Provincial Department of Education, Northern Province

First term Examination – 2024

Physics

Grade 12 (2025 Batch)

T **01** I

Time: - 3 hours 10 minutes

Instructions:

- Answer **all** questions.
- In each of the questions 1 – 25, pick one of the alternatives from (1), (2), (3), (4) and (5) which is **correct** or **most appropriate** and **mark your response on the answer sheet** with a **cross (X) on the number of the correct option.**
- **Use of calculators is not allowed.**

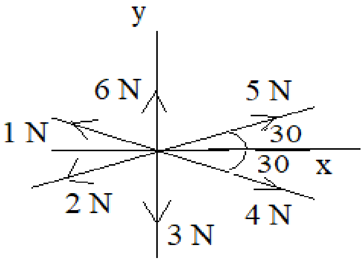
$(g = 10\ \text{m s}^{-2})$

1. Which one of the following SI unit of fundamental quantities?
   (1) mass (2) meter (3) time (4) Current electricity (5) Newton

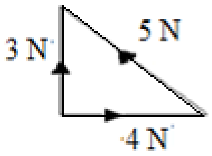
2. A certain vernier scale is constructed by dividing 24 divisions of the main scale which is calibrated in 0.5 mm divisions, into 25 equal divisions. The least count of the instrument is
   (1) 0.10 mm (2) 0.04 mm (3) 0.01 mm (4) 0.05 mm (5) 0.02 mm

3. A car moves along straight line from rest with constant acceleration. It covers a distance of 125 m in 13th second. What is the acceleration of car?
   (1) $1.4\ \text{m s}^{-2}$ (2) $1.5\ \text{m s}^{-2}$ (3) $10\ \text{m s}^{-2}$ (4) $14\ \text{m s}^{-2}$ (5) $15\ \text{m s}^{-2}$

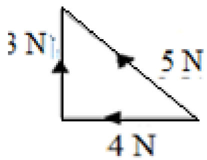
4. Six coplanar forces (6 N, 5 N, 4 N, 3 N, 2 N, 1 N) act in friction less horizontal plane on a particle of mass 0.5 kg as shown in the figure. Find the acceleration of particle?
   ($\text{Cos } 30^0 = \frac{\sqrt{3}}{2}$, $\text{Sin } 30^0 = 0.5$)
   (1) $10\ \text{m s}^{-2}$ (2) $14\ \text{m s}^{-2}$ (3) $20\ \text{m s}^{-2}$ (4) $12\ \text{m s}^{-2}$ (5) $18\ \text{m s}^{-2}$



5. Which of the following diagrams vector addition of two forces 4 N and 3 N represent in triangle correctly?



(1)



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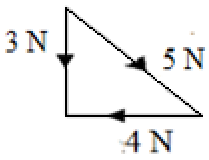

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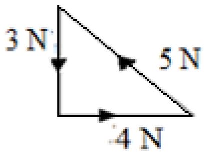

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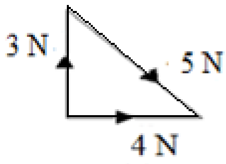


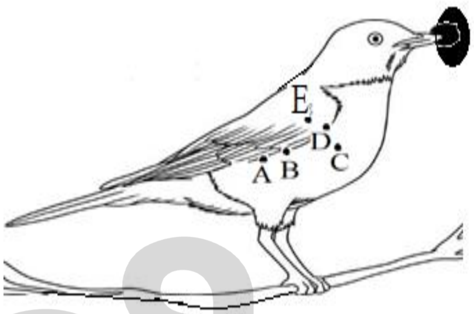
(5)

6. What force acts on a 20 g bullet travelling horizontally at velocity of 300 m s^{-1} and penetrate into a plank of fixed wooden to a depth of 10 cm with constant acceleration?
(1) 7000 N (2) 6000 N (3) 8000 N (4) 9000 N
(5) 2500 N

7. A physical quantity is represented by Q = $X^{\alpha} \div Y^{\beta}$. If percentage error in the measurement of X and Y are γ % and δ % respectively. Then the total percentage error of Q is

(1) $(\alpha\gamma - \beta\delta)$ % (2) $(\alpha\gamma + \beta\delta)$ % (3) $(\alpha^{\gamma} + \beta^{\delta})$ % (4) $(\alpha + \gamma + \beta + \delta)$ % (5) $(\alpha\gamma/\beta\delta)$ %

