameter is used
(D) longer diameter is used

5. A rod of negligible mass and length ℓ is pivoted at its centre. A particle of mass m is fixed to its left end & another particle of mass 2 m is fixed to the right end. If the system is released from rest,



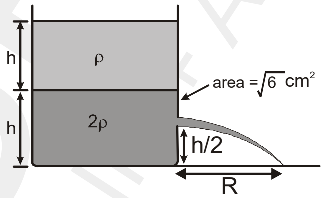
(a) what is the speed v of the two masses when the rod is vertical.
(b) what is the angular speed ω of the system at that instant.

6. A ball is given velocity $\sqrt{3g\ell}$ as shown. If the ratio of centripital acceleration to tangential acceleration is $1:y\sqrt{2}$ at the point where the ball leaves circular path then write the value of y. [Neglect the size of ball]



COMPREHENSION

A fixed cylindrical tank having large cross-section area is filled with two liquids of densities ρ and 2ρ and in equal volumes as shown in the figure. A small hole of area of cross–section a = $\sqrt{6}$ cm^2 is made at height h/2 from the bottom.



7. Velocity of efflux will be :

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

8. Distance (R) of the point at which the liquid will strike from container is :

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

9. Area of cross section of stream of liquid just before it hits the ground.

(A) 2 cm^2 (B) $\sqrt{3}$ cm^2 (C) 1 cm^2 (D) $\sqrt{5}$ cm^2

PHYSICS DPP

DAILY PRACTICE PROBLEMS

DPP No. 72

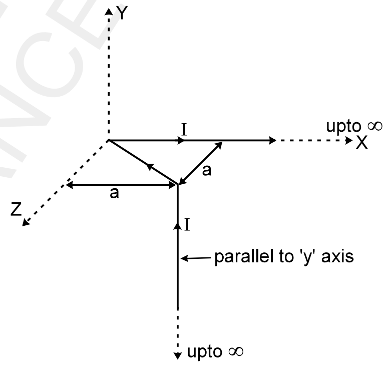
Total Marks : 28

Max. Time : 29 min.

Topics : Magnetic Effect of Current and Magnetic Force on Charge/current, Electromagnet Induction, Rotation, Current Electricity, Fluid, Center of Mass

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]

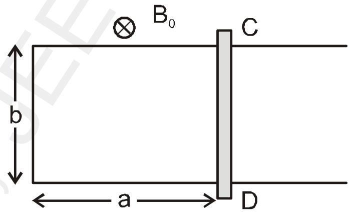
1. The magnetic field at the origin due to the current flowing in the wire is



(A) $-\frac{\mu_0 I}{8\pi a}(\hat{i}+\hat{k})$ (B) $\frac{\mu_0 I}{2\pi a}(\hat{i}+\hat{k})$

(C) $\frac{\mu_0 I}{8\pi a}(-\hat{i}+\hat{k})$ (D) $\frac{\mu_0 I}{4\pi a\sqrt{2}}(\hat{i}-\hat{k})$

2. A U-shaped conducting frame is fixed in space. A conducting rod CD lies at rest on the smooth frame as shown. The frame is in uniform magnetic field B_0, which is perpendicular to the plane of frame. At time t = 0, the magnitude of magnetic field begins to change with time t as, $B = \frac{B_0}{1+kt}$, where k is a positive constant. For no current to be ever induced in frame, the speed with which rod should be pulled starting from time t = 0 is (the rod CD should be moved such that its velocity must lie in the plane of frame and perpendicular to rod CD)



Frame in magnetic field before time t = 0

(A) ak (B) bk
(C) a(1 + kt) (D) b(1 + kt)

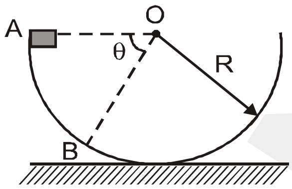
3. A uniform smooth rod is placed on a smooth horizontal floor is hit by a particle moving on the floor, at a distance $\frac{\ell}{4}$ from one end. Then the distance travelled by the centre of the rod after the collision when it has completed three revolution will be:
[$e \neq 0$ & 'ℓ' is the length of the rod]

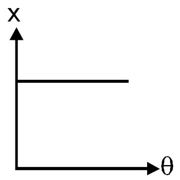
(A) $2\pi\ell$ (B) can't be determined

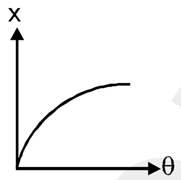
(C) $\pi\ell$ (D) none of these

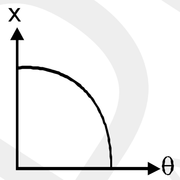
4. The convex lens is used in-
(A) Microscope (B) Telescope (C) Projector (D) All of the above

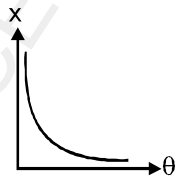
5. A small block of mass m is released from rest from point A inside a smooth hemisphere bowl of radius R, which is fixed on ground such that OA is horizontal. The ratio (x) of magnitude of centripetal force and normal reaction on the block at any point B varies with θ as :



(A)


(B)


(C)


(D)


6. A solid ice block (of any shape) is floating remaining in equilibrium in water. Some part of it is outside water because its density is less than the density of water. Prove that the level of water does not ascend or descend if the ice melts completely. Neglect the changes in volume due to temperature changes.

COMPREHENSION

Two small spheres of mass m_1 and m_2 are moving towards each other with constant velocities $\vec{u}_1$ and $\vec{u}_2$ respectively and undergo head on inelastic collision. If the coefficient of restitution is e and $m_1\vec{u}_1 + m_2\vec{u}_2 = 0$,

7. The velocity of sphere of mass m_1 after collision is :
(A) $-\,e\vec{u}_2$ (B) $-\,e\vec{u}_1$ (C) $e\vec{u}_1$ (D) None of these

8. The velocity of sphere of mass m_2 after collision is :
(A) $-\,e\vec{u}_1$ (B) $-\,e\vec{u}_2$ (C) $e\vec{u}_2$ (D) None of these

9. For the given situation, pick up the ***incorrect statement*** :
(A) During the collision, least kinetic energy of system of both spheres is non-zero.
(B) During the collision, least kinetic energy of system of both spheres is zero.
(C) Velocity of separation of both spheres after collision has magnitude = $e\,|\vec{u}_1 - \vec{u}_2|$
(D) At the instant of maximum deformation during collision, speed of each sphere is zero.

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 73

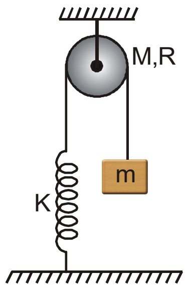
Total Marks : 36

Max. Time : 42 min.

Topics : Rotation, Fluid, Current Electricity, Magnetic Effect of Current and Magnetic Force on Charge/ current, Electromagnet Induction

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	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

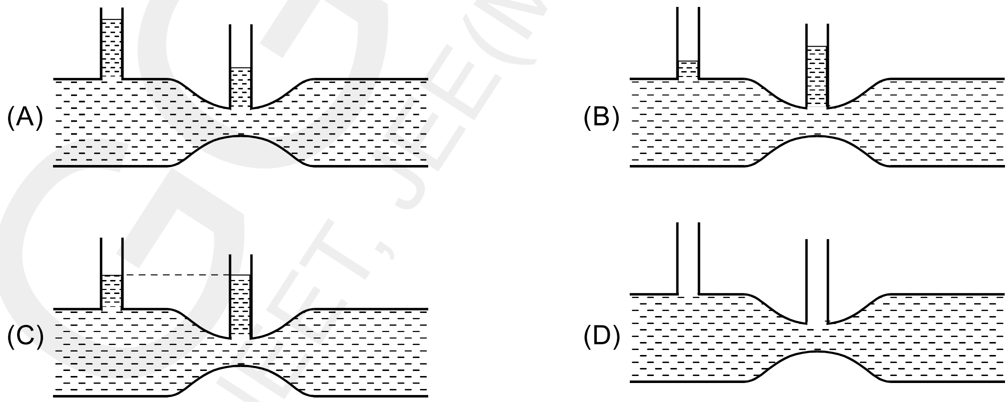
1. A uniform disc of mass m and radius R is free to rotate about its fixed horizontal axis without friction. There is sufficient friction between the inextensible light string and disc to prevent slipping of string over disc. At the shown instant extension in light spring is $\frac{3mg}{K}$, where m is mass of block, g is acceleration due to gravity and K is spring constant. Then at the shown moment, magnitude of acceleration of block is :



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

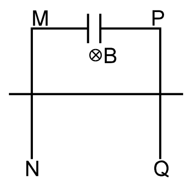
2. The focal length of the objective of a microscope is
(A) arbitrary
(B) less than the focal length of eyepiece
(C) equal to the focal length of eyepiece
(D) greater than the focal length of eyepiece

3. For a fluid which is flowing steadily, the level in the vertical tubes is best represented by



4. In the motorcycle stunt called "the well of death" the track is a vertical cylindrical surface of 18 m radius. Take the motorcycle to be a point mass and μ = 0.8. The minimum angular speed of the motorcycle to prevent him from sliding down should be:
(A) 6/5 rad/s (B) 5/6 rad/s (C) 25/3 rad/s (D) none of these

5. In the figure shown a conducting rod of length ℓ, resistance R & mass m can move vertically downward due to gravity. Other parts are kept fixed. B = constant = B_0. MN and PQ are vertical, smooth, conducting rails. The capacitance of the capacitor is C. The rod is released from rest. Find the maximum current in the circuit



COMPREHENSION

Tangent Galvanometer : In case of tangent galvanometer (Figure) a magnetic compass needle is placed horizontally at the centre of a vertical fixed current-carrying coil whose plane is in the magnetic meridian (the plane in which the earth's magnetic field is present in vertical and horizontal directions). So if the needle in equilibrium subtends an angle ϕ with the earth's horizontal magnetic field, then for equilibrium we have

$$|\vec{M} \times \vec{B}_H| = |\vec{M} \times \vec{B}_C| \quad \ldots (1)$$

(direction of the torque on the needle due to field of the earth (B_H) and due to field of the coil (B_C) must be opposite)

Here $\vec{M}$ is the magnetic moment of the needle

$\vec{B}_H$ is the earth's horizontal magnetic field

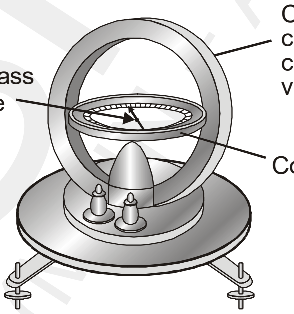
$\vec{B}_C$ is the magnetic field at centre due to coil

Now from equation-(1), we have

or, $MB_H \sin \phi = MB_C \sin (90 - \phi)$ or, $B_C = B_H \tan \phi$

or, $\dfrac{\mu_0 NI}{2R} = B_H \tan \phi$ here R is the radius of the coil and N is the number of turns.

i.e., $I = K \tan \phi$ with $K = \dfrac{2RB_H}{\mu_0 N}$ $\rightarrow$ Reduction factor of the tangent galvanometer, i.e., in case of a tangent galvanometer when the plane of coil is in magnetic meridian, current in the coil is directly proportional to the tangent of deflection of magnetic needle.



Tangent Galvanometer

6. If at a place horizontal component of Earth's magnetic field is $B_H = 2 \times 10^{-5}$ T, No. of turns in the coil N = 100, current I = 10 mA, coil radius = π cm. The angle of dip at this position will be :

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) Data insufficient

7. If no. of turns in coil are doubled, the reduction factor of tangent galvanometer will be :

(A) 0.001 (B) 0.002 (C) 0.005 (D) None of these

8. If at an instant in equilibrium after doubling the number of turns compass needle points in the direction 30º north of east then current in coil is :

(A) $\dfrac{\sqrt{3}}{200}$ (B) $\dfrac{\sqrt{3}}{500}$ (C) $\dfrac{1}{200\sqrt{3}}$ (D) $\dfrac{1}{500\sqrt{3}}$

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 74

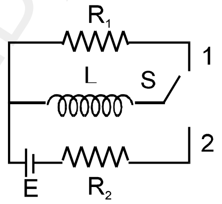
Total Marks : 24

Max. Time : 24 min.

Topics : Electromagnet Induction, Rotation, Center of Mass, Magnetic Effect of Current and Magnetic Force on Charge/current

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

1. In the circuit shown switch S is connected to position 2 for a long time and then joined to position 1. The total heat produced in resistance R_1 is :



(A) $\dfrac{LE^2}{2R_2^{\,2}}$ (B) $\dfrac{LE^2}{2R_1^{\,2}}$

(C) $\dfrac{LE^2}{2R_1R_2}$ (D) $\dfrac{LE^2(R_1+R_2)^2}{2R_1^{\,2}R_2^{\,2}}$

2. A tugsten bulb radiates 2 W of energy.The filament of the bulb has surface area 2 mm^2 and an emissivity of 0.9.The temperature of the bulb is: (Stefan's Constant σ = 5.6 × 10^{-8} S.I. units)

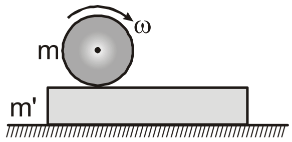
(A) 3500K (B) 4210K (C) 2110K (D) 211K

3. A person with a defective sight is using a lens having a power of +2D. The lens he is using is

(A) concave lens with f = 0.5 m (B) convex lens with f = 2.0 m

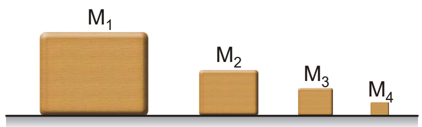
(C) concave lens with f = 0.2 m (D) convex lens with f = 0.5 m

4. A uniform solid cylinder is given an angular speed ω and placed on a rough plate of negligible thickness. The horizontal surface below the plate is smooth. Then the angular speed of the cylinder when it starts pure rolling on the plate will be: [Assume sufficient length of plate]



(A) $\dfrac{\omega}{2}$ (B) $\dfrac{\omega}{3}$ (C) $\dfrac{2\omega}{3}$ (D) none of these

5. Four blocks of masses M_1, M_2, M_3 and M_4 are placed on a smooth horizontal surface along a straight line as shown. It is given that $M_1 >> M_2 >> M_3 >> M_4$. All the blocks are initially at rest. M_1 is given initial velocity v_0 towards right such that it will collide with M_2. Consider all collisions to be perfectly elastic. The speed of M_4 after all collision are over is



(A) v_0 (B) 4 v_0 (C) 8 v_0 (D) 16 v_0

COMPREHENSION

A uniform and constant magnetic field $\vec{B} = (20\,\hat{i} - 30\,\hat{j} + 50\,\hat{k})$ Tesla exists in space. A charged particle with charge to mass ratio $\left(\dfrac{q}{m}\right) = \dfrac{10^3}{19}$ C/kg enters this region at time t = 0 with a velocity $\vec{V} = (20\,\hat{i} + 50\,\hat{j} + 30\,\hat{k})$ m/s. Assume that the charged particle always remains in space having the given magnetic field. (Use $\sqrt{2}$ = 1.4)

6. During the further motion of the particle in the magnetic field, the angle between the magnetic field $\vec{B}$ and velocity of the particle

(A) remains constant (B) increases

(C) decreases (D) may increase or decrease.

7. The frequency of the revolution of the particle in cycles per second will be

(A) $\dfrac{10^3}{\pi\sqrt{19}}$ (B) $\dfrac{10^4}{\pi\sqrt{38}}$ (C) $\dfrac{10^4}{\pi\sqrt{19}}$ (D) $\dfrac{10^4}{2\pi\sqrt{19}}$

8. The pitch of the helical path of the motion of the particle will be

(A) $\dfrac{\pi}{100}$ m (B) $\dfrac{\pi}{125}$ m (C) $\dfrac{\pi}{215}$ m (D) $\dfrac{\pi}{250}$ m

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 75

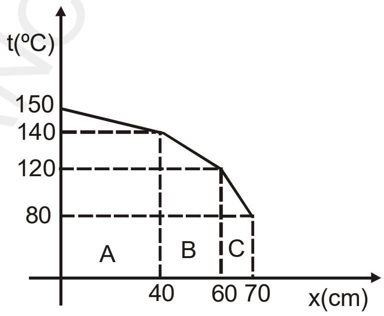
Total Marks : 27

Max. Time : 28 min.

