Royal College - Colombo 07

Grade 12

First Term test – November 2018

Physics I

01 E I

Time : 1 hour

$g = 10\ N\ kg^{-1}$

Answer all questions.

1) The units of the dimension given by $M L^2 T^{-3}$ is,

(1) N (2) Pa (3) J (4) W (5) Hz

2) The value of a physical quantity is $10\ g\ \mu m^{-2}\ s^{-2}$. What is the correct value if it is to be written in $kg\ m^{-2}\ s^{-2}$

(1) 10^{-10} (2) 10^{-9} (3) 10^{10} (4) 10^{6} (5) 10^{4}

3) In the equation $P + \frac{1}{2}\rho v^2 + \rho gh = K$ (K - constant), P = pressure, ρ = density, v = speed , g = gravitational acceleration and h - height

Consider the following statements.

A. K is dimensionless

B. The equation is dimensionally correct.

C. The dimension of P is $ML^{-1}T^{-2}$.

The correct statement/s is/are

(1) only A (2) only B (3) only C (4) only B and C (5) (A) , B and C all

4) When measuring the diameter of a rubber tube. Using the travelling microscope, the readings obtained are shown in the given figures. The diameter of the tube can be,

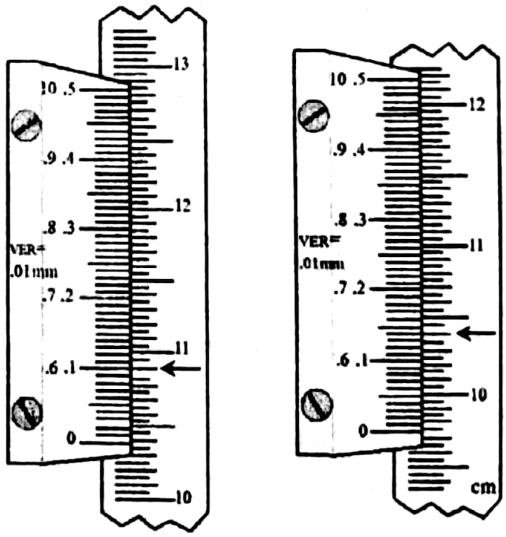
(1) 6.47mm

(2) 6.46mm

(3) 6.45mm

(4) 6.44mm

(5) 6.43mm



5) Figure shows a micrometer screw guage with the circular scale divided into 50 parts and the pitch is 0.5 mm. The position of the guage corresponding to the zero error and the diameter of a ball are shown in figure I and figure II respectively. The fractional error of the diameter measurment is

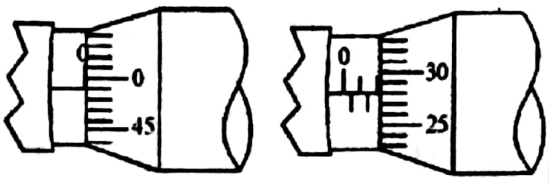
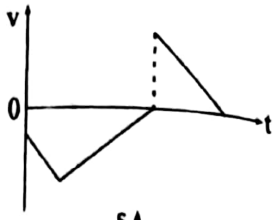
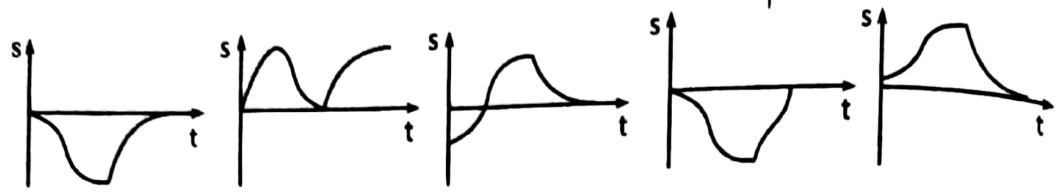


Figure I Figure II

(1) $\frac{0.01}{2.28}$ (2) $\frac{0.01}{2.27}$ (3) $\frac{0.01}{2.29}$ (4) $\frac{0.01}{2.33}$ (5) $\frac{0.01}{2.31}$

6) Figure shows the variation of velocity (v) of an object with time (t). The displacement (s) versus time (t) graph corresponding to this motion is shown by,





(1) (2) (3) (4) (5)

7) Two particles P and Q travelling on a smooth, horizontal surface collide with each other. The momentum of the particles before and after the collision are shown in figures 1 and 2 respectively.