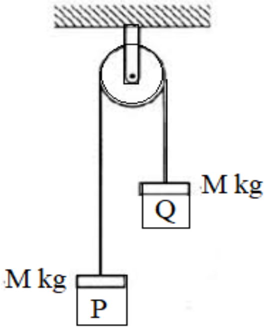
8. Bird holds heavy object on its mouth as shown in the figure. Where is the most possible of center of mass of bird **only** in given points A, B, C, D and E of the bird?
(1) A (2) B (3) C (4) D
(5) E



9. A particle moving with constant acceleration from A to B along in a straight line AB has velocities u and v at points of A and B respectively. Find the velocity of a particle in the mid-point of AB is

(1) $\frac{2uv}{u+v}$ (2) $\sqrt{\frac{v^2-u^2}{2}}$ (3) $\sqrt{\frac{uv}{2}}$ (4) $\frac{u+v}{2}$ (5) $\sqrt{\frac{u^2+v^2}{2}}$

10. Two equal masses P (M kg) and Q (M kg) are attached to a light inextensible string passing over a smooth light pulley as shown in the diagram. The mass P is moved down, held it stationary and then released it, which of the stements is correct?



(1) Mass P moves downwards with constant acceleration.
(2) Mass P moves upwards with constant velocity.
(3) Masses never move due to first law of Newton.
(4) Mass P moves upwards with constant acceleration.
(5) Mass Q moves upwards with constant velocity short time and then come to rest.

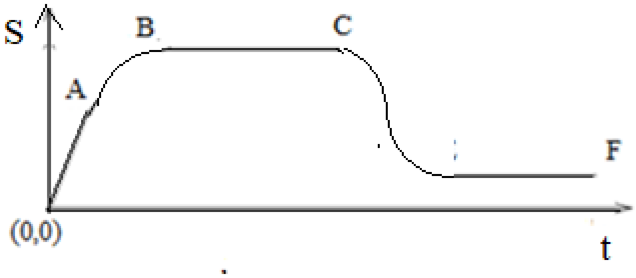
11. Two cars are moving front and back in the same direction with the speed 30 km h^{-1} in a straight line from left to right. They are separated by a distance of 5 km each other, Find the speed of 3rd car moving in the opposite direction from right to left in same parallel way, if it meets these two cars at an interval of four minutes, will be?

(1) 40 km h^{-1} (2) 45 km h^{-1} (3) 50 km h^{-1} (4) 55 km h^{-1} (5) 0 km h^{-1}

12. An engine pump m kg of water through a height of h m in t s. The efficiency of the is 80 %. If the power of engine P, find the correct relation?

(1) $P = \frac{mgh}{8\,t}$ (2) $P = \frac{mgh}{t}$ (3) $P = \frac{5\,mgh}{4t}$ (4) $P = \frac{4mgh}{5\,t}$ (5) $P = \frac{8\,mgh}{t}$

13. Figure shows displacement (s) versus time (t) curve for a motion of a particle. Which of following statement is **not** correct?



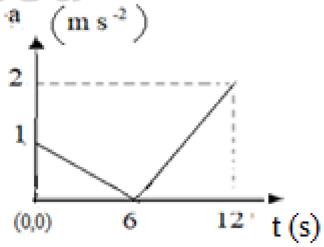
(1) Particle moves uniform velocity from O to A.
(2) Particle moves deceleration from A to B.
(3) Particle at rest from B to C only.
(4) Particle turns back at C.
(5) Particle moves from C to D with an acceleration in the negative direction.

14. A stone is dropped from window of a bus moving at 60 km h^{-1} . If the window is 1.80 m high, Find the distance along the track, which the stone moves before striking the ground?

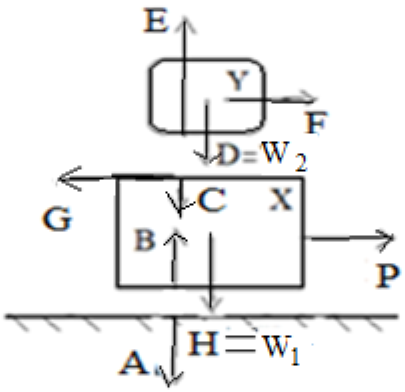
(1) 11 m (2) 12 m (3) 15 m (4) 18 m (5) 10 m

15. The acceleration a (m s^{-2}) verses time t (s) graph of a particle of the leaner motion is shown in figure. Find the velocity at 12 s and initial velocity of particle is 5 m s^{-1}?