Topics : Heat, Center of Mass, Magnetic Effect of Current and Magnetic Force on Charge/current, Rotation, 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 to Q.4	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–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. The graph shown gives the temperature along an x axis that extends directly through a wall consisting of three layers A, B and C. The air temperature on one side of the wall is 150°C and on the other side is 80°C. Thermal conduction through the wall is steady. Out of the three layers A, B and C, thermal conductivity is greatest of the layer



(A) A
(B) B
(C) C
(D) Thermal conductivity of A = Thermal conductivity of B.

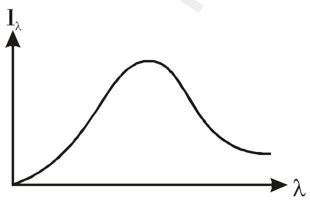
2. Which of the following statements is true concerning the elastic collision of two objects ?
(It is given that no net external force acts on the system of two object; and the objects do not exert force on each other except during collision)
(A) No net work is done on any of the two objects, since there is no external force on the system of given two object.
(B) The net work done by the first object on the second is equal to the net work done by the second on the first.
(C) The net work done by the first object on the second is exactly the opposite of the net work done by the second on the first.
(D) The net work done on the system depends on the angle of collision.

3. Choose the correct statements :

(A) For a closed surface, the surface integration $\oint \vec{B}.\vec{ds}$ is always zero, where $\vec{B}$ is magnetic field

(B) A current carrying circular loop is in a uniform external magnetic field and is free to rotate about its diametrical axis will be in stable equilibrium when flux of total magnetic field (external field + field due to the loop itself) is maximum.

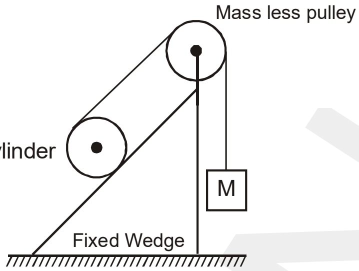
(C)



Spectral energy distributed graph of a black body is shown in figure. If temperature (in K) of the black body is doubled and surface area is halved, the area under the graph will be eight times.

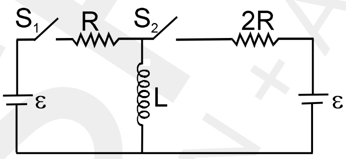
(D) In keplers III law, $\frac{T^2}{R^3}$ depends on the mass of the Sun, around which a planet is revolving.

4. A cylinder and a variable mass M are arranged on a fixed wedge using a light string and a massless pulley. There is enough friction between cylinder and the wedge to prevent any slipping.



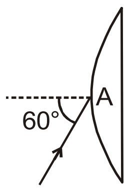
(A) Only one value of M is possible for which cylinder can remain in equilibrium.
(B) There is a range of value of M for which cylinder can remain in equilibrium.
(C) For a certain value of M, the cylinder starts to roll up the plane. In this situation, magnitude of friction force on the cylinder by the wedge will be greater than tension in the string
(D) For a certain value of M, the cylinder starts to roll down the plane. In this situation, magnitude of friction force on the cylinder by the wedge will be greater than tension in the string

5. In the circuit shown S_1 & S_2 are switches. S_2 remains closed for a long time and S_1 open. Now S_1 is also closed. Just after S_1 is closed, find the potential difference (V) across R and $\frac{di}{dt}$ (with sign) in L.



COMPREHENSION

Figure shows a plano-convex lens of refractive index $\sqrt{3}$ placed in air. The maximum thickness of the lens is 3 mm and its aperture diameter is 8 mm. Point A lies on the curved surface on the principal axis. A light ray is incident at the point A as shown in the figure making 60° with the normal.



6. The angle of deviation caused by the lens is :
(A) 60° (B) 30° (C) 0° (D) 15°

7. The lateral displacement of the light ray in passing through the lens is :
(A) 3 mm (B) $3\sqrt{3}$ mm (C) $\sqrt{3}$ mm (D) Zero

8. The focal length of the lens if treated as a thin lens is :
(A) $\frac{5}{12}$ cm (B) $\frac{5}{24}$ cm (C) $\frac{25}{12}(\sqrt{3}+1)$ cm (D) $\frac{5}{24}(\sqrt{3}+1)$ cm

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 76

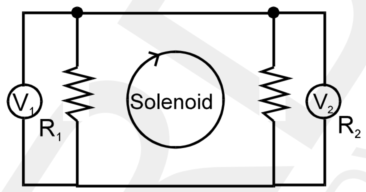
Total Marks : 26

Max. Time : 26 min.

Topics : Electromagnet Induction, Geometrical Optics, Center of Mass, Heat, Magnetic Effect of Current and Magnetic Force on Charge/current

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 to Q.5	(4 marks, 4 min.)	[8, 8]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. The current through the solenoid is changing in such way that flux through it is given by $\phi = \varepsilon t$. Then the reading of the two voltmeters V_1 and V_2 differ by :



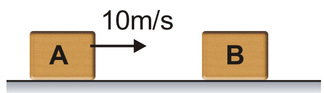
(A) zero (B) ε

(C) $\left|\frac{\varepsilon(R_1 - R_2)}{R_1 + R_2}\right|$ (D) $\frac{\varepsilon R_1 R_2}{R_1 + R_2}$

2. A car is fitted with a convex side–view mirror of focal length 20 cm. A second car 2.8 m behind the first car is overtaking the first car at a relative speed of 15 m/s. The speed of the image of the second car as seen in the mirror of the first one is :

(A) $\frac{1}{10}$ m/s (B) $\frac{1}{15}$ m/s (C) 10 m/s (D) 15 m/s

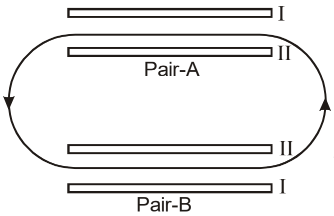
3. In the figure shown of a block A moving with velocity 10m/s on a horizontal surface collides with another block B at rest initially. The coefficient of restitution is $\frac{1}{2}$. Neglect friction every where. The distance between the blocks at 5s after the collision takes place is :



(A) 20 m (B) 10 m
(C) 25 m (D) Cannot be determined because masses are not given.

4. The ends of a rod of uniform thermal conductivity are maintained at different (constant) temperatures. After the steady state is achieved :
(A) heat flows in the rod from high temperature to low temperature even if the rod has nonuniform cross sectional area.
(B) temperature gradient along length is same even if the rod has non uniform cross sectional area.
(C) heat current is same even if the rod has non-uniform cross sectional area.
(D) if the rod has uniform cross sectional area the temperature is same at all points of the rod.

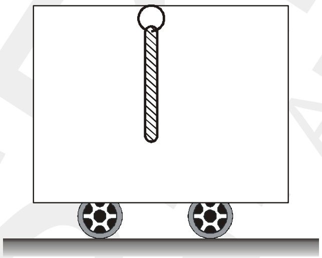
5. Figure shows the path of an electron in a region of uniform magnetic field. The path consists of two straight sections, each between a pair of uniformly charged plates, and two half circles. The electric field exists only between the plates.



(A) Plate I of pair A is at higher potential than plate-II of the same pair.
(B) Plate I of pair B is at higher potential than plate II of the same pair.
(C) Direction of the magnetic field is out of the page [$\odot$].
(D) Direction of the magnetic field in to the page [$\otimes$].

COMPREHENSION

A uniform rod is hinged at the ceiling of a cart and is free to rotate as shown in diagram. Hinge is smooth. Initially the cart is at rest. Mass of the rod is 'M' and length 'L'. Now the cart starts moving with constant acceleration in forward direction.



6. The minimum acceleration of the cart for which rod will become horizontal at some moment during motion is
(A) g
(B) $\frac{g}{2}$
(C) 2g
(D) Rod cannot become horizontal whatever may be acceleration

7. The normal reaction on the hinge at the initial instant when the cart starts moving with above minimum acceleration is

(A) Mg (B) $\sqrt{2}$ Mg (C) $\frac{Mg}{4}$ (D) $\sqrt{17}\ \frac{Mg}{4}$

8. If the mass of the cart is '2M' (without rod) then for the above condition the frictional force acting on the wheels of the cart at initial instant will be

(A) 2Mg (B) 3 Mg (C) $\frac{5Mg}{4}$ (D) $\frac{9Mg}{4}$

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 77

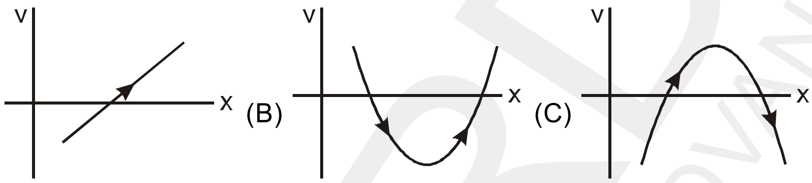
Total Marks : 26

Max. Time : 26 min.

Topics : Kinematics, Electromagnet Induction, Magnetic Effect of Current and Magnetic Force on Charge/ current, Center of Mass, Rotation

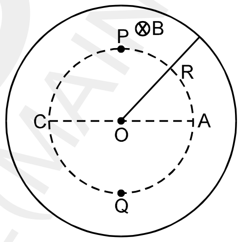
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.4 to Q.5	(4 marks, 4 min.)	[4, 4]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. For a particle moving along x-axis, which of the velocity versus position graphs given in options below is/are possible : (position is represented by x-coordinate of the particle)



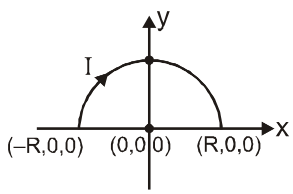
(A) (B) (C) (D) None of these

2. A uniform magnetic field B increasing with time exists in a cylindrical region of centre O and radius R. The direction of magnetic field is inwards the paper as shown. The work done by external agent in taking a unit positive charge slowly from A to C via paths APC, AOC and AQC be W_{APC}, W_{AOC} and W_{AQC} respectively. Then-



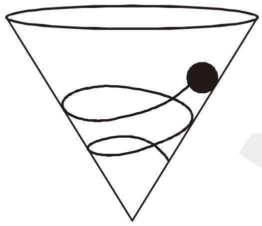
(A) $W_{APC} = W_{AOC} = W_{AQC}$
(B) $W_{APC} > W_{AOC} > W_{AQC}$
(C) $W_{APC} < W_{AOC} < W_{AQC}$
(D) $W_{APC} = W_{AQC} < W_{AOC}$

3. A semi–circular current carrying wire having radius R is placed in x–y plane with its centre at origin O. There is a position x dependent non–uniform magnetic field $\vec{B} = \frac{B_0 x}{2R}\hat{k}$ (here B_0 is positive constant) existing in the region. The force due to magnetic field acting on the semi–circular wire will be along :



(A) negative x-axis
(B) positive x-axis
(C) negative y-axis
(D) positive y-axis

4. A ball is rolling without slipping in a spiral path down the inner surface of a hollow fixed cone whose axis is vertical. The work done by the inner surface of the cone on the ball is



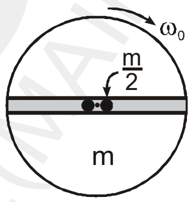
(A) positive (B) zero (C) negative (D) Impossible to determine

5. Two blocks of mass m and 2m are fixed to the ends of a spring. The spring is initially compressed & then the system is released in air (neglecting the air resistance). After time t

(A) the momentum of the system will be zero
(B) the momentum of the system will be 3 m g t
(C) the momentum of the system will be m g t
(D) the momentum of the system will not depend on the value of spring constant.

COMPREHENSION

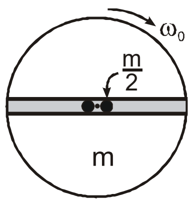
A disc of mass 'm' and radius R is free to rotate in horizontal plane about a vertical smooth fixed axis passing through its centre. There is a smooth groove along the diameter of the disc and two small balls of mass $\frac{m}{2}$ each are placed in it on either side of the centre of the disc as shown in fig. The disc is given initial angular velocity ω_0 and released.



6. The angular speed of the disc when the balls reach the end of the disc is :

(A) $\frac{\omega_0}{2}$ (B) $\frac{\omega_0}{3}$ (C) $\frac{2\omega_0}{3}$ (D) $\frac{\omega_0}{4}$

7. The speed of each ball relative to ground just after they leave the disc is :



(A) $\frac{R\omega_0}{\sqrt{3}}$ (B) $\frac{R\omega_0}{\sqrt{2}}$ (C) $\frac{2R\omega_0}{3}$ (D) none of these

8. The net work done by forces exerted by disc on one of the ball for the duration ball remains on the disc is

(A) $\frac{2mR^2\omega_0^2}{9}$ (B) $\frac{mR^2\omega_0^2}{18}$ (C) $\frac{mR^2\omega_0^2}{6}$ (D) $\frac{mR^2\omega_0^2}{9}$

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 78

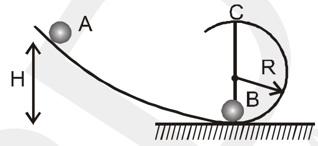
Total Marks : 24

Max. Time : 24 min.

Topics : Center of Mass, Electromagnet Induction, Magnetic Effect of Current and Magnetic Force on Charge/current, Rotation

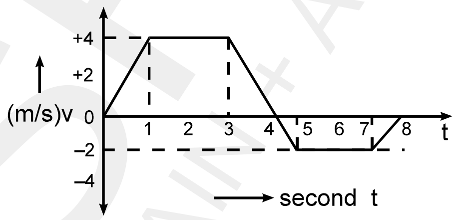
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. Ball A of mass m after sliding from an inclined plane, strikes elastically another ball B of same mass at rest. Find the minimum height H so that ball B just completes the circular motion.



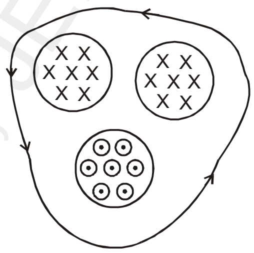
(A) H = 3R (B) H = 2R (C) H = $\frac{5R}{2}$ (D) H = 4R

2. The velocity time graph of a linear motion is shown in the figure. The distance from the starting point after 8 seconds will be:



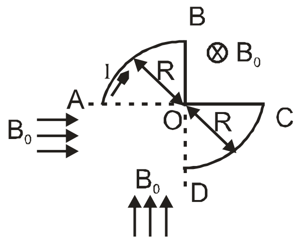
(A) 18 m (B) 6 m (C) 8 m (D) none of these

3. Figure shows three regions of magnetic field, each of area A, and in each region magnitude of magnetic field decreases at a constant rate α. If $\vec{E}$ is induced electric field then value of line integral $\oint \vec{E}\cdot d\vec{r}$ along the given loop is equal to



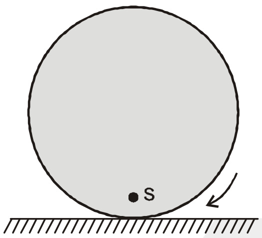
(A) αA (B) $-\alpha A$ (C) $3\alpha A$ (D) $-3\alpha A$

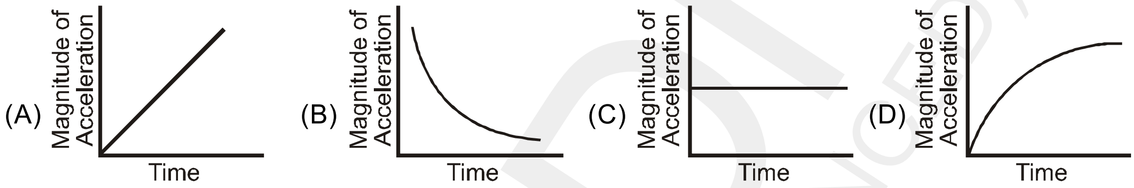
4. Wire bent as ABOCD as shown, carries current I entering at A and leaving at D. Three uniform magnetic fields each B_0 exist in the region as shown. The force on the wire is



(A) $\sqrt{3}\,IRB_0$ (B) $\sqrt{5}\,IRB_0$ (C) $\sqrt{8}\,IRB_0$ (D) $\sqrt{6}\,IRB_0$

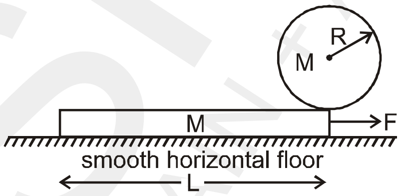
5. As shown in figure, S is a point on a uniform disc rolling with uniform angular velocity on a fixed rough horizontal surface. The only forces acting on the disc are its weight and contact forces exerted by horizontal surface. Which graph best represents the magnitude of the acceleration of point S as a function of time





COMPREHENSION

A uniform disc of mass M and radius R initially stands vertically on the right end of a horizontal plank of mass M and length L, as shown.The plank rests on smooth horizontal floor and friction between disc and plank is sufficiently high such that disc rolls on plank without slipping. The plank is pulled to right with a constant horizontal force of magnitude F.