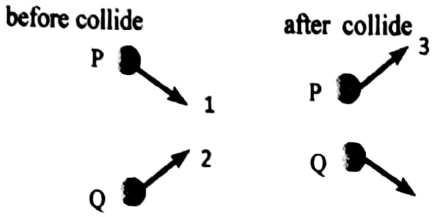
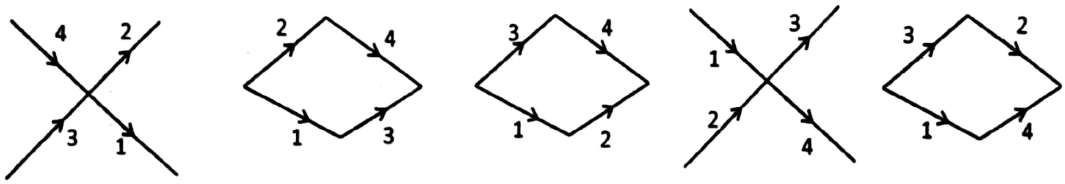


Figure I

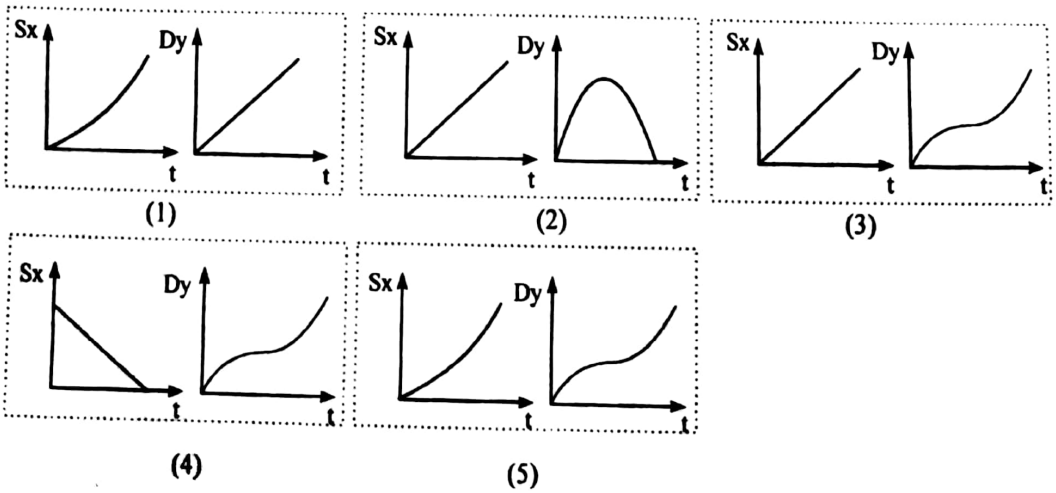
Figure II

The correct vector diagram showing the magnitude and directions of the momentums is given by,



(1) (2) (3) (4) (5)

8) A rock is projected from a horizontal surface at angle 45^0 from the horizontal. The correct diagram showing the **horizontal displacement** (Sx) and **vertical distance** (Dy) against time (t) for the rock is given by, (Ignore the air resistance)



(1) (2) (3)

(4) (5)

9) An object moves in linear motion .consider the following statements,

A. The direction of acceleration is the same as that of velocity.

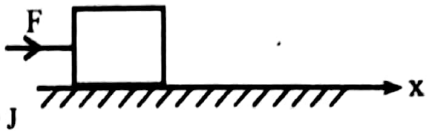
B. If the velocity is zero, acceleration will be zero.