(1) 14 m s^{-1} (2) 15 m s^{-1} (3) 20 m s^{-1}
(4) 11 m s^{-1} (5) 45 m s^{-1}

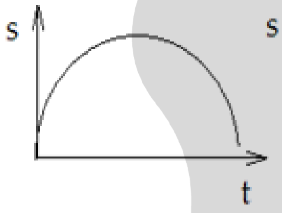


16. A block of Y weight W_2 is kept on another block X of weight W_1 on a smooth horizontal surface. The block X is pulled by a force P and the free body diagram of the system is shown in the figure. Out of forces marked on the diagram what could be considered as action – reaction.

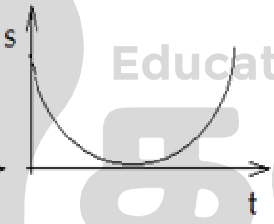


(1) E and D , A and B (2) E and C , B and H
(3) E and C , F and G (4) C and E , A and B (5) E and D , H and B

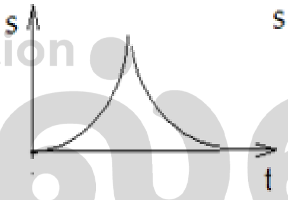
17. An object dropped from a height h bounces back from the floor a height h which of the following displacement (s) versus time (t) graphs best represents the motion of the object. (Displacement is measured from the floor and the upward direction as positive)



(1)



(2)



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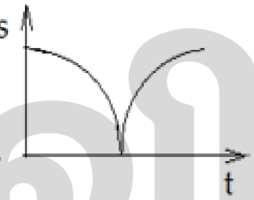
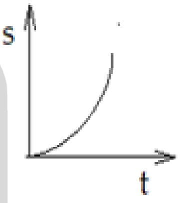
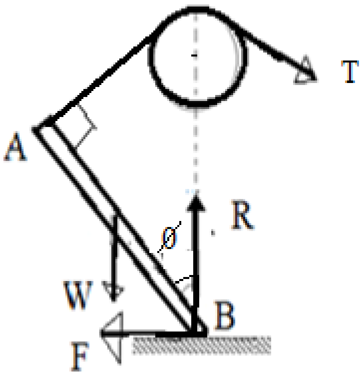


(4)



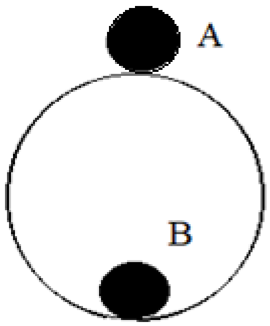
(5)

18. A uniform rod AB of weight W is raised in vertical equilibrium by pulling the rope of T, which passes over frictional less pulley and the tip of the rope tied at A is perpendicular to the rod AB. (R and F are reaction force and frictional force by surface). Which of following statement is **not** correct?



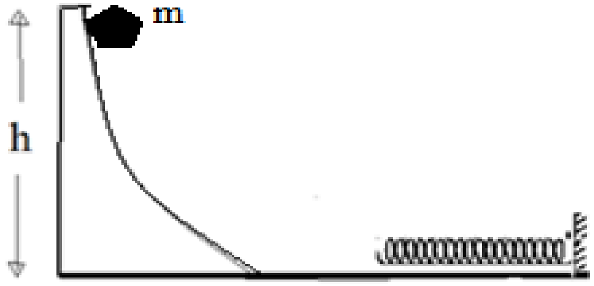
(1) $T \text{ Sin}\theta < W$
(2) $2\,T > W$
(3) $F < T$
(4) $2F = W \text{ Sin}\theta \text{ Cos}\,\theta$
(5) Resultant force of rod AB is zero

19. The uniform balls A and B both are kept at the inside bottom and top out of sphere of hemisphere. Which type of equilibriums of balls A and B respectively



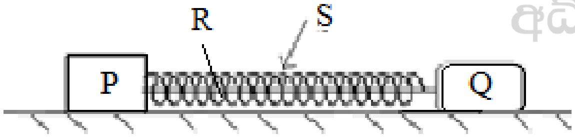
(1) Unstable equilibrium, Stable equilibrium.
(2) Stable equilibrium and neutral equilibrium.
(3) Stable equilibrium and unstable equilibrium.
(4) Unstable equilibrium and neutral equilibrium.
(5) Neutral equilibrium and stable equilibrium.