6. The magnitude of acceleration of plank

(A) $\frac{F}{8M}$ (B) $\frac{F}{4M}$ (C) $\frac{3F}{2M}$ (D) $\frac{3F}{4M}$

7. The magnitude of angular acceleration of the disc

(A) $\frac{F}{4mR}$ (B) $\frac{F}{8mR}$ (C) $\frac{F}{2mR}$ (D) $\frac{3F}{2mR}$

8. The distance travelled by centre of disc from its initial position till the left end of plank comes vertically below the centre of disc is

(A) $\frac{L}{2}$ (B) $\frac{L}{4}$ (C) $\frac{L}{8}$ (D) L

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 79

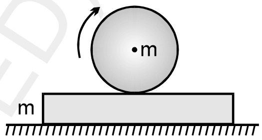
Total Marks : 25

Max. Time : 26 min.

Topics : Rotation, Electromagnet Induction, Simple Harmonic Motion

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	**(4 marks, 5 min.)**	**[4, 5]**
Comprehension ('–1' negative marking) Q.6 to Q.8	**(3 marks, 3 min.)**	**[9, 9]**

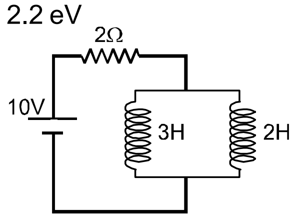
1. A sphere of mass 'm' is given some angular velocity about a horizontal axis through its centre and gently placed on a plank of mass 'm'. The co-efficient of friction between the two is μ. The plank rests on a smooth horizontal surface. The initial acceleration of the centre of sphere relative to the plank will be:



(A) zero (B) μg (C) (7/5) μg (D) 2 μg

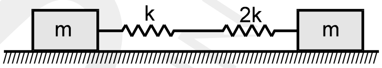
2. All electrons ejected from a surface by incident light of wavelength 200 nm can be stopped before travelling 1 m in the direction of uniform electric field of 4 N/C. The work function of the surface is:
(A) 4 eV (B) 6.2 eV (C) 2 eV (D) 2.2 eV

3. Both the inductors and the cell are ideal. Find the current (in Amperes) 2H inductance in steady state.



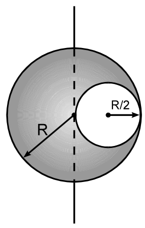
(A) zero (B) 1A
(C) 2A (D) 3A

4. A system is shown in the figure. The time period for small oscillations of the two blocks will be.



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

5. A spherical cavity is formed from a solid sphere by removing mass from it. The resultant configuration is shown in figure. Find out the moment of inertia of this configuration about the axis through centre of the solid sphere as shown. Take mass M (uniform) for the configuration and radius R for solid sphere and radius R/2 for cavity.



COMPREHENSION

A tank of height 'H' and base area 'A' is half filled with water and there is a very small orifice at the bottom and there is a heavy solid cylinder having base area $\frac{A}{3}$. The water is flowing out of the orifice. Here cylinder is put into the tank to increase the speed of water flowing out. It is given that height of the cylinder is same as that of the tank.

6. The speed of water flowing out of the orifice before the cylinder kept inside the tank

(A) $\sqrt{gH}$ (B) $1.414\sqrt{gH}$ (C) $\frac{\sqrt{gh}}{2}$ (D) $\sqrt{\frac{gh}{2}}$

7. The speed of water flowing out of orifice after the cylinder is kept inside it

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

8. After long time, when the height of water inside the tank again becomes equal to $\frac{H}{2}$. The solid cylinder is taken out. Then the velocity of liquid flowing out of orifice will be

(A) $\sqrt{2g\left(\frac{H}{2}\right)}$ (B) $\sqrt{2g\left(\frac{H}{3}\right)}$ (C) $\sqrt{\frac{gH}{3}}$ (D) $\sqrt{\frac{3gH}{2}}$

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 80

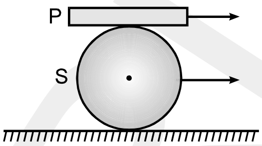
Total Marks : 26

Max. Time : 26 min.

Topics : Rotation, Simple Harmonic Motion, Electromagnet Induction, Alternating Current

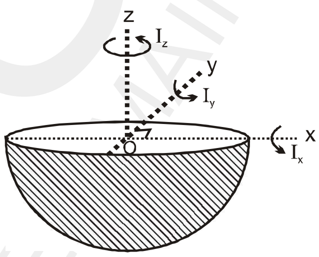
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.4 to Q.5	(4 marks, 4 min.)	[8, 8]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. 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

2. There is a uniform solid hemisphere. On its upper plane x and y axis are drawn which are mutually perpendicular as shown. Z–axis is perpendicular to the upper plane and passing through the centre O. If moment of inertia of the hemisphere about x, y and z-axis are I_x, I_y and I_z respectively then :



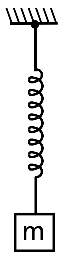
(A) $I_z = I_x + I_y$

(B) $I_z = I_x - I_y$

(C) $I_z = \frac{I_x + I_y}{2}$

(D) $I_z = \frac{I_x - I_y}{2}$

3. A block of mass 'm' is suspended from a spring and executes vertical SHM of time period T as shown in figure. The amplitude of the SHM is A and spring is never in compressed state during the oscillation. The magnitude of minimum force exerted by spring on the block is



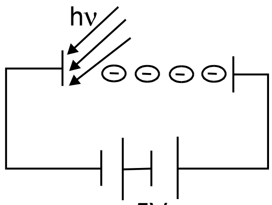
(A) $mg - \frac{4\pi^2}{T^2} mA$

(B) $mg + \frac{4\pi^2}{T^2} mA$

(C) $mg - \frac{\pi^2}{T^2} mA$

(D) $mg + \frac{\pi^2}{T^2} mA$

4. Photons of energy 5 eV are incident on cathode. Electrons reaching the anode have kinetic energies varying from 6eV to 8eV.



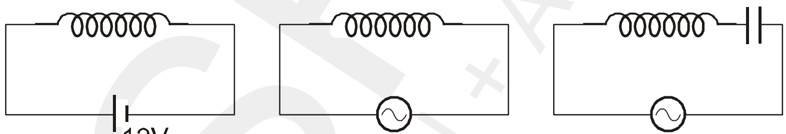
5V

(A) Work function of the metal is 2 eV
(B) Work function of the metal is 3 eV
(C) Current in the circuit is equal to saturation value.
(D) Current in the circuit is less than saturation value.

5. An ideal inductor, (having initial current zero) a resistor and an ideal battery are connected in series at time t = 0. At any time t, the battery supplies energy at the rate P_B, the resistor dissipates energy at the rate P_R and the inductor stores energy at the rate P_L.
(A) $P_B = P_R + P_L$ for all times t. (B) $P_R < P_L$ for all times t.
(C) $P_R < P_L$ only near the starting of the circuit. (D) $P_R > P_L$ only near the starting of the circuit.

COMPREHENSION

A steady current 4 A flows in an inductor coil when connected to a 12 V dc source as shown in figure 1. If the same coil is connected to an ac source of 12 V, 50 rad/s, a current of 2.4 A flows in the circuit as shown in figure 2. Now after these observations, a capacitor of capacitance $\frac{1}{50}$F is connected in series with the coil and with the same AC source as shown in figure 3 :



12V (Figure 1) 12V, 50rad/sec. (Figure 2) 12V, 50rad/sec. (Figure 3)

6. The inductance of the coil is nearly equal to
(A) 0.01 H (B) 0.02 H (C) 0.04 H (D) 0.08 H

7. The resistance of the coil is :
(A) 1 Ω (B) 2 Ω (C) 3 Ω (D) 4 Ω

8. The average power supplied to the circuit after connecting capacitance in series is approximately equal to:
(A) 24 W (B) 72 W (C) 144 W (D) None of these

PHYSICS
DPP
DAILY PRACTICE PROBLEMS

DPP No. 81

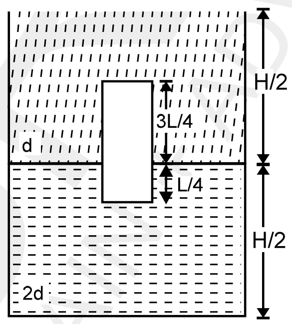
Total Marks : 24

Max. Time : 24 min.

Topics : Fluid, Electromagnet Induction, Rotation, Magnetic Effect of Current and Magnetic Force on Charge/current

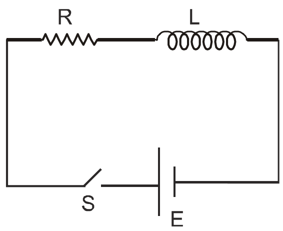
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Comprehension ('–1' negative marking) Q.5 to Q.7	(3 marks, 3 min.)	[9, 9]
Assertion and Reason (no negative marking) Q. 8	(3 marks, 3 min.)	[3, 3]

1. A container of a large uniform cross-sectional area A resting on a horizontal surface holds two immiscible, non-viscous and incompressible liquids of densities ' d ' and ' 2 d ' each of height (1/2)H as shown. The smaller density liquid is open to atmosphere. A homogeneous solid cylinder of length L$\left(< \frac{1}{2}H\right)$ cross-sectional area (1/5) A is immersed such that it floats with its axis vertical to the liquid-liquid interface with length (1/4) L in denser liquid. If D is the density of the solid cylinder then :



(A) D = $\frac{3d}{2}$ (B) D = $\frac{d}{2}$ (C) D = $\frac{2d}{3}$ (D) D = $\frac{5d}{4}$

2. In an L-R circuit connected to a battery of constant e.m.f. E switch S is closed at time t = 0. If e denotes the induced e.m.f. across inductor and i the current in the circuit at any time t. Then which of the following graphs shows the variation of e with i ?



(A) (B) (C) (D)

3. The effective value of current i = 2 sin 100 π t + 2 cos (100 π t + 30°) is:

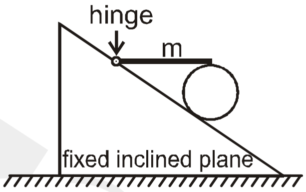
(A) $\sqrt{2}$ A (B) 2 A (C) 4 A (D) 2$\sqrt{2}$ A

4. The angular momentum of an electron in first orbit of Li^{++} ion is :

(A) $\frac{3h}{2\pi}$ (B) $\frac{9h}{2\pi}$ (C) $\frac{h}{2\pi}$ (D) $\frac{h}{6\pi}$

COMPREHENSION

A horizontal uniform rod of mass 'm' has its left end hinged to the fixed incline plane, while its right end rests on the top of a uniform cylinder of mass 'm' which in turn is at rest on the fixed inclined plane as shown. The coefficient of friction between the cylinder and rod, and between the cylinder and inclined plane, is sufficient to keep the cylinder at rest.



5. The magnitude of normal reaction exerted by the rod on the cylinder is

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

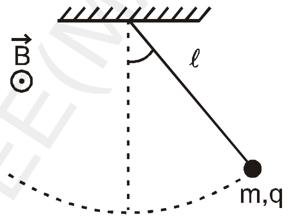
6. The ratio of magnitude of frictional force on the cylinder due to the rod and the magnitude of frictional force on the cylinder due to the inclined plane is:

(A) 1 : 1 (B) $2 : \sqrt{3}$ (C) 2 : 1 (D) $\sqrt{2} : 1$

7. The magnitude of normal reaction exerted by the inclined plane on the cylinder is:

(A) mg (B) $\frac{3mg}{2}$ (C) 2mg (D) $\frac{5mg}{4}$

8. **STATEMENT-1 :** A pendulum made of an insulated rigid massless rod of length ℓ is attached to a small sphere of mass m and charge q. The pendulum is undergoing oscillations of small amplitude having time period T. Now a uniform horizontal magnetic field $\vec{B}$ out of plane of page is switched on. As a result of this change, the time period of oscillations does not change.



STATEMENT-2 : A force acting along the string on the bob of a simple pendulum (such that tension in string is never zero) does not produce any restoring torque on the bob about the hinge.

(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

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 82

Total Marks : 24

Max. Time : 24 min.

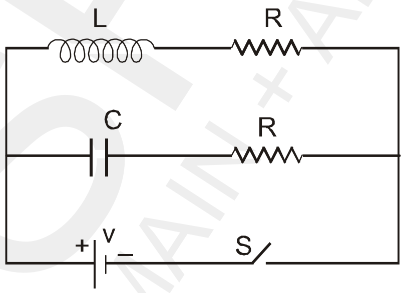
Topics : Fluid, Electromagnet Induction, Alternating Current, Morden Physics, Rotation, Magnetic Effect of Current and Magnetic Force on Charge/current

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Comprehension ('–1' negative marking) Q.5 to Q.7	(3 marks, 3 min.)	[9, 9]
Assertion and Reason (no negative marking) Q. 8	(3 marks, 3 min.)	[3, 3]

1. A block of silver of mass 4 kg hanging from a string is immersed in a liquid of relative density 0.72. If relative density of silver is 10, then tension in the string will be:[take g = 10 m/s^2]

(A) 37.12 N (B) 42 N
(C) 73 N (D) 21 N

2. In the circuit switch S is closed at time t = 0, the current through C and L would be equal after a time 't' equal to : (Given : R = $\sqrt{\frac{L}{C}}$) :



(A) RC (B) RL
(C) RC ℓn2 (D) R/L ℓn2

3. Current in an A.C. circuit is given by i = $2\sqrt{2}$ sin (πt + π/4), then the average value of current during time t = 0 to t = 1 sec is:

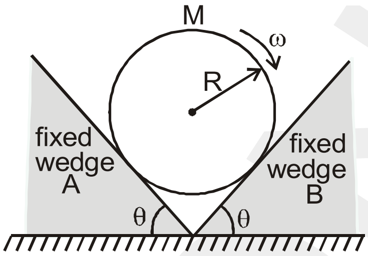
(A) 0 (B) $\frac{4}{\pi}$ A
(C) $\frac{4\sqrt{2}}{\pi}$ A (D) $2\sqrt{2}$ A

4. A hydrogen atom is in the 4th excited state, then:

(A) the maximum number of emitted photons will be 10.
(B) the maximum number of emitted photons will be 6.
(C) it can emit three photons in ultraviolet region.
(D) if an infrared photon is generated, then a visible photon may follow this infrared photon.

COMPREHENSION

A uniform solid cylinder of mass M and radius R is placed on two fixed wedges as shown. The inclined surface of each wedge makes an angle $\theta = 45^\circ$ with horizontal. The coefficient of friction between cylinder and each wedge is μ ($\mu < 1$). The angular velocity of cylinder at shown instant is non zero and sense of rotation of cylinder about its axis is clockwise.(g is acceleration due to gravity)



5. At the shown instant, magnitude of frictional force on cylinder exerted by left wedge A is :

(A) $\frac{\mu Mg(1+\mu)}{\sqrt{2}(1+\mu^2)}$ (B) $\frac{\mu Mg(1-\mu)}{\sqrt{2}(1+\mu^2)}$ (C) $\frac{\mu Mg(1+\mu)}{2(1+\mu^2)}$ (D)none of these

6. At the shown instant, magnitude of frictional force on cylinder exerted by right wedge B is -

(A) $\frac{\mu Mg(1+\mu)}{\sqrt{2}(1+\mu^2)}$ (B) $\frac{\mu Mg(1-\mu)}{\sqrt{2}(1+\mu^2)}$ (C) $\frac{\mu Mg(1+\mu)}{2(1+\mu^2)}$ (D) none of these

7. At the shown instant, magnitude of angular acceleration of cylinder is :

(A) 0 (B) $\frac{4\mu^2 g}{R(1+\mu^2)}$ (C) $\frac{2\sqrt{2}\mu g}{R(1+\mu^2)}$ (D)none of these

8. **STATEMENT–1 :** No electric current will be present within a region having uniform and constant magnetic field.

