FWC

தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்

முதலாம் தவணைப் பரீட்சை - 2022

Conducted by Field Work Centre, Thondaimanaru.

1st Term Examination - 2022

பௌதிகவியல் I Physics I	One Hour Gr -12 (2023)	01	E	I

Part – I

1. The unit of linear momentum, in terms of SI base units, is

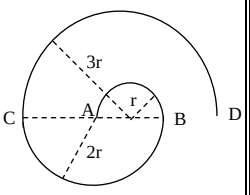
1) N s *2)* $kg\,m\,s^{-1}$ *3)* $kg\,m^2\,s^{-1}$ *4)* $N\,s^{-1}$ *5)* $kg\,m\,s^{-2}$

2. In the equation $v = K_1\,u\left(1+\frac{at}{K_2}\right)$, u and v represent velocity, t is the time and a is the acceleration. The dimensional formula for K_1 and K_2 are respectively.

1) $M^0\,L^0\,T^0$, $M^0\,L^0\,T^0$ *2)* $M^0\,L^0\,T^0$, $M^0\,L\,T^{-1}$ *3)* $M^0\,L\,T^{-1}$, $M^0\,L^0\,T^0$

4) $M^0\,L\,T^{-1}$, $M^0\,L\,T^{-1}$ *5)* $M^0\,L^{-1}\,T$, $M^0\,L^{-1}\,T^{-1}$

3. A vehicle moves along three semi circular arcs AB, BC and CD of radii r, 2r and 3r respectively at constant speed V (see the figure). The magnitude of the average velocity of its whole journey from A to D will be,



1) $\frac{3V}{2\pi}$ *2)* $\frac{2V}{3\pi}$ *3)* $\frac{2\pi V}{3}$ *4)* $\frac{3\pi}{2}$ *5)* V

4. Figures show the scale readings of a micrometer screw gauge when measuring the zero error (fig 1) and measuring the diameter of a thin wire (fig II). The accurate value of the diameter will be

1) 0.33 mm *2)* 0.77 mm

3) 0.83 mm *4)* 1.27 mm

5) 1.33 mm

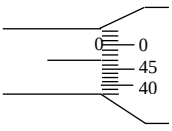


fig I

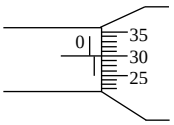
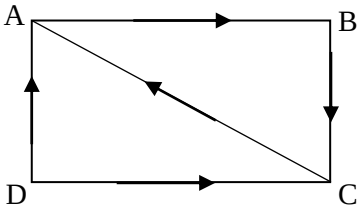


fig II

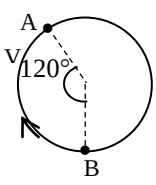
5. $\overrightarrow{AB}, \overrightarrow{BC}, \overrightarrow{DC}, \overrightarrow{DA}$ and $\overrightarrow{CA}$ are five vectors, represented both in magnitude and direction in the rectangle ABCD. The resultant of these vectors can be represented by

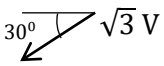


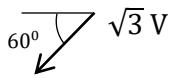
1) $\overrightarrow{AC}$ *2)* $\overrightarrow{BD}$ *3)* $\overrightarrow{AB}$

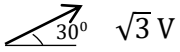
4) $\overrightarrow{CA}$ *5)* $\overrightarrow{DB}$

6. An object is moving in a circle at constant speed V as shown in the figure. The change in velocity of the object when moving from A to B is,



1) 

2) 

3) 

4) 

5) 0

7. A car accelerates from rest at a constant rate x for some time t_1, after which it decelerates at a constant rate y and comes to rest in a further time t_2. The total time elapsed is T. Consider the following statements.

A. $\frac{t_1}{t_2} = \frac{y}{x}$

B. The maximum speed acquired by the car is $\frac{xyT}{x+y}$.

C. The average velocity of the car during the periods of acceleration and the deceleration are the same.

Of the above statements,

1) Only A is true *2)* Only C is true *3)* Only A and B are true

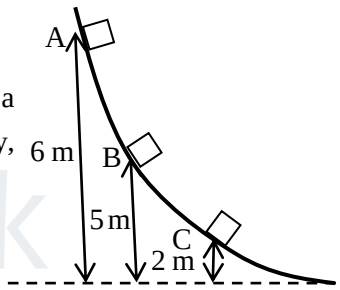
4) Only A and C are true *5)* All A, B and C are true

8. When two particles P and Q move towards each other along a straight line with constant speeds, they approach each other by 7 m in every second. When they move in the same direction along a straight line with their same initial speeds, they move away from each other by 3 m in every second. What are the speeds of P and Q?