20. A block of mass is released from a height h from the top of a smooth of the surface. There is an ideal spring constant k at the bottom of the track. find the maximum compression in the spring (Wedge is fixed)



(1) $\sqrt{\frac{mgh}{2\,k}}$ (2) $\sqrt{\frac{mgh}{k}}$
(3) $\sqrt{\frac{2\,mgh}{k}}$ (4) $\sqrt{\frac{4\,mgh}{k}}$
(5) $\sqrt{\frac{2\,mgh}{3k}}$

21. P and Q of masses M, m (M > m) are kept on a smooth horizontal floor. The blocks are attached to the ends compressed light spring S, and are held stationary by a string R. When the string R is cut,



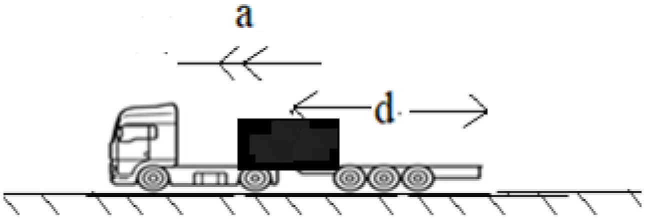
(A) The forces on the blocks exert spring are equal.
(B) The kinetic of energy of particles P and Q are same.
(C) The linear momentum of particles P and Q are same.
Of the above statement.

(1) Only (A) is true (2) Only (A)and (C) are true
(3) Only (B) and (C) are true (4) all (A), (B), (C) are true
(5) all (A), (B), (C) are false

22. Consider a perfectly-inelastic head-on collision between two particles that have equal masses and equal speeds which of the following correctly describes the velocities of the two particles after the collision?
(1) Both of their velocities are reversed.
(2) The velocities of both particles are zero.
(3) One of the particles continues with the same velocity and the other reverses direction at twice the speed.

(4) One of the particles continues with the same velocity and the other comes to rest.
(5) Both of their velocities are not reversed.

23. The rear side of truck is open and a block of mass is placed at a distance d from the open end as shown in the figure and coefficient of dynamic friction is μ between objet and truck bed. Find the time taken by the block to cover the distance d when the truck moves constant acceleration a?



(1) $\sqrt{\frac{2\,d}{\mu g}}$ (2) $\sqrt{\frac{d}{a-\mu g}}$ (3) $\sqrt{\frac{2\,d}{a-\mu g}}$ (4) $\sqrt{\frac{d}{\mu g}}$ (5) $\sqrt{\frac{4d}{a-\mu g}}$

24. The figure x shows that the object pulls with variable horizontal force P when an object is placed on a rough horizontal surface. The limiting frictional force F_0. Which of the following curve correctly represents the variation of frictional force F with time t?

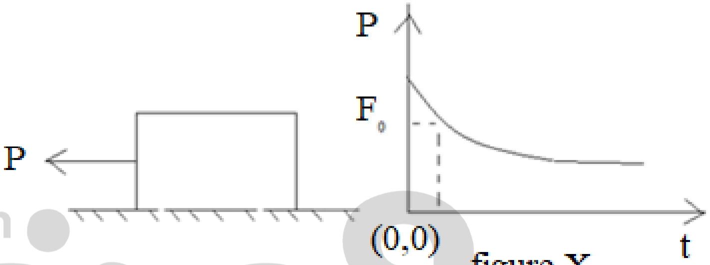
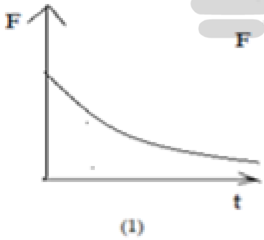
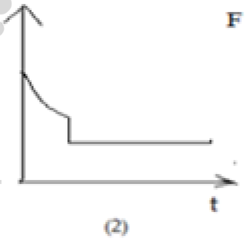
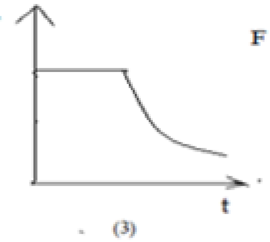
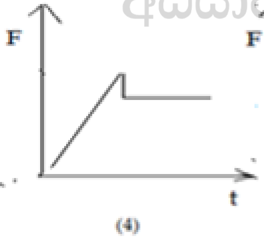


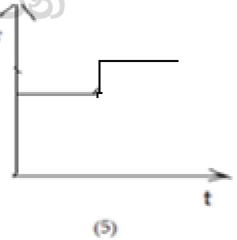
figure X



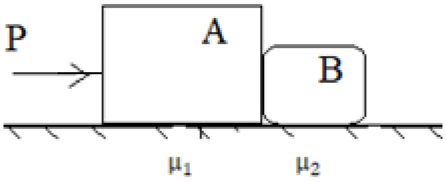








25. Two blocks A and B of equal masses M are placed in contact on a table as shown in the figure. If an external horizontal force P is applied on the block of A. Find the force of reaction between the blocks? Where μ_1, μ_2 $(\mu_1 < \mu_2)$ are the coefficients of dynamic friction of the blocks A and B with the horizontal surface respectively?