STATEMENT–2 : Within a region of uniform and constant magnetic field $\vec{B}$, the path integral of magnetic field $\oint \vec{B} \cdot d\vec{\ell}$ along any closed path is zero. Hence from Ampere circuital law $\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I$ (where the given terms have usual meaning), no current can be present within a region having uniform and constant magnetic field.

(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.

DPP 61 TO 82 (ANSWER KEY)

DPP NO. - 61

1. (B) 2. (A) 3. (A) (C) 4. (A) (C)
5. $x = 3$ m 6. (C) 7. (B) 8. (A)

DPP NO. - 62

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

DPP NO. - 63

1. (C) 2. (A) 3. (B) 4. (D)
5. 96 m 6. (D) 7. (C) 8. (B)

DPP NO. - 64

1. (C) 2. (B) 3. (A) 4. 12
5. 1 6. (B) 7. (B) 8. (A)

DPP NO. - 65

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

DPP NO. - 66

1. (B) 2. (B) 3. (A) 4. (A) (B)
5. $4.8\ Ma^2$ 6. (B) 7. (D)
8. (C)

DPP NO. - 67

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

DPP NO. - 68

1. (D) 2. (D) 3. (A) 4. (C)
5. (C) 6. (C) 7. $M' = m \times 2r = \frac{M}{l} \times \frac{2l}{\pi} = \frac{2M}{\pi}$
8. (A) p,r (B) p,q,r,s (C) p,q,r,s (D) q,s
9. (B)

DPP NO. - 69

1. (C) 2. (C) 3. (D)
4. (A)(B)(C)(D) 5. $2\hat{K}$ 6. 2 M B, M B
8. (A) p, s; (B) q; (C) r, s; (D) q 9. (C)

DPP NO. - 70

1. (C) 2. (A) 3. (C) 4. 9
5. $t = \sqrt{\frac{6}{g}}$ sec. 6. 0.44 T 7. 105 m
8. (A) – (q) ; (B) – (r) ; (C) – (s) ; (D) – (p)
9. (C)

DPP NO. - 71

1. (B) 2. (B) 3. (D) 4. (A)
5. **(a)** $V = \sqrt{g\ell/3}$, $\omega = \sqrt{4g/3\ell}$]
6. $y = 2$ 7. (A) 8. (D) 9. (A)

DPP NO. - 72

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

DPP NO. - 73

1. (B) 2. (B) 3. (A) 4. (B)
5. $i_{max} = \frac{mgB\ell c}{m + B^2\ell^2 c}$ 6. (D) 7. (C)
8. (A)

DPP NO. - 74

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

DPP NO. - 75

1. (A) 2. (C) 3. (A)(B) (D) 4. (A) (D)
5. $\frac{\varepsilon}{3}$ 6. (C) 7. (C) 8. (C)

DPP NO. - 76

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

DPP NO. - 77

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

DPP NO. - 78

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

DPP NO. - 79

1.	(D)	**2.**	(D)	**3.**	(D)	**4.**	(C)
5.	$I = \frac{57}{140} MR^2$			**6.**	(A)	**7.**	(C)
8.	(B)						

DPP NO. - 80

1.	(C)	**2.**	(C)	**3.**	(A)	**4.**	(A) (D)
5.	(A) (C)	**6.**	(D)	**7.**	(C)		

DPP NO. - 81

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

DPP NO. - 82

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

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अभ्यास ही सबसे बड़ा गुरू है।

CLASS : XII (PHYSICS)

DPP

DAILY PRACTICE PROBLEM

Solutions

DPP-61 TO 82

DPP NO. - 61

2. $I_1\omega_1 = I_2\omega_2$
Since, men move towards middle of turn table I_2 decreases hence ω_2 increases.

$$\therefore \quad \Delta K = \frac{1}{2}I_1\omega_1^2 - \frac{1}{2}I_2\omega_2^2$$

$$= \frac{1}{2}I_1\omega_1^2\left[1-\frac{I_2}{I_1}.\frac{\omega_2^2}{\omega_1^2}\right] \qquad \left\{\frac{\omega_2}{\omega_1}>1\right\}$$

$$= \frac{1}{2}I_1\omega_1^2\left[1-\frac{\omega_2}{\omega_1}\right] < 0$$

So kinetic energy increases.

3. **(A,B)** For steady state

$$\left(\frac{dQ}{dt}\right)_{in} = \left(\frac{dQ}{dt}\right)_{out}$$

$(V)\,(i_{55}) = 45(T-20)$
$(500)\,(4.5) = 45(T-20)$
$T_{55} = 70^oC$.

(C,D) Resistance at 20ºC is $R = \frac{v}{i} = \frac{500}{5}$

$R_{20} = 100\ \Omega$

Resistance at 70ºC is $R = \frac{v}{i} = \frac{500}{4.5} \simeq 111\ \Omega$

$R_f = R_0(1+\alpha\Delta T)$
$111 = 100(1+\alpha(50))$

$$\alpha = \frac{0.11}{50} \simeq 2.2\times10^{-3}\ /^oC.$$

4. For painter ;
$R + T - mg = ma$
$R + T = m(g + a)$ ....(1)
For the system ;
$2T - (m + M)g = (m + M)a$
$2T = (m + M)\,(g + a)$ ....(2)
where ; $m = 100$ kg
$M = 50$ kg
$a = 5$ m/sec^2

$$\therefore \quad T = \frac{150\times15}{2} = 1125\ N$$

and ; $R = 375$ N

5. By $W_{net} = \Delta K.E = 0$

$$\Rightarrow \frac{1}{2}k(x_0^{\,2}-x^2) = \mu mgx$$

$$\Rightarrow \frac{1}{2}\times200(2^2-x^2) = \frac{1}{2}\times60\times10x$$

$\Rightarrow$ x = 1m
Also at this moment $f_{max} > kx$
So, block will not move so total distance travelled = 2 + 1 = 3m.

6. In steady state, before the switch S is closed, potential difference across capacitor is 40 volts. Just after switch S is closed, charge and hence potential difference across the capacitor does not change appreciably. So, the potential difference across R_2 is 40–10 = 30 volt. The curent through R_2 is 3 ampere.

7. The current through resistors when the capacitor is in steady state with switch S closed.

$I = \frac{40-10}{R_1+R_2} = 1amp$. Therefore potential difference across R_2 is 10 × 1 = 10 volts. Hence the potential difference across the capacitor is $10 + I\,R_2 = 20$ volts. So, the charge on capacitor q = CV = 200μC.

8. At the given instant, p.d across capacitor is 20 Volts. Hence the current through R_1 at the required instant of time is $I = \frac{40-20}{R_1} = 1amp$

DPP NO. - 62

1. Heat current : $i = -kA\frac{dT}{dx}$

$idx = -kA\,dT$

$$i\int_0^{\ell}dx = -A\alpha\int_{T_1}^{T_2}T\,dT$$

$$\Rightarrow i\,\ell = -A\alpha\frac{(T_2^2-T_1^2)}{2}$$

$$\Rightarrow i = \frac{A\alpha(T_1^2-T_2^2)}{2\ell}$$

2. $i = \dfrac{2}{10+R} \quad \Rightarrow \quad V_{AB} = \dfrac{2}{10+R} \times 10$

$\Rightarrow x = \dfrac{2}{10+R} \times \dfrac{10}{10} \quad \Rightarrow \quad x_{max} = 0.2$ V/m.

3. $\vec{B} = \dfrac{\mu_0}{4\pi}\dfrac{2\vec{v} \times \vec{r}}{r^3}$

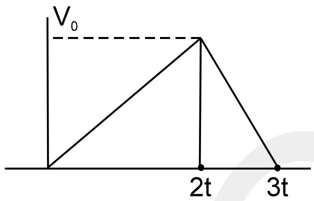
$B = \dfrac{\mu_0}{4\pi}\dfrac{qv\sin\theta}{r^2}$

$= 10^{-7} \times \dfrac{2 \times 100 \times \sin 30^\circ}{(2)2}$

$= 10^{-7} \times \dfrac{2 \times 100 \times \frac{1}{2}}{2^2}$

$= 25 \times 10^{-7}$ T
$= 2.5 \times 10^{-6}$ T
$= 2.5\ \mu$T

5.



$V_0 = 5 \times 2t = 10\,t$

$S = 1500 = \dfrac{1}{2}V_0.3t = \dfrac{1}{2}10t.3t$

$\Rightarrow$ t = 10 sec.
$\therefore$ total time = 3t = 30 sec.

6. Just before collision velocity of M and m = $\sqrt{2gL_0\sin\theta}$ = 12 m/s

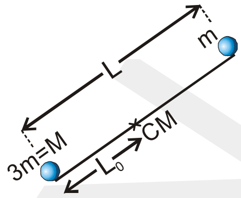
Since collision is elastic, let velocity of m just after collision is v then by relative velocity of separation = relative velocity of approach
v = 12 + 12 = 24 m/s **Ans.**

7. By momentum conservation during collision of m and M.

12 M – 12 m = 24 m
m : M = 1 : 3

8. By mechanical energy conservation for m, just after collision

$\dfrac{1}{2}mv^2 = mgL\sin\theta$



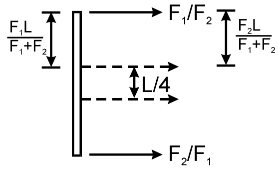
$\Rightarrow L = \dfrac{v^2}{2g\sin\theta} = \dfrac{24^2 \times 5}{20 \times 4} = 36$ meter.

Alternate :
since there is no energy loss, center of mass of m and M rises to the same initial position.
$3mL_0 = m(L - L_0)$
$\Rightarrow 4mL_0 = mL$
$\Rightarrow L = 4L_0 = 36$ meter.

DPP NO. - 63

1. (B) Initially effective resistance = 2R. In parallel effective resistance = $\dfrac{R}{2}$. It has reduced by a factor of 1/4 so rate of heat transfer would be increased by a factor of 4, keeping other parameters same.

4.

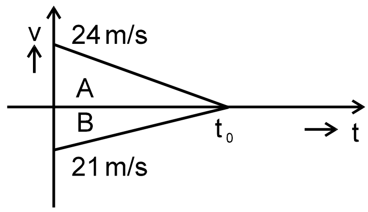


$\dfrac{F_1L}{F_1+F_2} - \dfrac{F_2L}{F_1+F_2} = \dfrac{L}{4}$

$\Rightarrow \dfrac{F_1}{F_4} = \dfrac{5}{3}$ K

[Ans.: 3: 5]

5. (A)
Distance travelled = $24t_0 + 21\,t_0$



$= 45\, t_0$

$\Rightarrow$ $45t_0 = 180$ m

$\Rightarrow$ $t_0 = 4$ seconds

$\therefore$ Distance translted by A is

$24t_0 = 24 \times 4 = 96$ m

Sol(57,58,59)

(57). Initial velocity of com

$$u = \frac{20\,m + 0}{m + m} = 10 \text{ m/s} \uparrow$$

acceleration of com

$= g = 10$ m/s² $\downarrow$

initial height = 10 m

$$S = ut + \frac{1}{2}at^2$$

$$10 = -10t + \frac{1}{2}(10)\,t^2$$

$5t^2 - 10\,t - 10 = 0$

$t^2 - 2t - 2 = 0$

$$t = \frac{2 + \sqrt{4+8}}{2}$$

$t = 1 + \sqrt{3}$

(58). $H_{max.} = 10 + \dfrac{u^2}{2g} = 10 + 5 = 15$ m

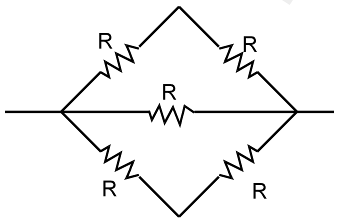
(59). $\Delta t = \dfrac{2 \times 20}{a} - \sqrt{\dfrac{2 \times 20}{g}} = 4 - 2 = 2$sec.

DPP NO. - 64

1. $\dfrac{dQ}{dt} = \dfrac{KA\Delta T}{2\ell} = \dfrac{\Delta T}{\frac{2\ell}{KA}} = \dfrac{10}{120}$ J /sec.

New rate $\dfrac{d\dot{Q}}{dt} = \dfrac{\Delta T}{\frac{\ell}{2KA}}$

$= \dfrac{40}{120}$ J /sec. ;

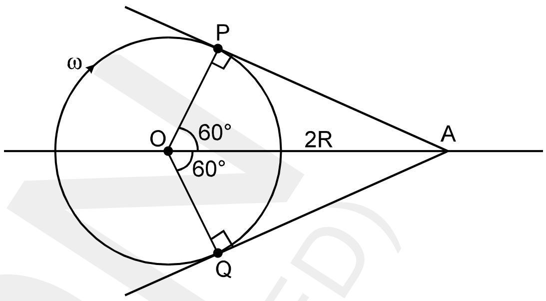


So time taken is $t = \dfrac{20}{40} \times 120$ sec.

$= 60$ sec.

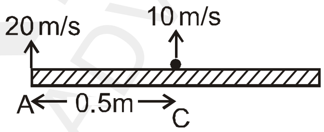
2. **(B)**

Point A shall record zero magnetic field (due to α-particle) when the α-particle is at position P and Q as shown in figure. The time taken by α-particle to go from P to Q is



$t = \dfrac{1}{3}\dfrac{2\pi}{\omega}$ or $\omega = \dfrac{2\pi}{3t}$

3. Angular velocity $w = \dfrac{20 - 10}{0.5} = 20$ rad/sec.



4. Potential difference across wire AB = 5 V

$\therefore$ p.d. across 40 cm of this wire

$= \dfrac{5}{100} \times 40 = 2$ volt.

$\therefore$ Potential difference across 20 cm of wire CD = 2 volt.

$\therefore$ p.d. across wire CD $= \dfrac{2}{20} \times 80 = 8$ volt.

p.d. across 2 Ω resistor = 2 × 2 = 4 volt

$\therefore$ Emf of the cell = 12 volt.

5. $\int \dfrac{2}{v} ds = \int \dfrac{2}{ds} dt\, ds = 2t = 8 \times 4 + \dfrac{1}{2} \times 10 \times 2$

t = 21 s

t – 20 = 1 s **Ans.**

Sol. **(1 to 3)**

$m_A \times 0.8 = \quad m_A \times 0.2 + \ m_B \times 1.0$

$m_A \times 0.6 \qquad m_B \times 1.0 \qquad m_B = 0.6\, m_A$

$e = \dfrac{1 - 0.2}{0.8} = 1 \qquad = 1.5$

$I_d = 6 \times 0.5 - \ 6 \times 0 \ = 3N - 5$

$= 10 \times \{0.8 - 0.5\} \qquad = 10 \times 0.3$

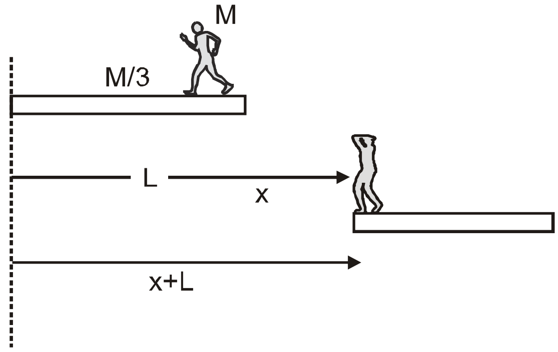
= 3 NS

$\Delta U = \dfrac{1}{2} \times 10 \times (0.8)^2 - \dfrac{1}{2} \times 10 \times (0.5)^2$

$= 5 \times 0.64 \quad 8 \times 0.25 \ = 3.2 - 2.0 = 1.2$ J

DPP NO. - 65

1.



$$Mx + \frac{M}{3}(x + L) = 0$$

$$\frac{4M}{3}x = -\frac{ML}{3} \qquad x = -\frac{L}{4}$$

2. $\vec{B} = \frac{\mu_0}{4\pi} q \frac{\vec{v} \times \vec{r}}{r^3}$ and $\vec{E} = \frac{1}{4\pi \in_0} \frac{q\vec{r}}{r^3}$

$$\therefore \quad \vec{B} = \mu_0 \in_0 (\vec{v} \times \vec{E}) = \frac{\vec{v} \times \vec{E}}{c^2}$$

3. $v = \frac{50}{100} V_e = \frac{1}{2}\sqrt{\frac{2GM}{R}}$

Applying energy conservation

$$\Rightarrow -\frac{GMm}{R} + \frac{1}{2}mv^2 = -\frac{GMm}{(R+h)}$$

$$v^2 = \frac{2GM}{R} - \frac{2GM}{R+h}$$

$$\Rightarrow \frac{1}{4} \cdot \frac{2GM}{R} = 2GM\left(\frac{1}{R} - \frac{1}{R+h}\right)$$

$$\Rightarrow \frac{1}{4R} = \frac{h}{R(R+h)}$$

$\Rightarrow$ R + h = 4h

$\Rightarrow$ h = R/3

4. $K_{eq.}$ is same in all three cases. All other parameter being same, rate of energy conduction is same in all three cases.
Simlarly temperature difference across any material in any wall is also same.