C. When the direction of velocity changes to the opposite direction, direction of acceleration will remain unchanged.

The correct statement/s is/are

(1) A (2) B (3) C (4) B, C (5) A, B, C are incorrect

10) The force F acting on the object with distance x is given by $F = (3x + 5)$ N. When the object travels from $x = 2$ m to $x = 4$ m, the work done on the object is,



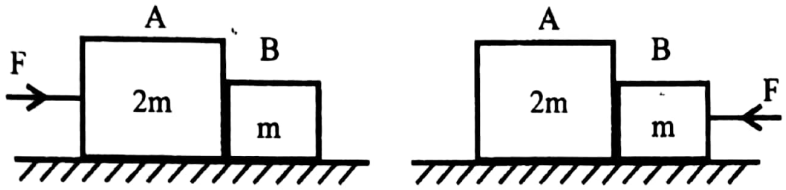
(1) 56 J (2) 28 J (3) 34 J (4) 22 J (5) 0 J

11) When two objects A and B are travelling in opposite directions and uniform speed, they move away from each other at 12 m per second and then they one moving in the same direction they approach each other at 2 m per second. The speeds of the objects are,

(1) $9\ ms^{-1}$ and $3ms^{-1}$ (2) $6ms^{-1}$ and $6ms^{-1}$ (3) $8ms^{-1}$ and $4ms^{-1}$

(4) $5ms^{-1}$ and $3ms^{-1}$ (5) $5ms^{-1}$ and $7ms^{-1}$

12)

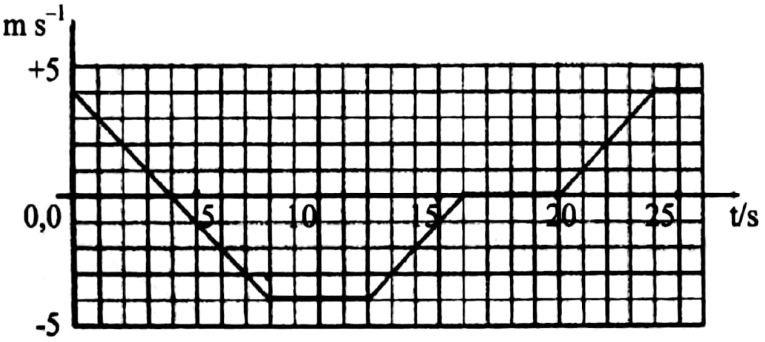


The objects A and B on a smooth, horizontal surface have masses 2m, m respectively. As shown in the figures, when a constant, horizontal force (F) is applied, the action force on B in figure (a) and action force on A in figure (b) respectively are,

(1) $\frac{F}{3}\rightarrow, \frac{2F}{3}\leftarrow$ (2) $\frac{F}{3}\rightarrow, \frac{2F}{3}\rightarrow$ (3) $\frac{2F}{3}\rightarrow, \frac{F}{3}\rightarrow$

(4) $\frac{2F}{3}\leftarrow\frac{F}{3}\rightarrow$ (5) $\frac{F}{3}\rightarrow, \frac{F}{3}\rightarrow,$

13)



Consider the above velocity – time graph,

(A) The maximum acceleration is 1 m s^{-2} and maximum deceleration is 2 m s^{-2}.

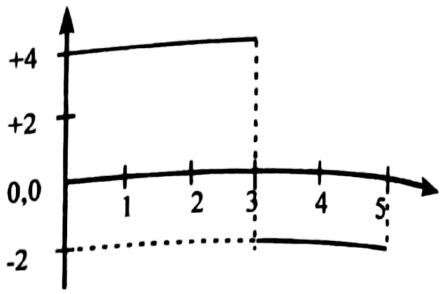
(B) The total displacement in the opposite direction is 32 m.

(C) The time spent at rest is 4 s.