(1) $\frac{P+2\,\mu_2\mu_1\,Mg}{2}$ (2) $\frac{P-(\mu_2-\mu_1)\,Mg}{4}$ (3) $\frac{P+(\mu_2-\mu_1)\,Mg}{4}$

(4) $\frac{P+(\mu_2-\mu_1)\,Mg}{2}$ (5) $\frac{P+\mu_2\mu_1\,Mg}{4}$

Provincial Department of Education
Northern Province
1st Term Examination - 2024

Physics

T **01** **II**

Grade - 12 (2025 Batch)

Part II

Index No : …………...……

Use additional reading time to go through the questions paper, select the questions you will answer and decide which of them you will priorities.

- This paper consists of two parts A and B. Time provided to answer these two parts is two hours.
- Use of calculator is not allowed.

Part (A) [Structured Essay] (Page 08-13)

- Answer all the questions on this paper itself.
- Write your answer in the space provided for each question. Please note that the space provided is sufficient for the answer and that extensive answers are not expected.

Part (B) [Essay] (Page 14-17)

- This part contains three questions of which two are to be answered.

At the end of the time allocated for this paper, part A & B together so that MCQ cross-sheet is on the top of part A before handling them over to the supervisor.

You are permitted to remove only part B of the question paper from the examination hall.

For Examiner's Use Only

Part	Question No	Marks
A	01	
	02	
	03	
	04	
B	05	
	06	
	07	
Total		

Total Marks

Part I	
Part II	
Total (in numbers)	
Total (in letters)	

PART (A) - Structured Essay

Answer all four questions on this paper itself

(g =10NKg^{-1})

(01) A spherometer used in our laboratory is shown in the figure (1) The number of circular divisions is 50. The circular scale moves linearly through 1 mm over the vertical scale when it completes two rotations.

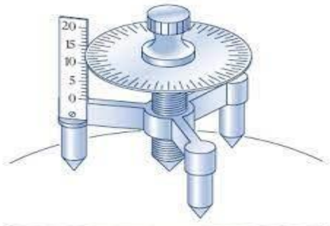


Figure (1)

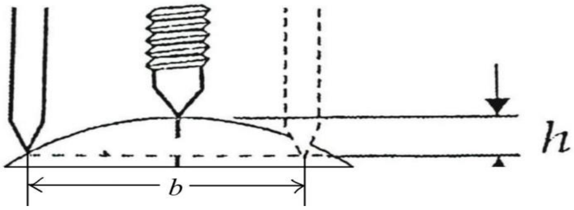


Figure (2)

The spherometer is used to find out the radius of curvature of a plano convex lens. It is placed on the curved surface of the convex lens as shown in the figure (2). The measurements h and b shown in the figure (2) are meaured then the radius of curvature R is calculated by using the following formula. $R = \frac{b^2}{6h} + \frac{h}{2}$

(a) Find the least count of the spherometer.

……………………………………………………………………………………………………

(b) (i) Before placing the spherometer on the curved surface , it has to be adjusted by placing it on a flat glass plate . How would you experimentally make sure that the tip of the screw just touches the glass plate.

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(ii) In Part b(i), A student states that a plane mirror can be used instead of using plane glass. Is the statement is correct or wrong? Explain.

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(c) (i) After the adjustment mentioned in part b(i) the spherometer is placed on the curved surface of the lens. What is the adjustment that has to be done before placing on the lens?

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(ii) What is the adjustment that has to be done before finding the measurement h ?

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(iii)

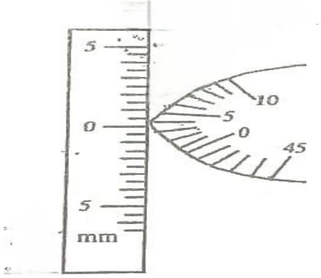

Figure (3)

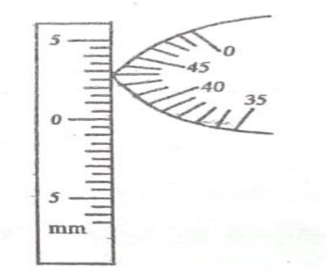

Figure (4)

Figure (3) and figure (4) show the positions of the division of the spherometer for the reading mentioned in part b(i) and part c (i) respectively. Find the value of the raised distance h of the centre screw.