1) $4\ m\ s^{-1}, 3\ m\ s^{-1}$ *2)* $4\ m\ s^{-1}, 2\ m\ s^{-1}$ *3)* $5\ m\ s^{-1}, 3\ m\ s^{-1}$

4) $5\ m\ s^{-1}, 2\ m\ s^{-1}$ *5)* $3\ m\ s^{-1}, 2\ m\ s^{-1}$

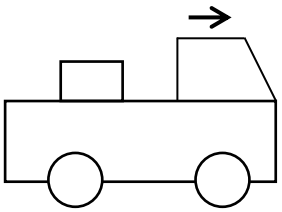
9. As shown in the figure a small object is released from rest at point A on a smooth track. If V_B and V_C are its speeds at points B and C respectively, the ratio $\frac{V_B}{V_C}$ is equal to



1) $\frac{1}{5}$ *2)* $\frac{1}{4}$ *3)* $\frac{1}{2}$

4) 2 *5)* 4

10. A truck is travelling horizontally to the right. When the truck starts to slow down, the crate on the (smooth) bed of the truck



1) Starts to slide to the left as the net force acts in the direction

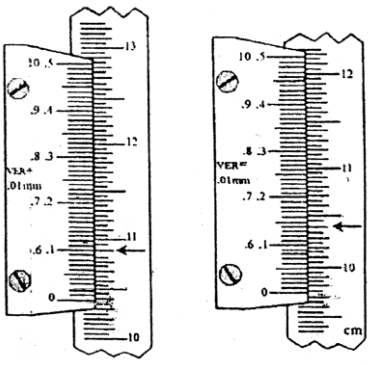
2) Starts to slide to the right as the net force acts in that direction

3) Will be at rest as there is no net force acting on it.

4) Starts to slide to the left as there is no net force acting on it.

5) Starts to slide to the right as there is no net force acting on it.

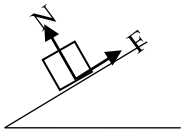
11. Figure shows the two readings taken by a student when the diameter of a rubber tube is measured. The diameter of the tube is

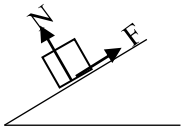


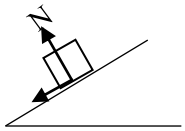
1) 0.56 mm *2)* 0.61 mm *3)* 3.86 mm

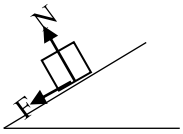
4) 5.96 mm *5)* 6.46 mm

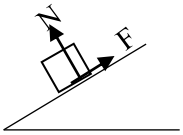
12. A uniform box is at rest on an inclined plane. Which of the following graphs best represents the friction force (F) and normal reaction (N) acting on the box?

1) 

2) 

3) 

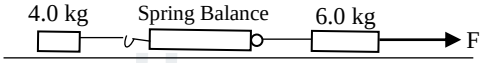
4) 

5) 

13. A truck moving with $10\ m\ s^{-1}$ has a head on collision with a small car moving with $20\ m\ s^{-1}$. Which statement best describes the situation?

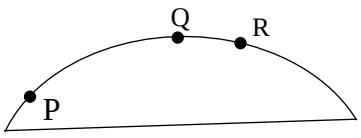
1) The truck has the greater change of momentum because it has the greater mass.
2) The car has the greater change of momentum because it has the greater speed.
3) Neither the car nor the truck changes its momentum in the collision because momentum is conserved.
4) They both have the same change in magnitude of momentum because momentum is conserved.
5) The change in momentum depends on whether the collision is elastic or inelastic

14. A block of mass 4.0 kg and a block of mass 6.0 kg are linked by a spring balance of mass 0.5 kg. The blocks are placed on a frictionless horizontal surface. When a force F is applied to the 6.0 kg block, the spring balance reads 7.2 N. What is the tension in the string that connects the spring balance and the block of mass 6.0 kg?