The correct statement/s is/are

(1) A (2) B (3) C (4) A, B (5) B, C

14) A 1 kg object moves in a straight line from rest. The variation of force (F) acting on the object with time is shown in the diagram. The speed of the object at 5 s will be,

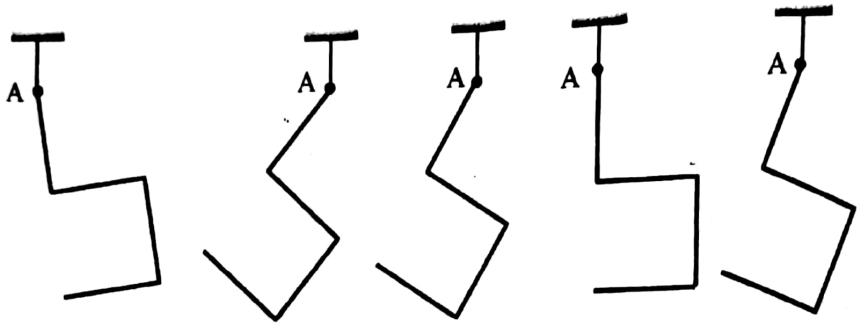


(1) 2 ms^{-1} (2) 8 ms^{-1} (3) 12 ms^{-1}
(4) 16 ms^{-1} (5) 20 ms^{-1}

15) A steel ball is released from a certain height. It contacts a concrete floor and rebounds upto 80% of the initial height. The percentage of kinetic energy loss due to the collision is? (Ignore the air resistance)

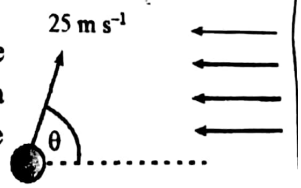
(1) 80% (2) 64 % (3) 36% (4) 20% (5) 15%

16) Four identical rods are connected as shown in the figure. If the system is hung using a string from the point A. The correct equilibrium position of the system is shown by,



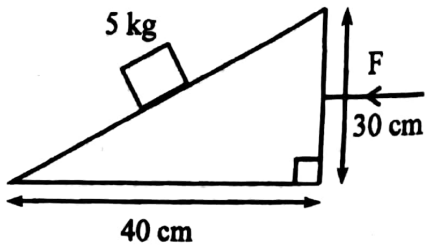
(1) (2) (3) (4) (5)

17) As shown in the figure, a ball is projected at 25 m s^{-1} at an angle θ to the horizontal. A wind is blowing as shown in the figure which causes a 5 m s^{-2} acceleration in the same direction. If the ball is to return back to the starting position, the value of θ should be,



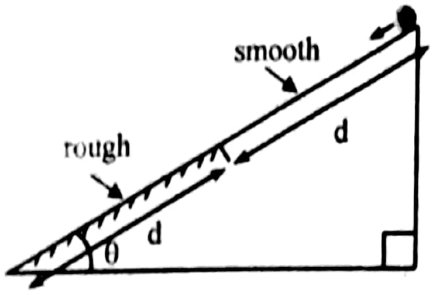
(1) $\tan^{-1}(0.5)$ (2) $\tan^{-1}(0.25)$ (3) $\tan^{-1}(2)$ (4) $\tan^{-1}(1)$ (5) $\tan^{-1}(0.2)$

18) As shown in the figure, a 5 kg block is placed on a smooth inclined block which is free to move on a smooth horizontal plane. If the system is released from rest, what is the horizontal force (F) that should be applied to prevent the movement of the inclined block?



(1) 0 N (2) 18N (3) 24N
(4) 30N (5) 32N

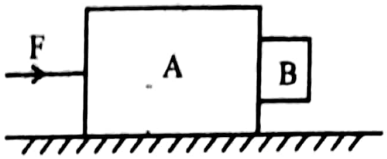
19) On a plane inclined θ from the horizontal, the upper half is smooth and the lower half is rough. An object released from the top of the inclined plane slides down the plane and comes to rest at the bottom. The coefficient of kinetic friction between the object and inclined plane is given by,



(1) $\mu = \tan\theta$ (2) $\mu = 2\tan\theta$ (3) $\mu = \frac{1}{2\tan\theta}$

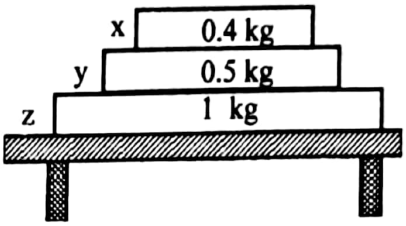
(4) $\mu = \frac{2}{\tan\theta}$ (5) $\mu = \frac{1}{\tan\theta}$

20) Two blocks A and B having masses 16 kg and 4 kg respectively are placed on a smooth surface as shown in the figure with B in contact with A. What is the horizontal force (F) that should be applied to A to prevent B from sliding down? The coefficient of static friction between A and B is 0.5.