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(d) The distance between the tips of outer legs should be measured to find R.

(i) What is the instrument which is used to measure the distance between the outer legs?

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(ii) What experimental steps that should be followed to find the measurement b?

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(iii) The distances between the outer legs are obtained as 4.02 cm , 3.98 cm and 4.03 cm. Find the mean value of the measurement b?

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(iv) Calculate the radius curvature of the lens. (No need to simplify)

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e) After extensive use , the reading taken from the vertical scale may not be so accurate in some spherometers.What is the reason for this?

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(02) The figure(1) shows an instrument which is used to measure length in our laboratory.

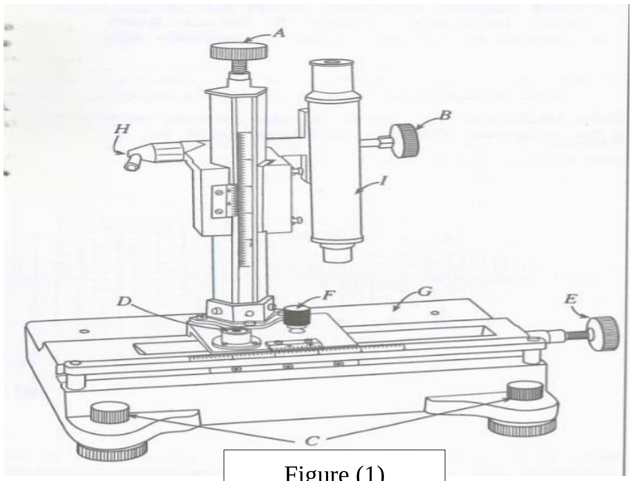

Figure (1)

a) (i)

1) What is the principle by which the instrument shown in figure(1) is made?

……………………………………………………………………………………………………

2) Give additional two instrument which are also made by the same principle.

……………………………………………………………………………………………………

(ii) Identify the parts indicated by the letters A,B,C and D and state their functions briefly.

Parts	Name of the part	Function
A		
B		
C		
D		

(iii) A student observed that when the horizontal fine adjustment screw was adjusted the corresponding vernier division did not move. Give reason for this.

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(iv) An enlarged figure of vernier scale is shown in the figure (2). Find its least count in cm.

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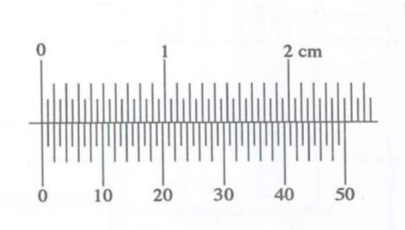

Figure (2)

(b) (i)

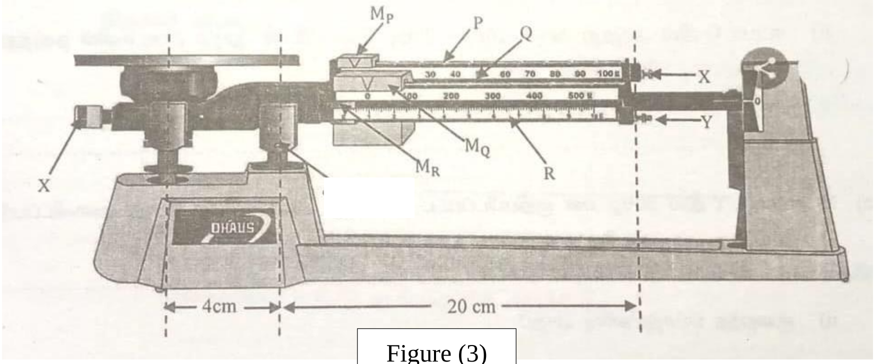

Figure (3)

(1) Give the name of the instrument given the figure (3)

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(2) In which principle the instrument is made ?

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(ii) When the cylindrical mass is not added to the attachment weight pivot X and Y

(1) What is the maximum mass that can be measured ?

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(2) What is the minimum mass that can be measured?

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(iii) When the cylindrical mass is added to the attachment weight pivot X and Y

(1) What is the maximum mass that can be measured ?

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(2) What is the minimum mass that can be measured?

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(iv) Before using the instrument it has to be balanced. How would you perform this?