1) 0.9 N 2) 7.2 N 3) 8.1 N
4) 10.8 N 5) 18.9 N

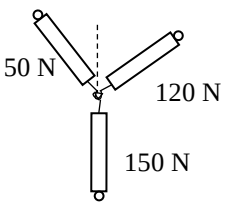
15. P, Q and R are three points on the path of a ball which is projected at an angle and moves under gravity. The air resistance on the ball is negligible. If V_P, V_Q and V_R are the speeds of the ball at the points P, Q and R respectively, the correct relationship among them is,



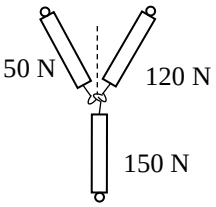
1) $V_P < V_Q < V_R$ 2) $V_P > V_R > V_Q$
3) $V_R < V_P < V_Q$ 4) $V_P < V_R < V_Q$ 5) $V_P = V_Q = V_R$

16. Figures A, B and C show three forces of magnitudes 50 N, 120 N and 150 N acting at a point. The forces keep the point in equilibrium in

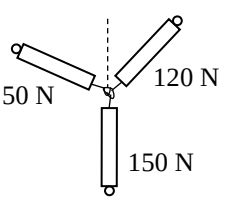
1) A only 2) B only
3) C only 4) A, C only
5) B, C only



(A)



(B)



(C)

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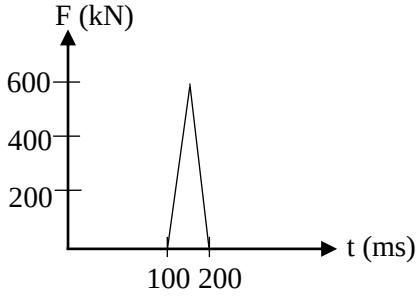
17. A machine gun has a mass of 5 kg. It fires 50 g bullets at the rate of 30 bullets per minute at a speed of 400 $m\,s^{-1}$. Force required to keep the gun in position is.

1) 5 N *2)* 10 N *3)* 15 N *4)* 20 N *5)* 30 N

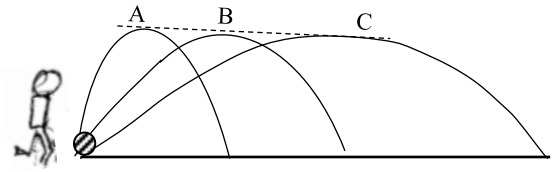
18. A force – time graph for a car crash can be approximated as shown in the figure. If the mass of the car is 1500 kg, what was its speed immediately before collision?

1) $10\,m\,s^{-1}$ *2)* $15\,m\,s^{-1}$ *3)* $20\,m\,s^{-1}$

4) $25\,m\,s^{-1}$ *5)* $30\,m\,s^{-1}$



19. Figure shows three kicks in the air, all reaching the same height. Air resistance could be neglected. Consider the following statements.



A. Time of flight for all the three kicks are the same.

B. Vertical components of initial velocities are the same for all the three kicks.

C. Horizontal component of initial velocity is greatest for C.

Which of the above statements is / are true.

1) B only *2)* C only *3)* A, B only

4) B, C only 5) A, B, C all.

20. A mass m is moving horizontally along a frictionless floor with velocity v. The mass now enters a part of the floor that has the coefficient of kinetic friction given by μ. The total distance travelled by the mass before it is slowed by friction to a stop is given by

1) $\frac{2\,V^2}{\mu\,g}$ *2)* $\frac{V^2}{2\,\mu\,g}$ *3)* $2\,\mu g v^2$ *4)* $\frac{\mu\,V^2}{2\,g}$ *5)* $\mu\,v\,g$

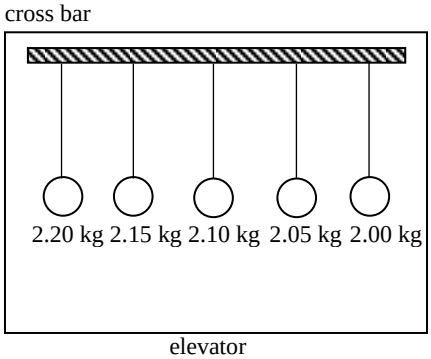
21. A ball is dropped from the top of a building of height h at time t = 0. If this ball reached the ground in time T, the height of the ball from the ground at time t = $\frac{T}{2}$ is,