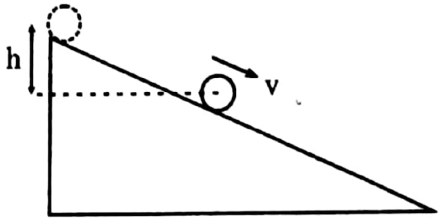
(1) 50N (2) 100N (3) 200N (4) 400N (5) 1600N

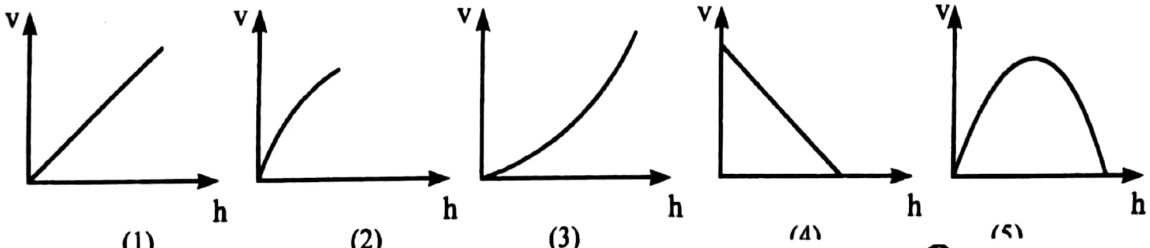
21) As shown in the figure three books x, y and z placed on a horizontal surface have masses 0.4 kg, 0.5 kg and 1kg respectively. What is the net force acting on book y?



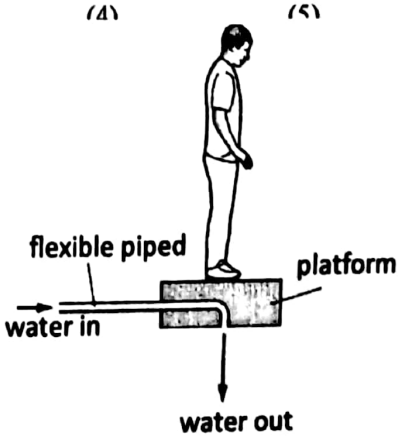
(1) 1N down (2) 4N down 3) 5N up
(4) 9N down (5) 0 N

22) Figure shows a ball released from top of a smooth inclined plane from rest. When it is falling along the plane, the falling height (h) versus speed(v) graph given by,





23) Figure shows a man standing on a platform to which a water supply is given using a flaxible pipe and a water jet exits from the bottom, maintaining the platform and man at a constant hight. If the vertical resultant force on the platform is zero, the speed of water flowing from the bottom of the platform is, (The combined mass of the man and platform is 96 kg and the rate of water flowing out of the pipe is 40 kg s^{-1}

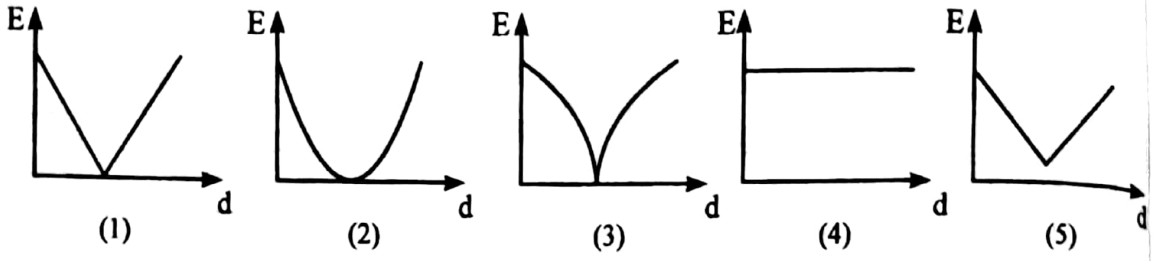


(1) 2.0 m s^{-1} (2) 2.4 ms^{-1}
(3) 12 m s^{-1} (4) 24 m s^{-1}
(5) 40 m s^{-1}

24) A large number of projectiles one projected upward in all directions from the middle of a playground. The maximum radius of travel of the projectiles will be, (Ignore the air resistance)