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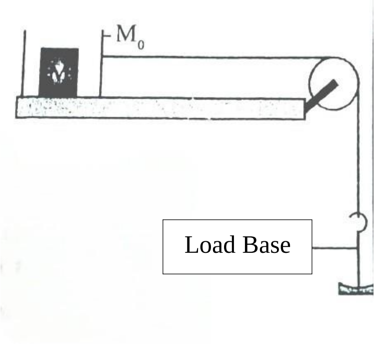
(03) Figure (3) shows an experimental setup arranged by a student to find out coeffifient of static friction. A mass M is put into the Box of mass M_0 and the box is placed on a horizontal table. A massless and inextensible string which goes over the smooth pulley joins the box and the hanger of the slotted mass . The value of mass M is varied, then the slotted mass m varied until the box comes to the position just start to move for the particular value of M. The limiting friction acts on the box at this position is F.



(i) Denote all the forces which acts on the system when it is on the verge of moving.

(ii) Identify self adjusting forces from the forces denoted in the above figure.

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(iii) Give one difference between self adjusting force and action reaction pair of forces.

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(iv) Write the relationship between normal reaction R and limiting friction F .

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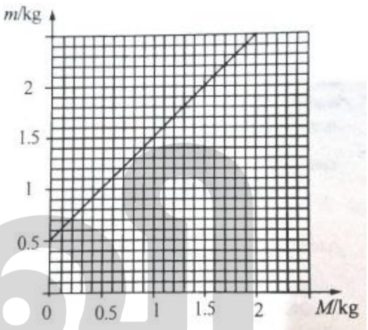
(v) A graph is drawn for several value of M and m to find coefficient of friction as shown in the figure.



(1) Give the equation for the graph as the form of y = mx + C in terms of the given quantities above.

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(2) Find coefficient of friction by using the graph.

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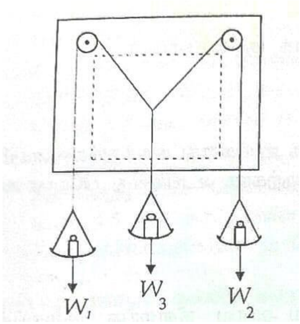
(04) The arrangement to varify the parallelogram law of forces in our school laboratory is shown in the figure.



(a) (i) State parallelogram law of force.

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(ii) (1) How would you confirm whether the pulley has friction or not ?

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(2) If the pulley has friction , how would you reduce it ?

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(iii) What is (or are) the apparatus used to mark the the position of the strings on the white sheet? And how would you perform it accurately ?

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(iv) How would be the strings used in this experiment and why they are such that ?

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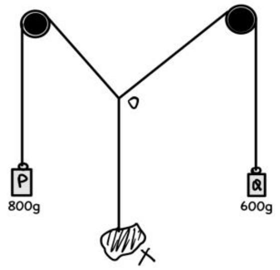
(b) (i) Find the weights of P, Q and X



Weight of P

…………………………………………………………………

Weight of Q

…………………………………………………………………

Weight of X

…………………………………………………………………

(ii) Denote the three forces in the figure which act on O.

(iii) The figure shows the position of the strings which is drawn on a white sheet .

1. Draw required geometrical construction on to this figure according to the scale to verify parallelogram law.

2. Explain that how would the parallelogram law is varified from your measurements.

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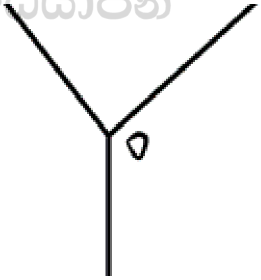


Part (B) – Essay

- **Select the questions according to the instructions given in the front page.**

(05)

a) A car travels on a linear, flat road at $20ms^{-1}$. At this time the car crosses the bike rider who is at rest and after it crosses, the bike rider starts to move in the same direction from rest. The motor bike gets $30ms^{-1}$ velocity at the end due to the constant resultant force acts on it for 4s.

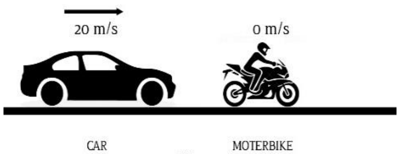


Fig 1

i. Draw the V vs T graph of both vehicles from the moment the car starts to cross the bike.

ii. Find the initial acceleration of the motorbike?

iii. In the end of 4s, find the distance between the car and motorbike.

iv. Mass of the motorbike is 320Kg and the mass of the driver is 80Kg. The force acting on the motorbike at 2nd second is 3500N. Then

1. Find the resistive force acts on the motor bike at this time period.
2. Why the force has to increase with time to maintain the bike in constant acceleration?

b) In the 4th second, the motorbike and the car travelling on a linear path put the brake due to the red signal. So, both vehicles involve in constant deceleration.