1) $\frac{h}{8}$ *2)* $\frac{h}{4}$ *3)* $\frac{h}{3}$ *4)* $\frac{h}{2}$ *5)* $\frac{3h}{4}$

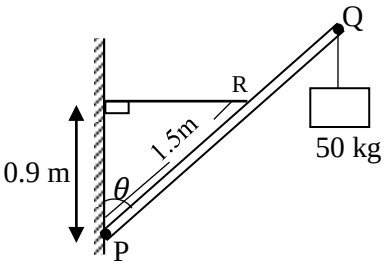
22. As shown in the figure, five balls (masses 2.00, 2.05, 2.10, 2.15 and 2.20 kg) are hung from a cross bar by five identical cords which can withstand a maximum tension of 22.5 N. When this device is attached to the roof of an elevator which accelerates uniformly in the upward direction, only the rope attached to the 2.00 kg mass does not break. The value of acceleration of the elevator can be

1) $0.4\,m\,s^{-2}$ *2)* $0.5\,m\,s^{-2}$ *3)* $0.8\ m\,s^{-2}$

4) $1.0\,m\,s^{-2}$ *5)* $1.3\,m\,s^{-2}$

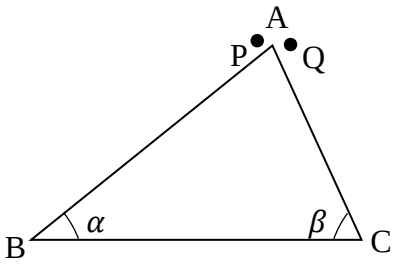


23. One end of a uniform pole of length 2.7 m and negligible mass is pivoted to a vertical wall at a point P. A rope tied to the pole at a distance 1.5 m from P is connected to a point on the wall 0.9 m vertically above P. A Load of 50 kg is supported at the free end of the pole as shown in the figure. The force exerted on the pole by the pivot at P is



1) 400 N *2)* 500 N *3)* 900 N
4) 1300 N *5)* 1700 N

24. ABC is a smooth, fixed wedge. Two small masses P and Q are released simultaneously at time t = 0 from rest along AB and AC respectively. The time taken by them to reach the bottom of the wedge are t_P and t_Q respectively. Their respective accelerations along the slope are a_P and a_Q. They reach the bottom with speeds V_P and V_Q respectively. Consider the following relationships



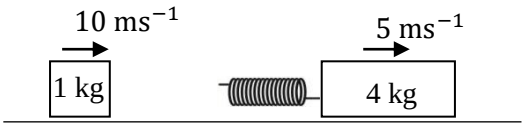
A. $a_P = a_Q$ B. $t_P = t_Q$ C. $V_P = V_Q$

Which of the above is / are correct.

1) A, B only *2)* B, C only *3)* B only *4)* C only *5)* A, B, C all.

25. Two blocks with masses 1 kg and 4 kg, respectively are, moving on a horizontal frictionless surface as shown in the figure. The 1 kg block has a velocity of $10\ m\ s^{-1}$ and the 4 kg block is ahead of it, moving at $5\ m\ s^{-1}$, as shown in the figure. The 4 kg block has a massless spring attached to the end facing the 1 kg block. If the spring has a force constant k equal to $1280\ N\ m^{-1}$ the maximum compression of the spring after collision will be (in cm)

1) 0.125 2) 4 3) 6.25
4) 8 5) 12.5



FWC

தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்
முதலாம் தவணைப் பரீட்சை - 2022
Conducted by Field Work Centre, Thondaimanaru.
1st Term Examination - 2022

பௌதிகவியல் - II A Physics - II A	Two Hours 10 min Gr -12 (2023)	01	E	II A

Part - II

Structured Essay

✶ Answer **all four** questions on this paper itself.

01.