(1) $\frac{v^2}{g}$ (2) $\frac{v^4}{g^2}$ (3) $\frac{v^2}{g^2}$ (4) $\frac{v}{g^2}$ (5) $\frac{2v^2}{g}$

25) A particle is projected vertically upwards and it comes back to the same point. Which graphs represents the variation of kinetic energy(E) with distance(d). (Ignore the air resistance)



(1) (2) (3) (4) (5)

Royal College - Colombo 07
Grade 12
First Term test – Nov. 2018
Physics II

01 E II

Time : 1 ½ hours

Index No:. ..... **Class :** .....

Important :

- *The question paper consists of* ***05*** *pages*
- *The question paper comprises* ***Part A*** *and* ***Part B.*** *The time allotted for both part in* ***1 hours and 30 minutes.***
- *Use of calculators is* ***not*** *allowed*

Part A - Structured Essay (03 pages)

Answer all the questions on this paper itself. Write your answers in this spaces provided is sufficient for your answers and that extensive are not expected.

Part B - Essay (02 pages)

This part contains three questions. Use the papers supplied for this purpose. At the end of the time allotted for this paper, tie the two papers so that ***Part A*** *is on top of* ***Part B*** *before handing them over to the Supervisor.*
You are permitted to remove ***only*** ***Part B*** *of the question paper from Examination hall.*

$g = 10\ Nkg^{-1}$

For Examiner's use only

For the second paper		
Part	Question nos.	Marks
A	1	
	2	
B	3	
	4	

Final Marks

In numbers	

Part A – Structured Essay

➢ Answer all the questions

1) a) A student has planned to design a spherometer to find the radius of a sphere of radius 300 m. He has used a screw of pitch 1.0 cm and a disc with 50 divisions.

$$R = \left(\frac{a^2}{6h} + \frac{h}{2}\right)$$

i) Find the least count of the spherometer.

.....

ii) What is the **least measurement** that can be taken using this spherometer as a laboratory measurement?

.....

.....

b) When taking a measurement using the spherometer, in the beginning we should keep the legs and the tip of the screw so that they touch a plane surface.

i) How do you confirm that the tip of the screw and the legs are in contact with the plane surface?

.....

.....

ii) When the tips of the legs of the spherometer touch the plane surface, what is the geometrical shape that can be formed by its parts?

.....

iii) If the distance between two legs is 'a' , give an experimental methed to find it.

.....

.....

iv) If the distance between the two legs of the spherometer is 'a' and the distance between the tip of a leg to the tip of the screw is 'x', write an expression for 'x' in terms of 'a'.

.....

.....

i) Write an expression for l_2 using m, M, m_0, l_1 and a for when the system is in equilibrium.

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ii) What is the precaution that has been used in this practical in order to measure l_1 and l_2 accurately?