5. $I = \frac{ma^2}{12} + m\left(\frac{a}{\sqrt{2}}\right)^2 = \frac{7ma^2}{12} = 7.$

6. $mgh = \frac{1}{2}mv^2 + \frac{1}{2}mv^2 + \frac{1}{2} \cdot \frac{2}{5}mv^2\left(\frac{2v}{r}\right)^2$

$$= \frac{1}{2}mv^2 [1 + 1 + \frac{8}{5}] = \frac{1}{2}mv^2 \frac{18}{5} = \frac{9mv^2}{5}$$

$$\Rightarrow v = \sqrt{\frac{5}{9}gh}$$

7. KE of the ball = $\frac{1}{2}mv^2 + \frac{1}{2}\frac{2}{5}mv^2\left(\frac{2v}{r}\right)^2 = \frac{13}{18}$ mgh

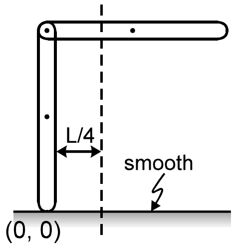
8. $X = 2vt = 2v\sqrt{\frac{2h}{g}}$

$$= 2.\sqrt{\frac{5}{9}gh}\sqrt{\frac{2h}{g}} = \frac{2\sqrt{10}}{3}h$$

DPP NO. - 66

1. Initially the centre of mass is at $\frac{L}{4}$ distance from the vertical rod.

$$\left(\text{As, } x_{cm} = \frac{m(\frac{1}{2}) + m(0)}{m+m} = \frac{L}{4}\right)$$



centre of mass does not move in x-direction as $\Sigma F_x = 0$.
After they lie on the floor, the pin joint should be at L/4 distance from the origin shown inorder to keep the centre of mass at rest.

$\therefore$ Finally x-displacement of the pin is $\frac{L}{4}$ and y-displacement of the pin is obviously L.

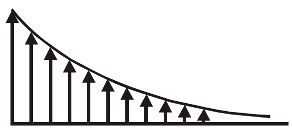
Hence net displacement = $\sqrt{L^2 + \frac{L^2}{16}} = \frac{\sqrt{17}L}{4}$

2. $H = -kA\dfrac{dT}{dx} \quad \Rightarrow \dfrac{dT}{dx} = \dfrac{-H}{kA}$

Now as k increases, $\dfrac{dT}{dx}$ becomes less (–)ve

So slope becomes less (–)ve

So curve will be



3. Since

$\vec{B} = \dfrac{\mu_0}{4\pi} q \dfrac{\vec{v} \times \vec{r}}{r^3}$, $\vec{v} \times \vec{r}$ must be same

where $\vec{v}$ = velocity of charge with respect to observer

Let A and B are the observers

then $(\vec{v}_C - \vec{v}_A) \times \vec{r} = (\vec{v}_C - \vec{v}_B) \times \vec{r}$

or $(\vec{v}_A - \vec{v}_B) \times \vec{r} = 0$

or $(\vec{v}_A - \vec{v}_B) \,||\, \vec{r}$

4. $I_1\omega_1 = I_1\omega_1$ (Angular momentum is conserved)

As I_2 decreases. ω_2 increases.

Thus $T = \dfrac{2\pi}{\omega}$ i.e. T decreases.

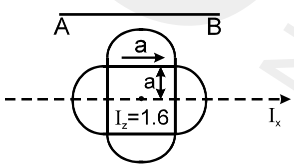
Therefore the earth is completing each circle around its own axis in lesser time.

$K.E. = \dfrac{1}{2} I\omega^2$

Therefore K.E. of rotation increases.

Duration of the year is dependent upon time taken to complete one revolution around the sun.

5. Using $\perp$ axis theorem



$I_x = I_y$

$2I_x = 1.6$

$I_x = .8\ Ma^2$

$I_{AB} = I_x + M(2a)^2$

$= 4.8\ Ma^2$

Ans.: 4.8 Ma²

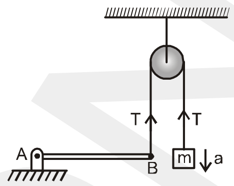
6, 7 & 8.

Let α be the angular acceleration of rod and a be acceleration of block just after its release.

$\therefore \quad mg - T = ma \qquad ..... (1)$

$T\ell - mg\dfrac{\ell}{2} = \dfrac{m\ell^2}{3}\alpha \qquad .... (2)$

and $a = \ell\alpha \qquad .... (3)$



Solving we get

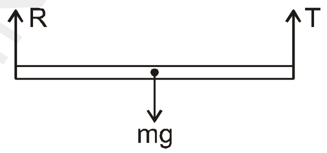
$T = \dfrac{5mg}{8}$ and $\alpha = \dfrac{3g}{8\ell}$

Now from free body diagram of rod, let R be the reaction by hinge on rod

$R + T - mg = m\,a_{cm} = m\,\dfrac{1}{2}\alpha$

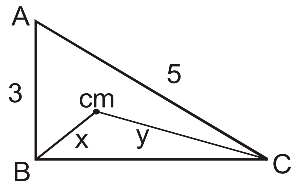
Solving we get

$R = \dfrac{9mg}{16}$



DPP NO. - 67

1. Moment of inertia is more when mass is farther from the axis. In case of axis BC, mass distribution is closest to it and in case of axis AB mass distribution is farthest .Hence



$I_{BC} < I_{AC} < I_{AB}$

$\Rightarrow \quad I_P > I_B > I_H \qquad I_C = I_{CM} + my^2$

$= I_B^1 - mx^2 + my^2$

$= I_B^1 + m(y^2 - x^2) \qquad = I_P + I_B + m(y^2 - x^2)$

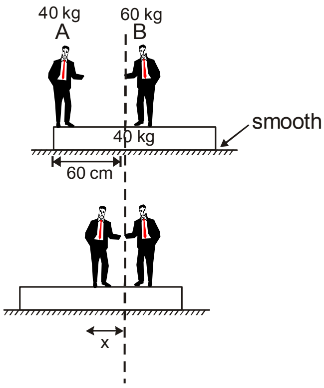
$> I_P + I_B$

$> I_P$

Here I_B^1 is moment of inertia of the plate about an axis perpendicular to it and passing through B.

$\therefore \quad I_C > I_P > I_B > I_H$

2. **(C)** Taking the origin at the centre of the plank.



$m_1\Delta x_1 + m_2\Delta x_2 + m_3\Delta x_3 = 0$
($\because\ \Delta x_{CM} = 0$)
(Assuming the centres of the two men are exactly at the axis shown.)
$60(0) + 40(60) + 40(-x) = 0$, x is the displacement of the block.
$\Rightarrow\ x = 60$ cm
i.e. A & B meet at the right end of the plank.

3. The slope of temperature variation is more in inner

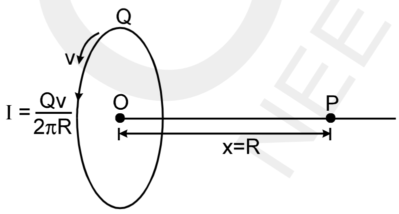
$$\frac{dQ}{dt} = \frac{KA}{\ell}.\Delta T$$

$$\Delta T = \frac{\ell}{KA}.\frac{dQ}{dt}$$

Slope $\alpha\ \frac{1}{K}$

Larger the conductivity, smaller is the slope.

4. Let Q be the charge on the ring. The electric field at point P is



$$\therefore\quad E = \frac{1}{4\pi\epsilon_0}\frac{Qx}{(x^2+R^2)^{3/2}}$$

$$= \frac{1}{4\pi\epsilon_0}\frac{QR}{(2R^2)^{3/2}}$$

The rotating charged (Q) ring is equivalent to a ring in which current I flows, such that

$$I = \frac{Qv}{2\pi R}$$

The magnetic field at point P is

$$B = \frac{\mu_0}{4\pi}\frac{2\pi IR^2}{(x^2+R^2)^{3/2}} = \frac{\mu_0}{4\pi}\frac{QvR}{(2R^2)^{3/2}}$$

$$\therefore\quad \frac{E}{B} = \frac{1}{\mu_0\epsilon_0 v} = \frac{c^2}{v}$$

5. The orbital velocity,

$$v_0 = \sqrt{\frac{GM}{r}}$$

Its velocity is increased by $\sqrt{2}$ times, new velocity

$$v = \sqrt{2}\sqrt{\frac{GM}{r}} = \sqrt{\frac{2GM}{r}} = \text{escape velocity}$$

The path is parabolic in case of escape velocity.

8. $\Delta L = \int \tau dt = \int xFdt = x\Delta P$ (because x is essentially constant during the quick blow) since, the rod starts at rest, the final values therefore satisfy $L = xP$.

$$\Rightarrow \frac{1}{2}m\ell^2\omega = xmv \Rightarrow \frac{\omega}{v} = \frac{12x}{\ell^2}\ \ .... (1)$$

Another expression for $\frac{\omega}{v}$ is obtained from the given information that rod makes one revolution by the time centre reaches the dot.
$\omega t = 2\pi$ and $vt = d$

$$\Rightarrow \frac{\omega}{v} = \frac{2\pi}{d} .... (2)$$

from equation 1 and 2 : $\frac{12x}{\ell^2} = \frac{2\pi}{d}\quad \therefore\ x = \frac{\pi\ell^2}{6d}$

x cannot be larger than $\frac{\ell}{2}$

$$\frac{\pi\ell^2}{6d} \le \frac{\ell}{2} \quad \Rightarrow \frac{\pi\ell}{3} \le d$$

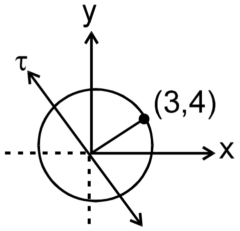
DPP NO. - 68

1. $MP = \left(1+\frac{D}{f}\right) = \left(1+\frac{25}{5}\right) = 6$

2. Heat radiated (at temp same temp) $\propto$ A
$\Rightarrow$ $Q \propto 4\pi R^2$ and $Q' \propto (4\pi R^2 + 2 \times \pi R^2)$

$$\Rightarrow \frac{Q'}{Q} = \frac{6\pi R^2}{4\pi R^2} = 1.5$$

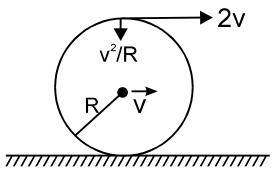
Here πR^2 is extra surface area of plane surface of one of the hemisphere.

3. 

Megnetic moment $\vec{M} = \pi r^2 i\ \hat{i}$ & $\vec{B} = 3\hat{i} + 4\hat{j}$

$\therefore\ \vec{\tau} = \vec{M} \times \vec{B} = \pi r^2 (3\ \hat{j} - 4\ \hat{i})$

$\vec{\tau}$ will be along the direction shown .
Hence , the point about which the loop will be lift up will be : (3, 4)

4. 

Radius of Curvature = $\dfrac{(\text{velocity})^2}{\text{Normal Acceleration}}$

$= \dfrac{(2v)^2}{v^2/R} = 4R$

5. By linear momentum conservation in horizontal direction = for (bob + string + cart)
$mV_0 = (m + m)v$

$v = \dfrac{V_0}{2}$

By mechanical energy conservation for (bob + string + cart + earth)

$\dfrac{1}{2}mV_0^{\,2} + 0 + 0 = \dfrac{1}{2}(2m)v^2 + mgh + 0$

$\dfrac{1}{2}mV_0^{\,2} - \dfrac{1}{2}(2m)\ \dfrac{V_0^{\,2}}{4} = mgh$

Solving it,

$h = \dfrac{V_0^2}{4g}$.

6. When two drops of radius r each combine to form a big drop, the radius of big drop will be given by

$\dfrac{4}{3}\pi R^3 = \dfrac{4\pi}{3}r^2 + \dfrac{4\pi}{3}r^3$

or $R^3 = 2r^3$ or $R = 2^{1/3}r$ Now

$\dfrac{V_R}{V_r} = \left(\dfrac{R}{r}\right)^2 = 2^{\frac{2}{3}} = 4^{\frac{1}{3}}$

$\therefore\ V_R = 5 \times 4^{1/3}$ cm/s

7. If m is pole strength , then

$m = m = \dfrac{M}{l}$

When the wire is bent into a semicircular arc, the separation between the two poles changes from l to 2l, where new magnetic moment of the steel wire,

$M' = m \times 2r = \dfrac{M}{l} \times \dfrac{2l}{\pi} = \dfrac{2M}{\pi}$

8. (A) Real image of a real object is formed by concave mirror and convex lens.
(B) Virtual image of a real object is formed by all four.
(C) Real image of a virtual object may be formed by all four.
(D) Virtual image of a virtual object may be formed by convex mirror and concave lens.
(A) p,r (B) p,q,r,s (C) p,q,r,s (D) q,s

9. Let $E_1 < E_2$ and a current i flows through the circuit. Then the potential difference across cell of emf E_1 is $E_1 + ir_1$ which is positive, hence potential difference across this cell cannot be zero. Hence statement 1 is correct.
For current in the circuit to be zero, emf of both the cells should be equal. But $E_1 \neq E_2$. Hence statement 2 is correct but it is not a correct explanation of statement 1.

DPP NO. - 69

3. Equal area means equal power output. A_3 area pertains to highest wavelength range, thus photons with minimum range of frequency. Thus maximum number of photons are required from this segment to keep the power same.

4. Work done by kinetic friction may be positive when it acts along motion of the body.
Friction on rigid body rolling on inclined plane is along upward because tendency of slipping is downwards.

5. The torque of system = Torque on loop [AFGH + BCPE + ABEF]

$= ISB\ (-\hat{i}) + ISB(\hat{i}) + ISB\hat{k}$ (I = current, S = area of loop, B = magnetic field.

$= I\ S\ B\ \hat{k}$

$= 1 \times 1 \times 2\ \hat{k} = 2\hat{k}$ units

[Ans: $2\hat{K}$ **]**

6. The work done to rotate a bar magnet from its initial position $\theta = \theta_1$ to the final position $\theta = \theta_2$ is given by $W = MB(\cos\theta_1 - \cos\theta_2)$,
(i) Here $\theta_1 = 0°$ and $\theta_2 = 180°$
$\therefore W = MB(\cos\theta_1 - \cos 180°) = MB = [1-(-1)] = 2$ **M B**
(ii) Here $\theta_1 = 0°$ and $\theta_2 = 90°$
$\therefore W = MB(\cos 0° - \cos 90°) = MB = [1-0)]$
$=$ **M B**

7. If velocity of m_2 is zero then by momentum conservation
$m_1 v' = m_2 v$

$$v' = \frac{m_2 v}{m_1}$$

Now kinetic energy of m_1

$$= \frac{1}{2} m^1 v'^2 = \frac{1}{2} m_1 \left(\frac{m_2}{m_1}\right)^2 v^2$$

$$= \frac{1}{2}\left(\frac{m_2}{m_1}\right) m_2 v^2 = \left(\frac{m_2}{m_1}\right) \frac{1}{2} m_2 v^2 = \frac{m_2}{m_1} \times \text{initial}$$

Kinetic energy
Kinetic energy of m_1 > initial mechanical energy of system m_1
Hence proved

8. $C = \sin^{-1}\left(\frac{1}{2/1}\right) = 30°$

for $i = 37$ TIR
so, $\delta = \pi - 2(37°) = 104°$

$i = 25$, Refraction $\delta < \frac{\pi}{2} - C$

$i = 45°$, TIR

so, $\delta = \pi - 2\left(\frac{\pi}{4}\right) = 90°$

By applying snells law for prism :
$i = 90$
$r_1 = 30$
$r_2 = 30$
$e = 45$
$\delta = 90 + 45 - 60 = 75°$

9. The points A and B are at same potential, then under given conditions points A and B on the circuit can be connected by a conducting wire. Hence the circuit can be redrawn as shown in figure 2.