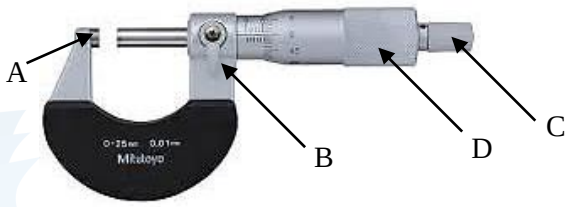
(i) Name the parts A, B, C, D of the micro screw gauge.

A :- ……

B :- ……

C :- ……

D :- ……



(ii) When the thimble of this micro screw gauge is screwed 10 times the circular scale on the main scale moves 5 mm. There are 50 divisions of the circular scale. What is the least count of this equipment?

……

(iii) What is the range of the scale of the micro screw gauge in the laboratory?

……

(iv)

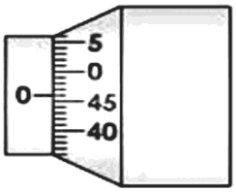


figure 1

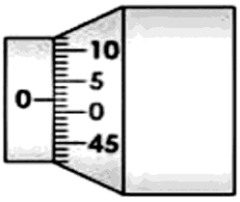


figure 2

I. Above figures show that the readings when the anvil and spindle contact each other of the different micro screw gauges.

a) What is the zero error in figure 1?

……

……

b) What is the zero error in figure 2?

……

……

(v) What should be done to get the actual reading, with zero errors and signs, to add or to subtract above?

A :- …… B :- ……

(vi) What are the situations question (IV) given above readings (zero errors) which you mentioned?

……

……

(vii) What is the minimum length that can be measured with a fractional error of less than 1% the least count 0.01 mm micro screw gauge?

……

(viii) When you determine the radius for a rod what is the reading you can measure by using the equipment? What is the Practical method to reduce the random error in this situation?

……

……

(ix) Micro screw gauge and spherometer given to you for measure the real thickness of a square plate having one side length 10 cm and range of thickness approximately 2mm -3mm.

a) What is the suitable equipment from these equipment for measure the real thickness?

……

b) What is the reason for other equipment cannot be used to this measuring?

……

02. Determine the volume of the material of a uniform capillary tube with a length of approximately 10 cm. A travelling microscope is used for this.

a) (i) Specify the following parts of the picture in alphabet letters.

1. Vertical main scale - A
2. Horizontal fine adjustment screw – B
3. Objective lens – C
4. The screw that changes the direction of the microscope – D

(ii) Length of a main division of the given microscope is 0.5 mm. If the 49 divisions of main scale are divided by 50 vernier divisions. What is the least count of the equipment?

……..

b) How to fit the capillary tube to get the reading for the diameter.

…….....

c) Give the practical steps to obtain the active length (Focusing length) of the travelling microscope?

…….....

…….....

d) How to use the length, when you are observing the cross-section of the capillary tube.

…….....

…….....

e) The cross section of the capillary tube is shown in the figure. Draw the positions of cross wires when taking the readings using the horizontal scale for the outer diameter?

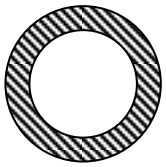
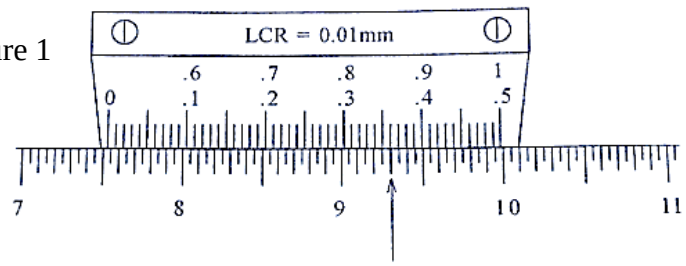


Figure 1



f) The figure shows the positions of the main scale and the vernier scale when observing a reading in part (c) above. What is the reading for this?

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i) If another reading obtained in part (e) above is $69 \times 36\ mm$, find the outer diameter D?

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ii) Give the expression for the cross section of the material of capillary tube in terms of D, d. if the magnitude of inner diameter d.

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iii) If measurements of 16.45 mm and 114.95 mm are obtained when measuring the length of the capillary tube, find the length of the capillary tube?

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iv) If the inner diameter of the capillary tube is 3 mm, determine the volume of the material of capillary tube? (Assume that $\pi = 3$.)