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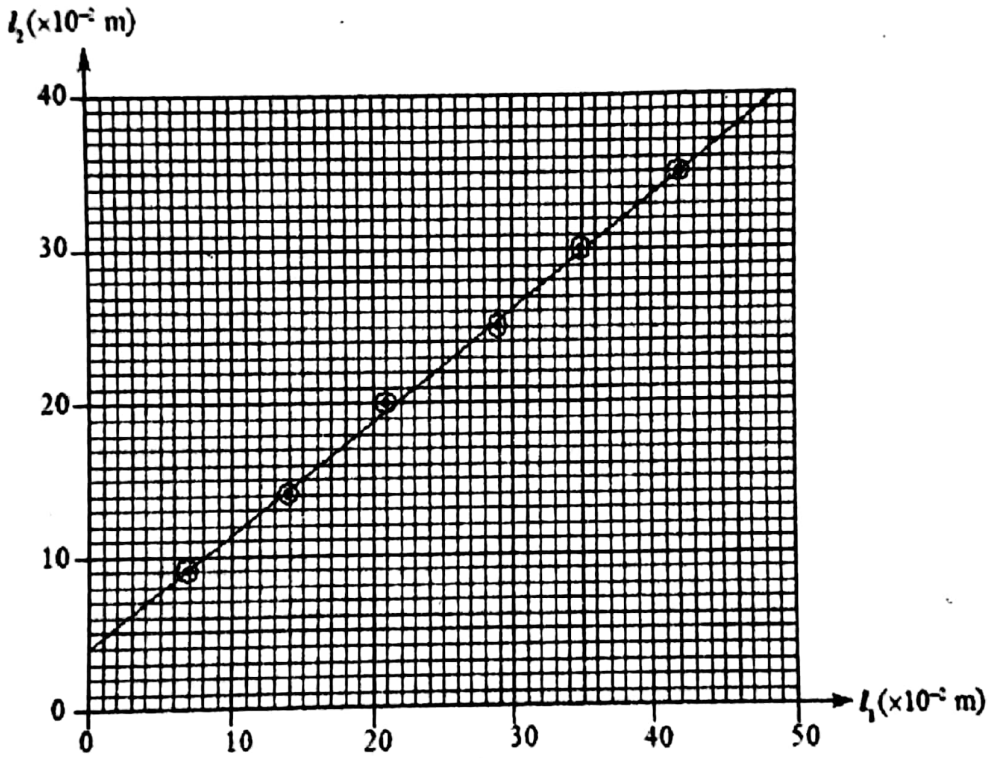
b) The graphs of l_1 vs l_2 has been drawn using 6 readings.



i) What is the method used in this practical to get 6 readings with a wide range?

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ii) Select two suitable points and mark them in the graph to find the gradient and find the value of the gradient.

.....

.....

iii) Find the mass M.

.....

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c) If the minimum distance that can be measured by the spherometer is 300 m, find the minimum distance between the two legs. (Consider 300 – 0.01 = 300)

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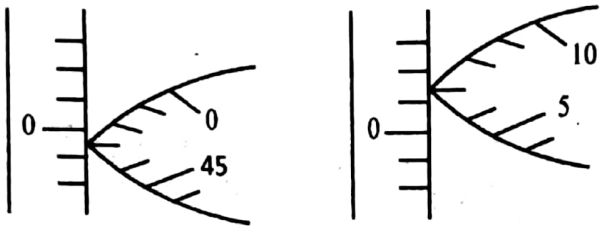
d) When finding the radius of a different sphere by using the above spherometer, the values obtained are given below.



i) Find the radius of the 2nd sphere by using the readings taken in c) and d).

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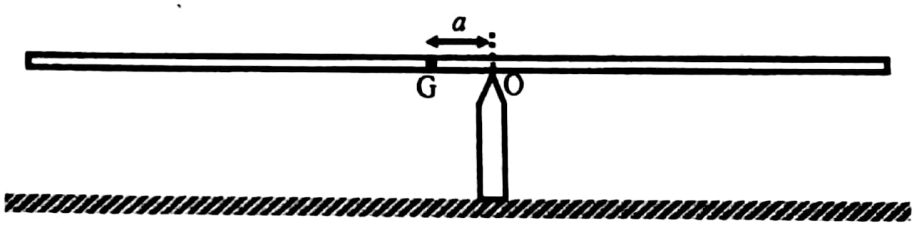
ii) Why is it not necessary to consider the zero error when taking a reading using a spherometer?

.....

2) A student must find the mass of an object (M) and the mass of the meter ruler (m_0) using the principle of moments. He was given a meter ruler, a knife edge, a weight of m(=50 g) and pieces of threads.

a) The meter ruler is balanced on a knife edge at a point 'O' instead of the centre of gravity (G) by using the weight of mass m on the left side and the object of mass M on the right side of the ruler. The lengths to the balanced positions from point 'o' are l_1 and l_2 respectively. The distance between 'O' and 'G' is 'a'.



iv) If a=2 cm, find the mass of the ruler (m_0).