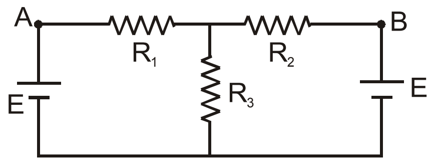
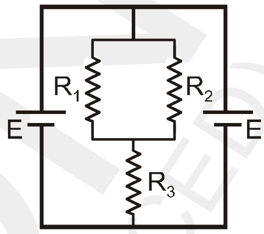


Fig-1



(fig.2)

Therefore statement 1 is true. Statement 2 is obviously false.

DPP NO. - 70

1. In normal adjustment

$$m = \frac{f_0}{f_e}$$

so $\quad 50 = \frac{100}{f_e}$

$\Rightarrow f_e = 2$ cm

($\because$ eyepiece is concave lens)
and $L = f_0 - f_e = 100 - 2 = 98$ cm

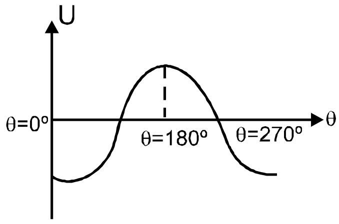
2. $\lambda_m T = $ const.
$\ln \lambda_m + \ln T = C$

$$\frac{d\lambda_m}{\lambda_m} + \frac{dT}{T} = 0 \qquad \therefore \frac{d\lambda_m}{\lambda_m} = -\frac{dT}{T}$$

Now $\frac{d\lambda_m}{\lambda_m} = -1\ \% = -\frac{1}{100}$ (–ve sign indicates decrease)
$dT = 1$ (given)
$\therefore T = 100$ K.

3. Emissive power $= \sigma T^4$
$= 6 \times 10^{-8} \times 100^4\ W/m^2$

4.



to reach $\theta = 270°$, it has to cross the potential energy barrier at $\theta = 180°$ and to cross $\theta = 180°$ angular velocity at $\theta = 180°$ should be 0^+

$$k_i + U_i = k_f + U_y$$

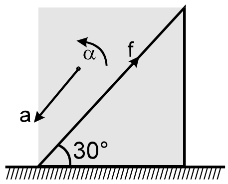
$$\frac{1}{2}\left(\frac{3}{2}MR^2\right)\omega^2 + (-Mi\ AB\ \cos 0°) = 0 + (-NiAB\ \cos 180°)$$

$$\omega = \sqrt{80} \approx 9 \text{ rad/sec.}$$

5. Equation for linear motion

$mg\sin\theta - f = ma$

for rotary motion



$$f.\,R = I\,.\frac{a}{R} \Rightarrow f = \frac{I}{R^2}\,.$$

$$a \quad mg\sin\theta = ma + \frac{MR^2}{2.R^2}.a = \frac{3}{2}ma$$

$$a = \frac{2g\sin\theta}{3} = \frac{g}{3}$$

using $S = ut + \frac{1}{2}at^2$ for linear motion.

$$1 = 0 + \frac{1}{2}\cdot\frac{g}{3}\cdot t^2$$

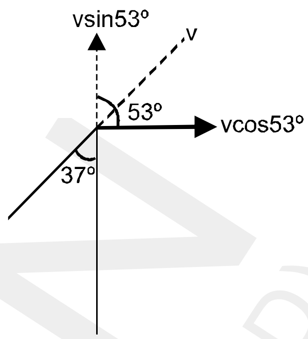
$$t = \sqrt{\frac{6}{g}} \text{ sec.}$$ **Ans.**

6. Here $B_H = 0.22$ T ; $B_V = 0.38$ T

Now $B = \sqrt{B_H^2 + B_V^2}$

$= \sqrt{(0.22)^2 + (0.38)^2} = \sqrt{0.1928} =$ **0.44 T**

<u>7.</u> w.r.t. the wedge



As maximum height = 125 m

$\Rightarrow$ block want by a height 20m over the wedge

$\Rightarrow$ $(v \sin 53°)^2 = 2.g.20$

$$v^2\,\frac{16}{25} = 400$$

$v^2 = 25 \times 25$

$v = 25$ m/sec.

$\Rightarrow$ block left the wedge with a relative velocity 25 m/sec.

Now, time of flight = 2 + 5 = 7 sec.

horizontal range w.r.t. wedge

$= v_x \times T$

$= 25 \cos 53 \times 7$

$= 105$ m.

8. For slab no deviation so $\delta = 0$ for any i

for slab for light from D to R

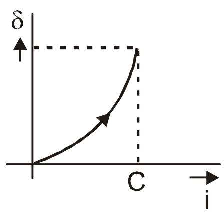
$\delta = r - i$ ....(i)

$n_d \sin i = n_r \sin r$

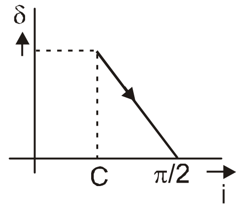
$$\Rightarrow r = \sin^{-1}\left[\frac{n_d}{n_r}\sin i\right]$$

$$\delta = \sin^{-1}\left[\frac{n_d}{n_r}\sin i\right] - i$$

it is non-linear function and graph is



After i > C T.I.R. will occur and graph is straight line for D to R



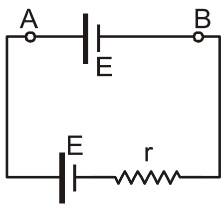
Similarly for light going from R to D

$$\delta = i - \sin^{-1}\left[\frac{n_r}{n_d}\sin i\right]$$

and for prism graph is drawn from

$i = i_{min}$ to $i = e$ that is graph(s)

9. Statement-2 is wrong as in this case

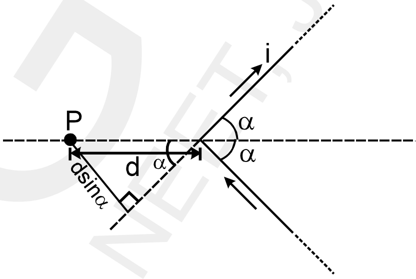


A is at high potential and B is at low potential and there is no current from A to B. It also justifies Statement-1.

DPP NO. - 71

1. By right hand thumb rule, the field by both the segments are out of the plane i.e.along **+ve z-axis**.

2. Let us compute the magnetic field due to any one segment :



$$B = \frac{\mu_0 i}{4\pi(d\sin\alpha)}(\cos 0^0 + \cos(180-\alpha))$$

$$= \frac{\mu_0 i}{4\pi(d\sin\alpha)}(1-\cos\alpha) = \frac{\mu_0 i}{4\pi d}\tan\frac{\alpha}{2}$$

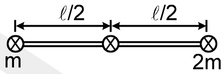
Resultant field will be :

$$B_{net} = 2B = \frac{\mu_0 i}{2\pi d}\tan\frac{\alpha}{2} \quad \Rightarrow k = \frac{\mu_0 i}{2\pi d}$$

3. Due to the motion of the loop, there will be an induced current flowing in the circuit, resulting in a force acting on each element of the loop equally & radially. Therefore the net force on the loop is zero.

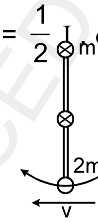
Hence (D).

5. Decrease in PE =



Increase in rotation K.E

$$\Rightarrow 2mg.\frac{\ell}{2} - mg.\frac{\ell}{2} = \frac{1}{2} I\omega^2$$



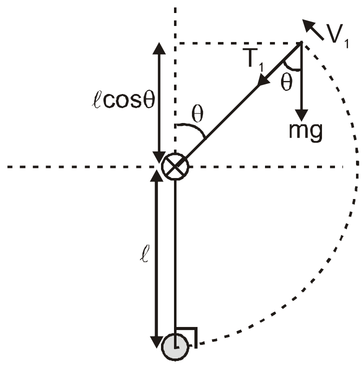
$$= \frac{1}{2}\left(2m\frac{\ell^2}{4} + m.\frac{\ell}{4}\right)\omega^2$$

$$\frac{mg\ell}{2} = \frac{1}{2}.\frac{3m\ell^2}{4}.\omega = \frac{3m\ell^2}{8}\omega^2$$

$$\omega = \sqrt{\frac{4g}{3\ell}} \text{ and } v = r\omega = \frac{\ell}{2}\sqrt{\frac{4g}{3\ell}} = \sqrt{\frac{g\ell}{3\ell}}$$

[Ans.: (a) $V = \sqrt{g\ell/3}$, $\omega = \sqrt{4g/3\ell}$]

6.



$$mg\cos\theta + T_1 = \frac{mv_1^2}{\ell}$$

for leaving circle $T_1 = 0$

$mv_1^2 = mg\ \ell\cos\theta$ ...(i)

and by energy conservation

$$0 + \frac{1}{2}m(\sqrt{3g\ell})^2 = \frac{1}{2}mv_1^2 + mg(\ell + \ell\cos\theta)$$

$$\frac{1}{2}m(3g\ell) = \frac{1}{2}mv_1^2 + mg\ell(1+\cos\theta)$$

$$\frac{3mg\ell}{2} = \frac{mg\ell\cos\theta}{2} + mg\ell + mg\ell\cos\theta$$

(by eqation (i))

$$\frac{mg\ell}{2} = \frac{3}{2}mg\ell\cos\theta$$

$$\cos\theta = \frac{1}{3}$$

$$\sin\theta = \sqrt{1-\frac{1}{9}} = \frac{\sqrt{8}}{3}$$

$$a_c = \frac{v_1^2}{\ell} = \frac{g\ell\cos\theta}{\ell} = g\cos\theta$$

$$a_t = g\sin\theta$$

then $\frac{a_c}{a_t}$

$$= \frac{g\cos\theta}{g\sin\theta} = \frac{1/3}{\sqrt{8}/3} = \frac{1}{\sqrt{8}} = \frac{1}{2\sqrt{2}} = \frac{1}{y\sqrt{2}}$$

so y = 2

Ans. y = 2

Sol. (7 to 9)

Applying bernoulli's equation

$$P_0 + \frac{1}{2} \times 2\rho \times V^2 = P_0 + 2\rho g \times \frac{h}{2} + \rho gh$$

$$v = \sqrt{2gh}$$

$$\frac{1}{2} \times g \times t^2 = \frac{h}{2}$$

$$\Rightarrow t = \sqrt{\frac{h}{g}}$$

R = v × t

$$\Rightarrow \sqrt{2}h$$

Applying continuity equation

$$\sqrt{6} \times \sqrt{2gh} = \sqrt{3gh} \times A$$

$A = 2cm^2$

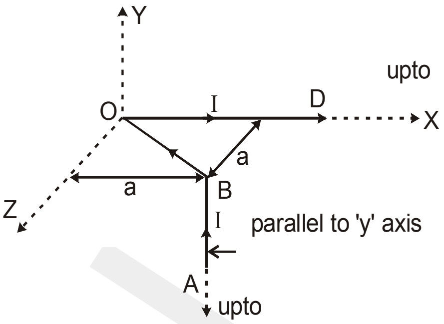
DPP NO. - 72

1. $B_{OD} = 0$

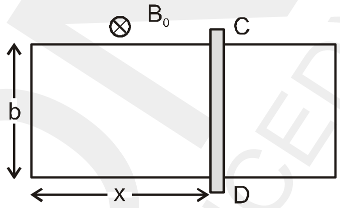
$B_{OB} = 0$

$$B_{AB} = \frac{\mu_0 I}{4\pi a\sqrt{2}}[\cos 45°(-\hat{i}) + \cos 45°\hat{k}]$$

$$= \frac{\mu_0 I}{8\pi a}(-\hat{i}+\hat{k})$$



2.



The magnetic flux must remain constant

$$\therefore \phi_m = B_0ab = \frac{B_0}{1+kt}bx$$

where x is as shown

$\therefore$ x = a(1 + kt)

or $v = \frac{dx}{dt} = ak$ **Ans.**

3. **(A)** Let 'F' be the magnitude of force exerted on the rod due to the collision.

Then : F = ma

and $F.\frac{\ell}{4} = \frac{m\ell^2}{12}.\alpha$

(about 'O')

$$\Rightarrow a = \frac{\ell}{3}\alpha \qquad .... (1)$$

Using ; $S = ut + \frac{1}{2}at^2$ and $\theta = \omega_0 t + \frac{1}{2}\alpha t^2$

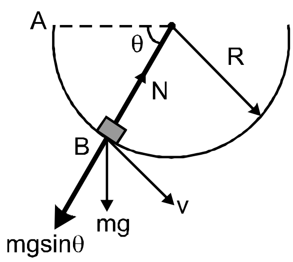
$S = ut + \frac{1}{2}at^2$ $\quad \theta = \omega_0 t + \frac{1}{2}\alpha t^2$

$S = \frac{1}{2}at^2$ $\quad$ and $6\pi = \frac{1}{2}\alpha t^2$

$$\Rightarrow \frac{6\pi}{s} = \frac{\alpha}{a} = \frac{3}{\ell} \qquad \text{(from (1)))}$$

$\Rightarrow S = 2\pi\ell$ **Ans.**

5. $\frac{mv^2}{R} = N - mg\sin\theta$



$$N = \frac{mv^2}{R} + mg\sin\theta$$

By energy conservation,

$$mgR\sin\theta = \frac{1}{2}mv^2$$

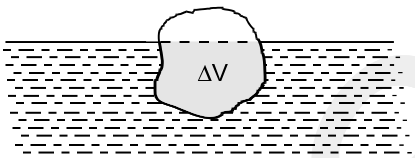
$$\frac{mv^2}{R} = 2mg\sin\theta$$

$N = 3mg\sin\theta$

$$\text{Ratio} = \frac{mv^2}{RN} = \frac{2}{3}\text{(constant)}$$

$$x = \frac{2}{3}.$$

6. Consider a block of ice having volume V and density ρ_i.
Let the volume of ice submerged in water (of density ρ_w) be ΔV



Since the ice block is in equilibrium

$$\rho_i V g = \rho_w \Delta V g \quad \text{or} \quad \Delta V = \frac{\rho_i V}{\rho_w} \quad \text{... (1)}$$

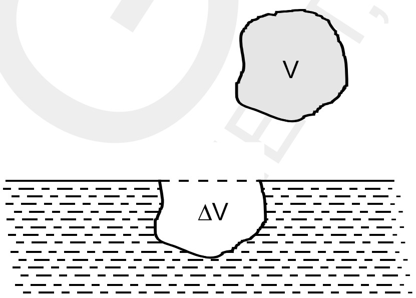
Let V volume of ice melt in to V′ of water. Then

$\therefore \quad \rho_i V = \rho_w V'$

$$\text{or } V' = \frac{\rho_i V}{\rho_w} \quad \text{... (2)}$$

from (1) and (2) $\Rightarrow \Delta V = V'$

Hence when V volume of ice melts it occupies $V' = \Delta V$ volume of water.



Hence the level of water does not change on melting of ice.

9. The velocity of centre of mass is always zero. At maximum deformation during head on collision, velocity of each sphere is equal to velocity of centre of mass and hence zero. Therefore at maximum deformation K.E. of system is also zero.

Velocity of separation after collision = e (velocity of approach before collision).
From centre of mass frame in a head-on collision, if $\vec{u}_1$ and $\vec{v}_1$ be velocity of a ball before and after collision $\vec{v}_1 = -e\vec{u}_1$. Since, v_{cm} = 0 from ground frame, ground frame and centre of mass frame carry same meaning.

DPP NO. - 73

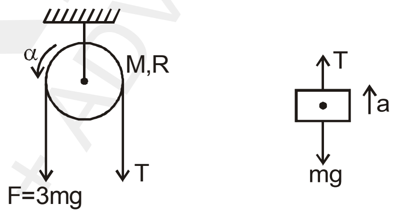
1. For disc, from torque equation

$$3\,mg\,R - TR = \frac{mR^2}{2}\alpha \quad \text{.... (1)}$$

By application of Newton's second law on block we get,

$T - mg = ma$ .... (2)

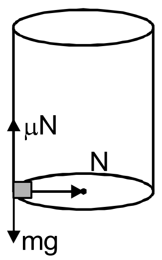
where $a = R\alpha$ ..... (3)



$$\text{solving } a = \frac{4g}{3}$$

3. (A) From continuity equation, velocity at cross-section (1) is more than that at cross-section (2).
Hence ; $P_1 < P_2$
Hence (A)

4.