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03. You have been asked to determine the mass of a stone using law of parallelogram in laboratory.

(a) Write down the law of parallelogram in words.

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(b) Write down the expression for the resultant force R which the two forces P, Q are acting on an object with an angle θ.

States when obtained the maximum and minimum resultant for θ and write down the expressions separately for those values.

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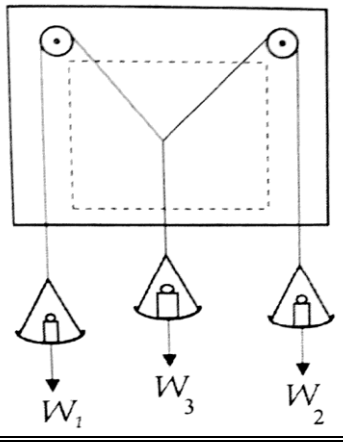
(c)

20 g, 30 g weights are using as weights W_1, W_2 and a stone is placed for W_3 and system become equilibrium as shown in figure.



(i) What do you have to do for the practical method before mark on the white sheet of strings positions?

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……

(ii) What is the purpose for the above (C) (I) practical method?

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(iii) What are the needful other equipment for complete this practical?

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(d) After correcting the errors occurred in practical which are in above part (C), are marking the positions of strings on a white sheet.

(i) How can you mark string position correctly?

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(ii) Write down the geometrical steps in order to draw the parallelogram after remove the white sheet from the board.

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(iii) Find the mass of the stone if the angle between W_1, W_2 is 45^0 after drawn the parallelogram.

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(e) What are the reasons for the difference between the mass of the stone calculated value and measured value by using the balance?

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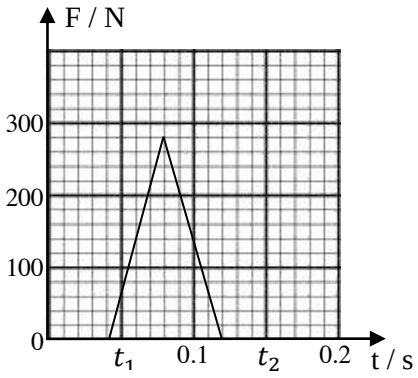
04. (a) A ball weighing 0.61 kg travels straight at 35 ms^{-1} and is hit by a bat and travels in the opposite direction. Variation of force applied on the ball versus time is shown in the figure.



(i) What is the magnitude of momentum of the ball before it hit by the bat?

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(ii) What is the impulse applied on the ball? How did you get it?

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(iii) Determine the average force exerted on the ball when it contacts with the bat.

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(iv) Find the speed of the ball just after it hit by the bat.

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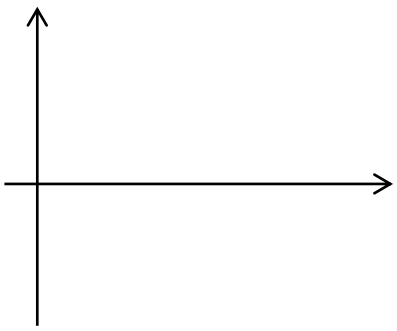
(v) Draw an approximate velocity – time graph when the time interval is from t_1 to t_2. (Consider the initial direction of the ball is positive (+)) Indicate the initial and final velocities of the ball and the corresponding time on the speed axis and time axis respectively.



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(b) An athlete weighing 50 kg exerts a force on the ground for 0.1 seconds and jumps 0.2 m to catch the ball.

(i) Determine the maximum speed of the athlete when exiting the ground.

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……

……

(ii) Find the average acceleration of the athlete when the time interval is 0.1 s.

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(iii) Find the average force exerted by an athlete on the ground.

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(iv) What is the initial kinetic energy of the athlete?

……

(v) What is the power of the athlete?