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c) A student now balances the meter ruler on the knife edge by its centre of gravity (G) and hangs masses m and M as said in part (a) at balanced lengths l_1 and l_2 from the centre of gravity of the ruler and obtains another 6 readings. Draw is the expected shape of the graph in the above axes.

d) The balanced point of the meter ruler on the knife edge is 47 cm. If we hang a 50 g weight on one side of the ruler, what are the minimum and maximum masses needed to be hung on the other side in order to balance the ruler? (The minimum distance that the weight can be hung from the knife edge is 5 cm.)

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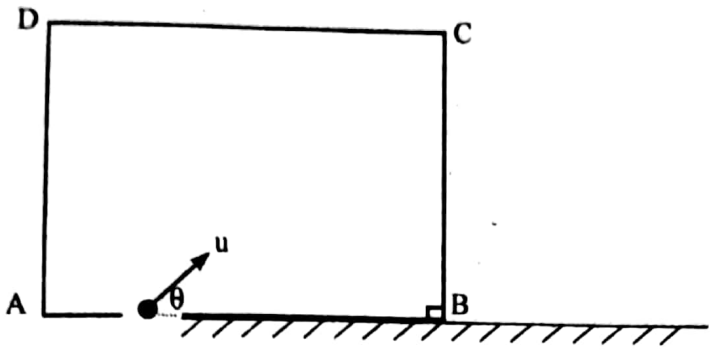
Part B – Essay

➢ Answer all the questions

03)



The figure shows a box (mass 0.6 kg) kept on a smooth horizontal surface. A ball of mass 0.2 kg enters into the box with a velocity u inclined with an angle θ to the horizontal, from a small hole in the box. After 0.2 s the ball moves in a direction 30^0 inclined to the horizontal, and after 0.3 s it reaches its maximum height and collides elastically on the BC surface. (consider $\sqrt{3} = 1.7$)

i) Draw the velocity – time and displacement – time graphs for the vertical and horizontal motions of the ball from the moment it enters the box till it collides on the BC surface.

ii) Find the velocity of the ball (u) when it enters from the hole.

iii) Find the horizontal distance between the hole and the BC surface.

iv) What is the vertical height from B to the point where the ball collides on the BC surface?

v) Find the velocity of the box and ball after collision

vi) What is the change in momentum of the BC surface of the box because of the collision?

vii) After the collision the ball moves towards AB surface. Draw the path of the ball till it collides again on AB surface.

(a) Observed by an observer on the earth

(b) Observed by an observer in the box

viii) If the time taken for the collision is 0.01s, find the developed force on box surface.

04) a) A rough inclined surface of dynamic coefficient of friction 0.5 is inclined with an angle 30^0 to the horizontal. A mass of 10 kg is kept on the inclined surface and by applying a force, it is moved upwards along the plane with an acceleration of $2ms^{-2}$. (consider $\sqrt{3} = 1.7$)

i) Find the dynamic frictional force acting on the object by the plane.

ii) Find the horizontal force required to be applied on the object for it to move upwards with an acceleration of 2 m s^{-2}.

iii) What is the kinetic energy gain by the object in 10 s if the force is applied for 10s?

iv) Find the increase in potential energy.

v) Find the work done by the frictional force.

vi) Find the work done by the external force.

b) A vehicle of mass 2×10^3 kg moves upwards along an inclined rough road starting from rest. It obtaining a velocity of 20 m s^{-1} after travelling 400 m.

The net resistance force exerted by the road on the vehicle is 1×10^3 N, and the vertical height gain by the vehicle by moving 100 m along the plane is 1 m.

i) Find the acceleration along the plane and the force given by the engine.

ii) Find the work done during the acceleration.

iii) After gaining the velocity of 20 m s^{-1}, the vehicle maintains this velocity for 10 minutes. Find the power of the engine when it is moving with a velocity of 20 m s^{-1}

iv) Find the work done by the engine when it is moving with a constant velocity

v) The efficiency of the engine is 80 % and the energy given by burning 1l of petrol is 2×10^6 J. find the volume of petrol required for the above motion.

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