$N = mr\omega^2$ ....(i)

$\mu N = mg$ ....(ii)

From (i) & (ii),

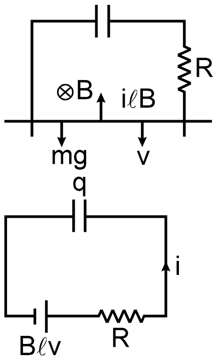
$\mu(mr\omega^2) = mg$

$$\omega^2 = \frac{g}{\mu r} = \frac{10}{0.8 \times 18}$$

$$\omega = \frac{5}{6}\text{ rad/s.}$$

5. By newton's law :

$$mg - i\ell B = m\frac{dv}{dt} \quad \ldots\ldots\ldots\ (1)$$



By kvl $\quad B\ell v = iR + \frac{q}{c} \quad \ldots\ldots\ldots\ (2)$

differentiate (2) w.r.t. time

$$B\ell\frac{dv}{dt} = R\frac{di}{dt} + \frac{i}{c} \quad \ldots\ldots\ldots\ (3)$$

Eliminate $\frac{dv}{dt}$ by (1) & (3)

$$mg - i\ell B = \frac{m}{B\ell}\left[R\frac{di}{dt} + \frac{i}{c}\right]$$

$$\Rightarrow \ mgB\ell - iB^2\ell^2 = mR\frac{di}{dt} + \frac{mi}{c} \quad \ldots\ldots\ldots\ (4)$$

i will be maximum when $\frac{di}{dt} = 0$.

Use this in (4)

$\Rightarrow \ mgB\ell c = i(B^2\ell^2 c + m)$

$$\Rightarrow \ i_{max} = \frac{mgB\ell c}{m + B^2\ell^2 c} \quad \textbf{Ans.}$$

6. Angle of dip can not be calculated by tangent galvanometer.

7. $K = \frac{2\times\pi\times10^{-2}\times2\times10^{-5}}{4\pi\times10^{-7}\times200} = 0.005$

8. $i = K\tan\phi$

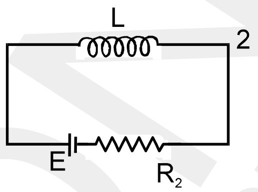
using values ($\phi = 60°$)

$i = 0.005 \times \sqrt{3} \quad = \frac{\sqrt{3}}{200}$

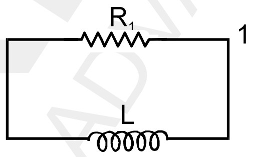
DPP NO. - 74

1. When the key is at position (B) for a long time ; the energy stored in the inductor is :

$$U_B = \frac{1}{2}Li_0^2 = \frac{1}{2}.L.\left(\frac{E}{R_2}\right)^2 = \frac{L.E.^2}{2R_2^2}$$



This whole energy will be dissipated in the form of heat when the inductor is connected to R_1 and no source is connected.



Hence (A).

2. $P = Ae\sigma T^4$

$2 = 2 \times 10^{-6} \times 0.9 \times 5.6 \times 10^{-8} \times T^4$

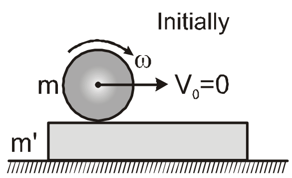
$$T^4 = \frac{10^{14}}{0.9\times5.6}$$

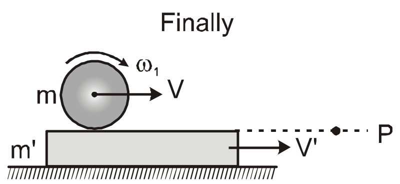
$T = 2110\ k$

3. $f = \frac{1}{p} = \frac{1}{2}$ metre

f = 0.5 m this is positive so lense is convex lense.

4.





Condition for pure rolling

$V - \omega R = V' \quad \ldots\ldots\ldots\ldots(i)$

Momentum conservation

$m'V' = mV$

$\Rightarrow \; V' = \frac{mV}{m'}$ ....(ii)

From (i) and (ii) $\quad V = \frac{'m\omega_1 V}{m'-m}$

Torque of friction about point P is zero Angular momentum will remain conserved about this point

$$\frac{mR^2}{2}\omega = \frac{mR^2}{2}\omega_1 + mVR$$

Solving this we get $\omega' = \frac{m'-m}{3m'-m} \cdot \omega$

5. M_1 is very large as compared to M_2. Hence for collision between M_1 and M_2, M_1 can be considered equivalent to a wall and M_2 as a small block. Thus the velocity of M_2 will be $2v_o$ after collision with M_1. Similarly after collision between M_2 and M_3, the velocity of M_3 will be $2(2v_o)$. In sequence, the velocity of M_4 shall be $2(2(2v_o)) = 8\,v_o$ after collision with M_3.

6. The component of velocity of charged particle along the magnetic field does not change. The component of velocity of charged particle normal to magnetic field only changes in direction but always remains normal to magnetic field. Hence angle between velocity and magnetic field remains same.

7. $f = \frac{qB}{2\pi m} = \frac{10^3}{19} \times \frac{\sqrt{3800}}{2\pi}$

$= \frac{10^4}{\pi\sqrt{38}}$

8. Pitch = $T.V_{||}$

$= \frac{1}{f} \cdot \frac{\vec{V}.\vec{B}}{|\vec{B}|} = \frac{\pi\sqrt{38}.400}{10^4.\sqrt{3800}} = \frac{4\pi}{10^3}$ m

$= \frac{\pi}{250}$ m

DPP NO. - 75

1. Rate of heat transfer is same through all walls

$$\frac{K_1.A.(10)}{40\,\text{cm}} = \frac{K_2 A(20)}{20\,\text{cm}} = \frac{K_2\,A(40)}{10\,\text{cm}}$$

$\Rightarrow \frac{K_1}{4} = K_2 = 4K_3 \Rightarrow K_1 = 4K_2 = 16\,K_3$.

$$\frac{K_1.A.(10)}{40\,\text{cm}} = \frac{K_2 A(20)}{20\,\text{cm}} = \frac{K_2\,A(40)}{10\,\text{cm}}$$

$\Rightarrow \frac{K_1}{4} = K_2 = 4K_3 \Rightarrow K_1 = 4K_2 = 16\,K_3$.

2. For the elastic collision, total kinetic energy is constant.
If we consider both the colliding bodies as system, then net work done on the system is zero (By work energy theorem)

$K_1 + K_2 = K'_1 + K'_2$ .... (1)

K is kinetic energy of object before the collision and K' is kinetic energy of object after the collision
In general masses of both the objects are different, So speed of each object becomes different after collision $\quad K_1 \neq K'_1$ and $K_2 \neq K'_2$
By work energy theorem

$W_1 = K'_1 - K_1$ .... (2)

$W_2 = K'_2 - K_2$ .... (3)

From (1), (2) and (3)

$W_1 \neq 0, \quad W_2 \neq 0$

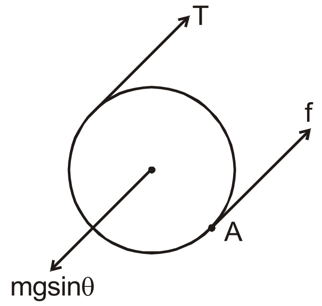
$W_1 + W_2 = 0$

$W_1 = -W_2$

i.e. the work done by the first object on the second object is exactly the opposite of the work done by the second object on the first object.

3. **A, B, D**

4. The F.B.D. of cylinder is as shown. In equilibrium $\Rightarrow$
T = Mg = tension in string
In equilibrium, net force on cylinder is zero
$\therefore$ Torque is same about any axis.
$\Rightarrow$ Torque on cylinder about any point is zero.
$\tau_A = Mg\,2R - mg\sin\theta\,R = 0$



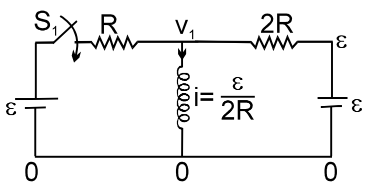
$\therefore M = \frac{m \sin\theta}{2}$ Hence for only one value of M cylinder can remain in equilibrium.

$\Rightarrow$ A is true, B is false

When the cylinder rolls up the incline, sense of rotation of cylinder about center of mass is clockwise. Hence T > f. $\Rightarrow$ C is false.

When the cylinder rolls down the incline, sense of rotation of cylinder about center of mass is anticlockwise. Hence T < f. $\Rightarrow$ D is True.

5. When S_2 is closed current in inductor



remains, $i = \frac{\varepsilon}{2R}$

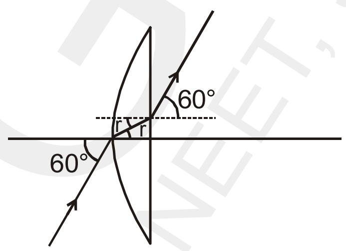
$$\therefore \frac{\varepsilon - V_1}{R} + \frac{\varepsilon - V_1}{2R} = \frac{\varepsilon}{2R} \qquad \left(V_1 = \frac{2\varepsilon}{3}\right)$$

$\therefore$ Potential difference

$$(V) = \varepsilon - \frac{2\varepsilon}{3} = \frac{\varepsilon}{3} \textbf{ Ans.}$$

And $\quad L\frac{di}{dt} = \frac{2\varepsilon}{3} \qquad \frac{di}{dt} = +\frac{2\varepsilon}{3L}$ **Ans.**

6. From ray diagram it is clear that ray emerges out of lens parallel to itself. Hence the angle of deviation caused by the lens is 0°.



7. From snells law at first interface

$\sin 60 = \sqrt{3}\ \sin r \qquad$ or $r = 30°$

Since the emergent ray is parallel to initial incident ray, the portion of lens used for refraction can be assumed as slab

Hence lateral displacement

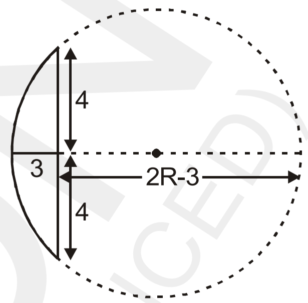
$$= t\frac{\sin(i-r)}{\cos r} = 3\frac{\sin(60-30)}{\cos 30} = \sqrt{3}\text{ mm.}$$

8. If R denotes radius of curvature of curved surface, then from above figure

$3 \times (2R - 3) = 4 \times 4$

or $\quad R = \frac{25}{6}$ mm

From the formulae of focal length for plano-convex lens

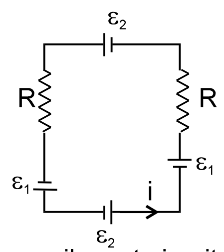


$$f = \frac{R}{\mu - 1} = \frac{25}{6(\sqrt{3}-1)} = \frac{25}{6(\sqrt{3}-1)} \times \left(\frac{\sqrt{3}+1}{\sqrt{3}+1}\right)$$

$$= \frac{25}{12}(\sqrt{3}+1)\text{ cm}$$

DPP NO. - 76

1.



equilavent circuit

$$i = \frac{2\varepsilon_1 + 2\varepsilon_2}{R_1 + R_2} = \frac{\varepsilon}{R_1 + R_2}$$

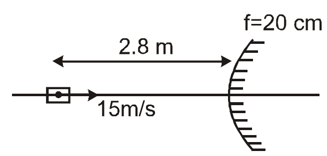
Where $\varepsilon = \frac{d\phi}{dt}$ is the net emf in the circuit.

$$\therefore V_1 - V_2 = (\varepsilon - iR_1) - (\varepsilon - iR_2) = \frac{\varepsilon(R_2 - R_1)}{R_1 + R_2}$$

2. Mirror formula :

$$\frac{1}{v} + \frac{1}{-280} = \frac{1}{20}$$

$$\frac{1}{v} + \frac{1}{20} + \frac{1}{280}$$



$$\frac{1}{v}+\frac{14+1}{280}$$

$$v=\frac{280}{15}$$

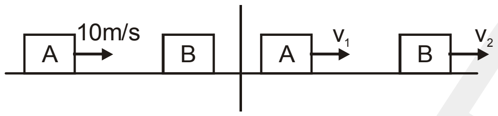
$$v_I=-\left(\frac{v}{u}\right)^2.v_{om}$$

$$\therefore\ v_I=-\left(\frac{280}{15\times 280}\right)^2.15$$

$$\therefore\ v_I=\frac{-15}{15\times 15}$$

$v_I=-\dfrac{1}{15}$ m/s **Ans.**

3.



$m\times 10=mv_1+mv_2$

$\Rightarrow\ 10=v_1+v_2$ ...(i)

and $\dfrac{1}{2}\times 10=v_2-v_1$ ...(ii)

From I and II

$v_1=\dfrac{5}{2}$ m/s ; $v_2=\dfrac{15}{2}$ m/s

Distance between the two blocks

$S=(-v_1+v_2).t$

$=\left(-\dfrac{5}{2}+\dfrac{15}{2}\right)\times 5=25$ m

4. Heat obviously flows from higher temperature to lower temperature in steady state. $\Rightarrow$ A is true.

Temperature gradient $\propto \dfrac{1}{\text{cross section area}}$ in steady state. $\Rightarrow$ B is false.

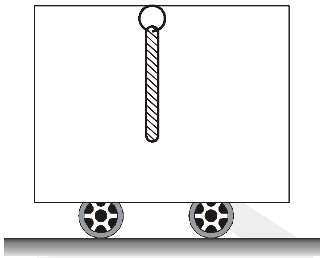
Thermal current through each cross section area is same. $\Rightarrow$ C is true.

Temperature decreases along the length of the rod from higher temperature end to lower temperature end.

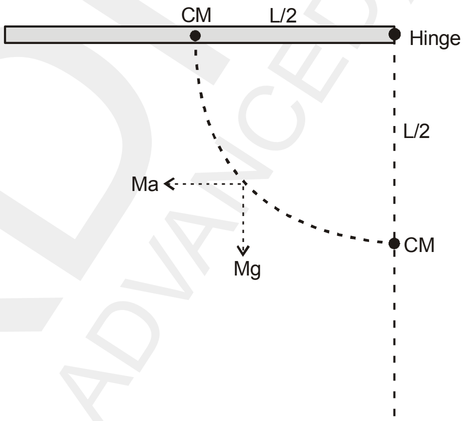
$\Rightarrow$ D is false.

5. **A,B,C**

Using $-e(\vec{V}\times\vec{B})$ for the region outside the plates, direction of magnetic field can be found. Inside the plates, net force on the electron is zero hence electric force is opposite to that of magnetic force. Direction of electric field between the plates is opposite to that of direction of force on the negative (electron) charge.



6.



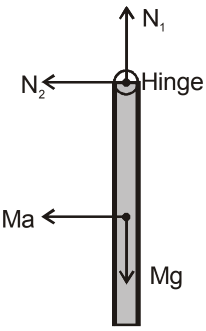
From the cart's frame

$W_{all}=KE_2-KE_1$

$\Rightarrow\ Ma\left(\dfrac{L}{2}\right)+Mg\left(-\dfrac{L}{2}\right)=0-0$

$\Rightarrow\ a=g$

7.



Initially rod is at rest

So, $N_1=Mg,\ N_1=Mg$

Torque = $I\alpha$

$$Ma\left(\frac{L}{2}\right)=\left(\frac{ML^2}{3}\right)\alpha$$

$\Rightarrow \frac{3}{4}a = \left(\frac{\alpha L}{2}\right)$

$\Rightarrow \frac{3}{4}g = \frac{\alpha L}{2}$

$Ma + N_2 = Ma_{CM}$

$\Rightarrow Mg + N_2 = M\left(\frac{3}{4}g\right)$

$\Rightarrow N_2 = -\frac{Mg}{4}$

$N = \sqrt{N_1^2 + N_2^2} = \frac{\sqrt{17}\,Mg}{4}$

8. Equation of motion for the cart

$-\frac{Mg}{4} + f = 2Ma$

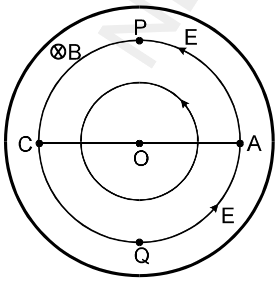
$\Rightarrow f = 2Ma + \frac{Mg}{4}$

$\Rightarrow f = \frac{9Mg}{4}$

DPP NO. - 77

1. It is clearly visible from all graphs that as x-increases. Velocity changes sign. Since this is not possible, no graph represents the possible motion.