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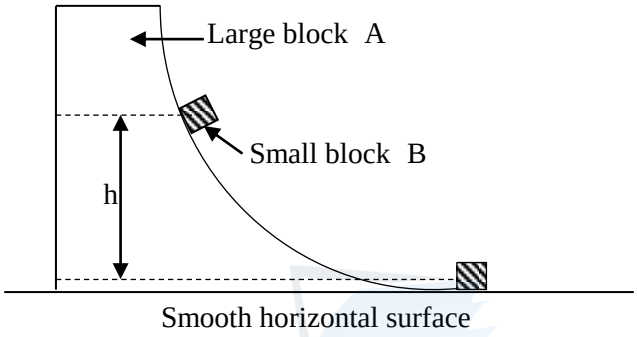
FWC

தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்
முதலாம் தவணைப் பரீட்சை - 2022
Conducted by Field Work Centre, Thondaimanaru.
1st Term Examination - 2022

பௌதிகவியல் - II B Physics - II B	Gr -12 (2023)	01	T	II B

பகுதி – II B

1)



The large wooden block A with mass M is placed on the horizontal smooth surface, while the small wooden block B with mass m is placed on block A as shown in the figure. Block B slides down from rest on the smooth surface of Block A.

a) Assume that the wooden block A is fixed when you answer to this part.
   (i) Draw the free force diagram of the system.
   (ii) What is the velocity (V_0) of the block B when exiting horizontally from A?
   (iii) Does the work on block B by the normal reaction which is acting on the block B by the curve surface of block A?

b) Assume that the wooden block A can moves freely as you answer to this part.
   (i) Find the speed of block B in terms of V using the conservation of momentum, If the speed of the block A is V when the block B exiting from A.
   (ii) Determine the expression for V in terms of m, M, h, g.
   (iii) Does the work on block A by the normal reaction which is acting on the block A by the block B on the curve surface.

c) Now a small block having mass m is thrown with velocity U on the large block as shown in the figure.

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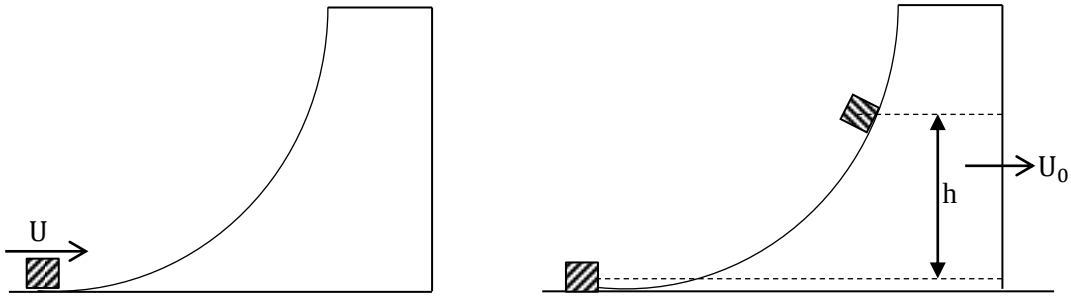

Initial stage Final stage

(i) Determine the initial kinetic energy of the system.

(ii) Find the following when small block reaches the maximum height,

a) Velocity in vertical direction

b) Horizontal velocity of small wooden block relative to large wooden block

(iii) Consider, U_0 is the horizontal velocity of the large wooden block when it reaches its maximum Height. Determine the relationship between U_0, U.

(iv) Find the maximum Height of the small block (h_0) on the large block in terms of U, M, m, g.

(All the surfaces are smooth. The large block cannot be flipped and both small and large blocks are move freely)

2) A balance works by using the physical principles of equilibrium and moment of force.

a) (i) Give the conditions for the equilibrium of a system.

(ii) State the principle of moments.

b) The experimental setups for determine the unknown mass m by using the known mass M are shown in figures (a) and (b). The masses are hung on a uniform beam using weightless strings and both setups are in equilibrium.

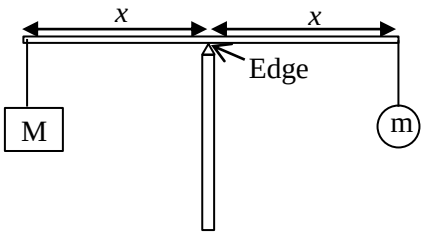

figure (a)

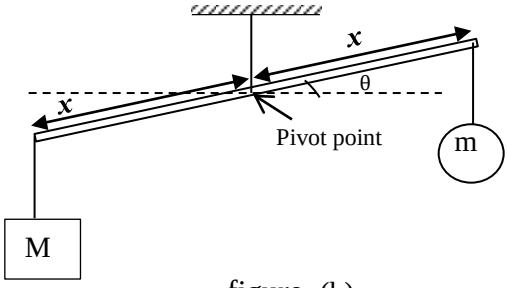

figure (b)

(i) Copy the figure (a) in your answer sheet indicates and name the forces act.