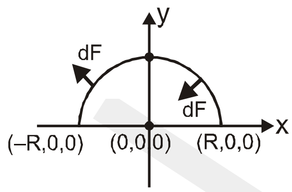
2. Because of increase in magnetic field with time, electric field is induced in the circular region and represented by lines of forces as shown in figure. The signs of minimum work done by external agent in taking unit positive charge from A to C via path APC, AOC and AQC are



$W_{APC} = -ve$, $W_{AOC} = 0$, $W_{AQC} = +ve$

$\therefore$ (C) is the correct choice.

3. The direction of forces on the two elements taken symmetrical on two sides of the y–axis are shown. Clearly the net force will be on negative x-axis.



4. For a ball rolling without slipping on a fixed rough surface, no work is done by friction.

5. Δp - Implse = Ft = 3mgt

6. Let the angular speed of disc when the balls reach the end be ω. From conservation of angular momentum

$\frac{1}{2}mR^2\,\omega_0 = \frac{1}{2}mR^2\omega + \frac{m}{2}R^2\,\omega + \frac{m}{2}R^2\,\omega$ or $\omega = \frac{\omega_0}{3}$

7. The angular speed of the disc just after the balls leave the disc is $\omega = \frac{\omega_0}{3}$

Let the speed of each ball just after they leave the disc be v.

From conservation of energy

$$\frac{1}{2}\left(\frac{1}{2}mR^2\right)\omega_0^2 = \frac{1}{2}\left(\frac{1}{2}mR^2\right)\omega^2 + \frac{1}{2}\left(\frac{m}{2}\right)v^2 + \frac{1}{2}\left(\frac{m}{2}\right)v^2$$

solving we get

$v = \frac{2R\omega_0}{3}$

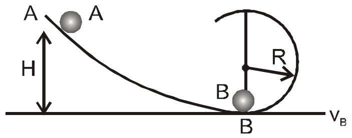
NOTE : $v = \sqrt{(\omega R)^2 + v_r^2}$

; v_r = radial velocity of the ball

8. Workdone by all forces equal $K_f - K_i = \frac{1}{2}\left(\frac{m}{2}\right)v^2 = \frac{mR^2\omega_0^2}{9}$

DPP NO. - 78

1.



For the just completing the circular motion, minimum velocity at bottom in

$v_B = \sqrt{5gR}$

Energy conservation b/w point A and B

$$MgH + 0 = 0 + \frac{1}{2} m v_B^2$$

$$MgH = \frac{1}{2} m (5gR)$$

$$H = \frac{5R}{2}$$

3. $\int \vec{E} \cdot d\vec{r} = -\frac{d\phi}{dt}$

and take the sign of flux according to right hand curl rule get.

$$\int \vec{E} \cdot d\vec{r} = -(-(-\alpha A) - (-\alpha A) + (-\alpha A)) = -\alpha A$$

4. $\vec{F} = \vec{F} = I\vec{\ell} \times \vec{B}$

$\vec{\ell} = \overrightarrow{AD} = R(\hat{i} - \hat{j})$

$\vec{B} = B_0 \ (\hat{i} + \hat{j} - \hat{k})$

$\therefore \quad \vec{F} = IRB_0 \quad (\hat{i} - \hat{j}) \quad \times \quad (\hat{i} + \hat{j} - \hat{k}) \quad = \quad IRB_0$

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 0 \\ 1 & 1 & -1 \end{vmatrix} = IRB_0 \ (\hat{i} + \hat{j} + 2\hat{k})$$

$F = IRB_0 \sqrt{6}$

Aliter :

$\vec{B} = B_0 (\hat{i} + \hat{j} - \hat{k})$

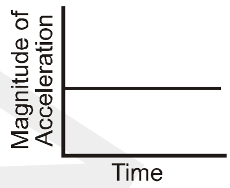
$\vec{\ell} = R(\hat{i} - \hat{j})$

$\vec{B} \ \vec{\ell} = 0$

$\Rightarrow$ Angle = 90°

$\Rightarrow \quad F = BI\ell = \sqrt{3} B_0 I \sqrt{2} R = \sqrt{6} B_0 I R$

5. Since angular velocity is constant, acceleration of centre of mass of disc is zero. Hence the magnitude of acceleration of point S is $\omega^2 x$ where ω is angular speed of disc and x is the distance of S from centre. Therefore the graph is



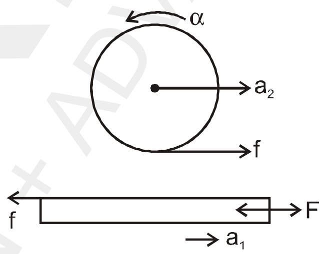
Sol. 14 to 16

The free body diagram of plank and disc is
Applying Newton's second law

$F - f = Ma_1$ .... (1)

$f = Ma_2$ .... (2)

$FR = \frac{1}{2} MR^2 \alpha$ .... (3)



from equation 2 and 3

$$a_2 = \frac{R\alpha}{2}$$

From constraint $a_1 = a_2 + R\alpha$

$\therefore \ a_1 = 3a_2$ .... (4)

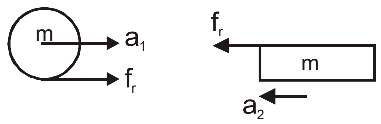
Solving we get $a_1 = \frac{3F}{4M}$ and $\alpha = \frac{F}{2MR}$

If sphere moves by x the plank moves by L + x.
The from equation (4)

$$L + x = 3x \quad \text{or} \quad x = \frac{L}{2}$$

DPP NO. - 79

1. FBD for sphere & block



$$a_1 = \frac{f_r}{m} = \frac{\mu mg}{m}$$

$$a_2 = \frac{f_r}{m} = \frac{\mu mg}{m}$$

$$\vec{a}_1 = \mu g\hat{i} \qquad \vec{a}_2 = -\mu g\hat{i}$$

$$\vec{a}_{rel} = \vec{a}_1 - \vec{a}_2 = 2\mu g\hat{i}$$

$a_{rel} = 2\mu g.$

2. The electron ejected with maximum speed v_{max} are stopped by electric field E = 4N/C after travelling a distance d = 1m

$$\therefore \quad \frac{1}{2} mV_{max}^2 = eE\,d = 4eV$$

The energy of incident photon = $\frac{1240}{200}$ = 6.2 eV

From equation of photo electric effect

$$\frac{1}{2} mv_{max}^2 = h\upsilon - \phi_0$$

$$\therefore \quad \phi_0 = 6.2 - 4 = 2.2 \text{ eV.}$$

3. In steady state current from battery = $\frac{10}{2}$ = 5A

In parallel inductors $L_1I_1 = L_2I_2$ all the time

$$\Rightarrow \quad i_1 = \frac{L_2}{L_1 + L_2} i = \frac{3}{3+2} \times 5 = 3A$$

4. Both the spring are in series

$$\therefore \quad K_{eq} = \frac{K(2K)}{K+2K} = \frac{2K}{3}$$

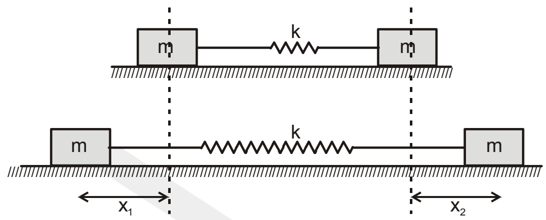
Time period

$$T = 2\pi\sqrt{\frac{\mu}{K_{eq}}} \qquad \text{where } \mu = \frac{m_1m_2}{m_1+m_2}$$

Here $\mu = \frac{m}{2}$

$$\therefore T = 2\pi\sqrt{\frac{m}{2} \cdot \frac{3}{2K}} = 2\pi\sqrt{\frac{3m}{4K}}$$

Method II



$\therefore \quad mx_1 = mx_2 \;\Rightarrow\; x_1 = x_2$

force equation for first block;

$$\frac{2k}{3}(x_1 + x_2) = -m\frac{d^2x_1}{dt^2}$$

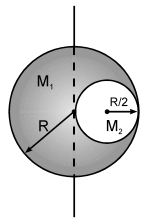
Put $x_1 = x_2$

$$\Rightarrow \quad \frac{d^2x_1}{dt^2} + \frac{4k}{3m} \times x_1 = 0$$

$$\Rightarrow \quad \omega^2 = \frac{4k}{3m}$$

$$\therefore \; T = 2\pi\sqrt{\frac{3m}{4K}}$$

5. $\rho = \dfrac{M}{(4/3)\pi R^3 - (4/3)\pi(R/2)^3}$

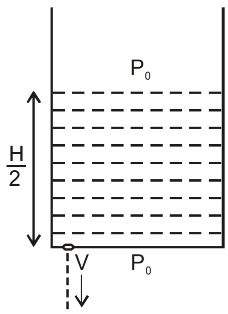


$$M_1 = \frac{8}{7}M, \quad M_2 = \frac{1}{7}M$$

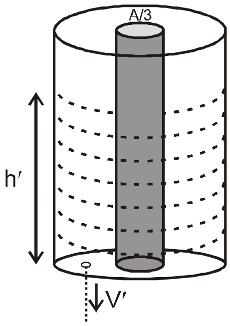
$$I = \frac{2}{5}M_1R^2 - \left(\frac{2}{5}M_2\left(\frac{R}{2}\right)^2 + M_2\left(\frac{R}{2}\right)^2\right)$$

$$;\, I = \frac{57}{140}MR^2$$

6.



$$V = \sqrt{2gh} = \sqrt{2g\left(\frac{H}{2}\right)} = \sqrt{gH}$$

7. 

Let h′ be height of water column just after putting cylinder,

$$\rho h'\left(A-\frac{A}{3}\right)=\left(\frac{H}{2}\right)A\rho$$

$$\Rightarrow \ h' = \frac{3}{4}H$$

$$V' = \sqrt{2gh'} = \sqrt{\frac{3}{2}gH}$$

8. $\rho\left(\frac{H}{2}\right)\left(A-\frac{A}{3}\right) = h'' A \rho$

$$\Rightarrow \ h'' = \frac{H}{3}$$

$$v'' = \sqrt{2gh''} = \sqrt{\frac{2}{3}gH}$$

DPP NO. - 80

1. 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 = $\frac{1}{2}mv^2$

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

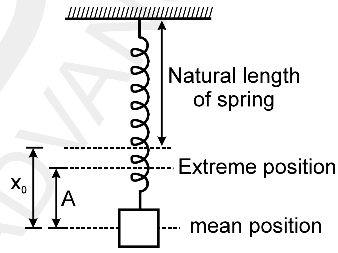
$= \frac{1}{2}mv^2\left(1+\frac{1}{2}\right)$

$= \frac{3}{2}\cdot\frac{1}{2}mv^2$

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

2. $I_x = I_y = I_z = \frac{2}{5}mR^2$

3. The spring is never compressed. Hence spring shall exert least force on the block when the block is at topmost position.



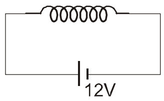
$$F_{least} = kx_0 - kA = mg - m\omega^2A = mg - 4\frac{\pi^2}{T^2}mA$$

4. $KE_{max} = (5-\phi)$ eV
when these electrons are accelerated through 5V, they will reach the anode with maximum energy $= (5-\phi+5)$eV
$\therefore\ 10-\phi = 8$
ϕ = 2eV Ans.
Current is less than saturation current because if slowest electron also reached the plate it would have 5eV energy at the anode, but there it is given that the minimum energy is 6eV.

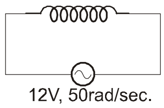
5. By principal of energy conservation.
$P_B = P_R + P_L$
Near the starting of the circuit

$P_R = i^2R$ and $P_L = L\,i\,\frac{di}{dt}$.

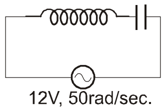
As $\frac{di}{dt}$ has greater value at the starting of the circuit, $P_L > P_R$



(Figure 1)



(Figure 2)



(Figure 3)

Sol. 1 to 3. : When connected with the DC source

$R = \frac{12}{4} = 3\ \Omega$

When connected to ac source $I = \frac{V}{Z}$

$\therefore 2.4 = \frac{12}{\sqrt{3^2 + \omega^2 L^2}} \Rightarrow L = 0.08$ H

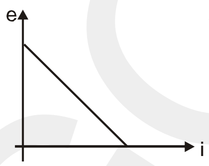
Using $P = I_{rms} V_{rms} \cos\phi$

$= \frac{V_{rms}^2}{Z} \cos\phi$

$= \frac{V_{rms}^2\ R}{R^2 + (\omega L - \frac{1}{\omega C})^2} = 24$ W

DPP NO. - 81

2. The potential difference across the inductor is e = E– iR.
Hence the plot of e versus i is a straight line with negative slope.



3. Equation can be written as i = 2 sin 100 π t + 2 sin (100 π t + 120º)
so phase difference ϕ = 120º

$= \sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos\phi}$

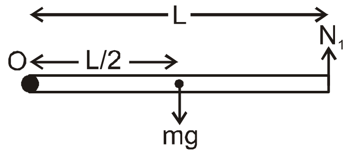
$= \sqrt{4 + 4 + 2 \times 2 \times 2\left(-\frac{1}{2}\right)} = 2$ so effective value will

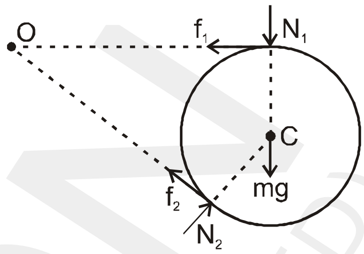
rms. value = $2/\sqrt{2} = \sqrt{2}$ A

4. Angular momentum $= \frac{nh}{2\pi} = \frac{h}{2\pi}$ $(\because n = 1)$

$(mvr) = n.\frac{h}{2\pi} = \frac{h}{2\pi}$ (n = 1)

Sol.5 to 7.
FBD of rod and cylinder is as shown.





Net torque on rod about hinge 'O' = 0

$\therefore N_1 \times L = mg \times \frac{L}{2}$

or $\boxed{N_1 = \frac{mg}{2}}$

Net torque on cylinder about its centre C is zero.

$\therefore f_1R = f_2R$ or $\boxed{f_1 = f_2}$

Net torque on cylinder about hinge O is zero.

$\therefore N_2 \times L = N_1 \times L + mgL$

or $N_2 = \boxed{\frac{3mg}{2}}$

8. The magnetic force on bob does not produce any restoring torque on bob about the hinge. Hence this force has no effect on time period of oscillation. Therefore both statements are correct and statement-2 is the correct explanation.

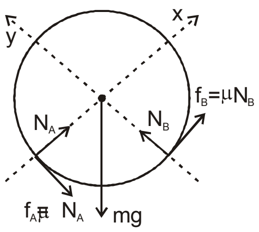
DPP NO. - 82

3. $\langle i\rangle = \dfrac{\int_0^1 i\,dt}{1} = 2\sqrt{2}\int_0^1 \sin\left(\pi t + \dfrac{\pi}{4}\right)dt = \dfrac{4}{\pi}$

4. The hydrogen atom is in n = 5 state.
$\therefore$ Max. no of possible photons = 4
To emit photon in ultra violet region, it must jump to n = 1, because only Lyman series lies in u.v. region. Once it jumps to n = 1 photon, it reaches to its ground state and no more photons can be emitted. So only one photon in u. v. range can be emitted.
If H atom emits a photon and then another photon of Balmer series, option D will be correct.

7. The FBD of cylinder is as shown

Resolving forces along x and y axis



$N_A + f_B = \dfrac{mg}{\sqrt{2}}$ .... (1)

$f_B = \mu N_B$

$N_B - f_A = \dfrac{mg}{\sqrt{2}}$ .... (2)

$f_A = \mu N_A$

solving we get

$f_A = \dfrac{\mu Mg(1-\mu)}{\sqrt{2}\,(1+\mu^2)}$ and

$f_B = \dfrac{\mu Mg(1+\mu)}{\sqrt{2}\,(1+\mu^2)}$

Angular acceleration

$= \dfrac{(f_A + f_B)R}{\frac{MR^2}{2}} = \dfrac{2\sqrt{2}\mu g}{R(1+\mu^2)}$

8. $\oint \vec{B}\cdot d\vec{\ell}$ along any closed path within a uniform magnetic field is always zero. Hence the closed path can be chosen of any size, even very small size enclosing a very small area. Hence we can prove that net current through each area of infinitesimally small size within region of uniform magnetic field is zero. Hence we can say no current (rather than no net current) flows through region of uniform magnetic field. Hence statement -2 is correct explanation of statement-1.