(ii) Find the direction and magnitude of the reaction force which is acting by the edge in figure (a)

(iii) Write down the expression to find the unknown mass m in figure (a).

(iv) Write down the expression to find the unknown mass m in figure (b)

c) Figure (c) and figure (d) shows the Beam balance with no mass and with unequal masses, respectively. Pan of the balance hangs by three chains while the angle which the chain with vertical axis is 30^0. Mass of a pan of the balance is m'. Center of mass of the beam is 4 cm downward from the pivot point.

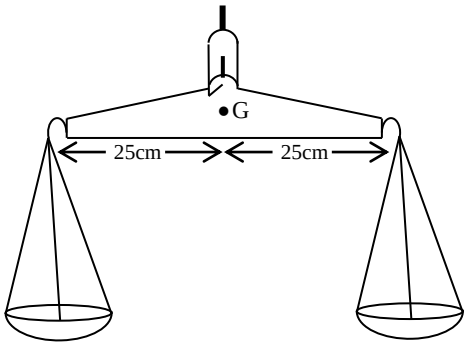

figure (c)

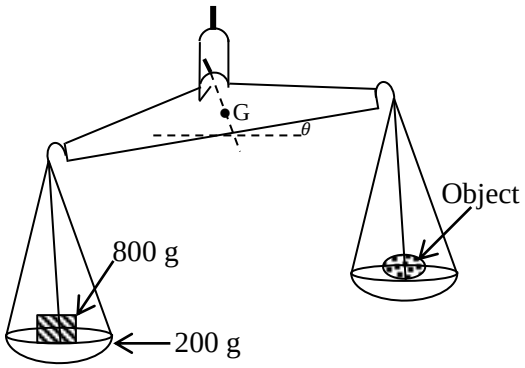

figure (d)

(i) Find the force acting on a chain in terms of m' in figure (c).

(ii) Find the magnitude of the moment due to mass of the beam if mass of the beam is 100 g and angle of the beam in figure (d) is 5.74^0.(sin 5.74^0=0.1)

(iii) Determine the mass of the object if mass of a pan of the balance is 200 g and mass of weights is 800 g. (cos $5.74^0 \approx 1$)

(iv) What is the benefit of that pivot point is not in the center of mass of the beam?

3) a) A Rocket having a mass $5 \times 10^5\ kg$ is launching with a constant acceleration in upward direction due to an exert force by burning the liquid fuel pushing out continuously with a constant rate. At the same time that the rocket reaches an altitude of 1 km in 40 seconds an object A immediately falls freely from the rocket (Neglect the mass of combusted fuel)

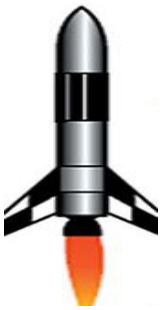

figure 01

I. Write down the name and denote the forces acting on the rockets. (Copy the given figure 01 for the purpose)

II. Find the acceleration of the rocket.

III. Determine the exert force on the rocket by the burning the fuel.

IV. Find the following when the object A instantly started to falling down.

i. Velocity of rocket with respect to earth.

ii. Velocity of object A with respect to earth.

iii. Velocity of object A with respect to rocket.

V. Draw the approximate diagram for the path of the object A with respect to earth to reaches the ground.

VI. Find the time taken for the object A to reaches the ground.

VII. Find the velocity of object A when reaches the ground?

VIII. Draw the velocity time graph for object A, from the rocket launch until the object reaches the ground. (Assume upward direction is positive (+))

b) Consider the object A is throwing towards the ground with the velocity of 50 ms^{-1} which is relative to rocket and other conditions in the above question (a) are same. Answer the following questions. $(\sqrt{2} = 1.4)$

I. Find the initial relative velocity of object A with respect to earth.

II. Find the time taken for the object A to reach the ground

III. Find the velocity of object A when it reaches the ground.