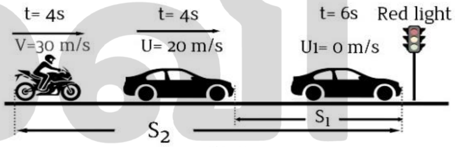


fig 2

i. After applying brake, the car rests under the red signal for 2s. Then, find the acceleration of the car & find the distance between the car and the red signal at the instance of applying brake?

ii. If the motorbike involves to $10ms^{-2}$ deceleration, then find the velocity and the time needed further to make the motorbike collide with the car?

c) The coefficient of dynamic friction between the wheels of both car & bike and path is 0.2. The car travels further 4m distance after collide with the motorbike and comes to rest again. The weight of motor car is 800Kg.

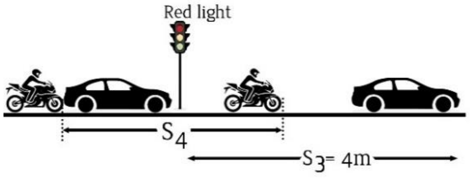


fig 3

i. Find the velocity of the car after collision?

ii. Find the velocity of the motorbike after the collision?
[Assume that the driver was still present in the bike after the collision.]

iii. Find the distance travelled by the motorbike after the collision?
[Assume that there is no force acts on the bike]

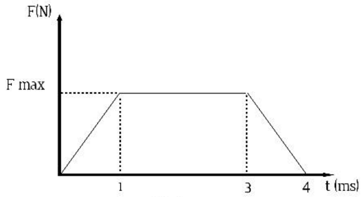


fig 4

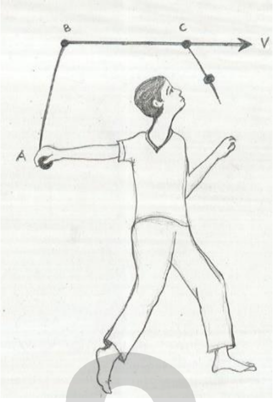
iv. The graph depicts the force acts on both vehicles with time when the collision happens. Then find the maximum force acts due to the collision. [Fmax]

(06)

a) A cricketer starts running from the rest and travels 4m distance and gains 4ms-1 velocity. Then he throws the speed ball towards the batsman. The mass of the bowler is 60Kg and the mass of the ball is 100g.

i. Find the acceleration of the bowler?

ii. Find the average horizontal force acts on the bowler?



b) The picture (1) depicts different positions of the right hand relative to the bowler's shoulder when he rans $4ms^{-1}$ velocity. In the bending motion of hand, the part BC was presented to be as horizontal 2.5m. The ball's velocity at B & C relative to shoulder is $16ms^{-1}$ and $26ms^{-1}$ respectively. The length of BC is 12.5m.

i. Find the velocity of ball at B relative to the earth?

ii. Find the velocity of ball at C relative to the earth?

iii. Find the acceleration of ball in BC?

iv. Find the time taken by the ball to reach "C" from B, where the ball starts to leave from the hand?

v. Find the average force given by the hand to the ball?

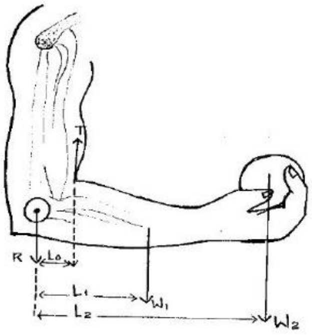
c) The picture nearby shows the keeper who keeps the ball at equilibrium in his hand. The forces associate with image is gives as

a. The resultant force act on the elbow –R

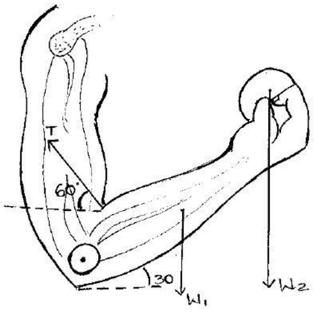
b. Weight of the hand below the elbow –W_1

c. Weight of the ball -W_2

d. Tension forms by the muscular fiber –T



1. Write the expression of T relative to W_1, W_2, L_o, L_1, L_2?
2. The ball lifts up in the same state as like in the figure (2). For this purpose, the tension of the muscle fiber changes to 60^o to the horizontal. The forces to state is given below but the forces act on the elbow is not shown.



$W_1 = 20N$ $W_2 = 1N$

$L_o = 5cm$ $L_1 = 15cm$

$L_2 = 30cm$ $\sqrt{3} = 1.73$

i. Find the tension acts on the muscle fiber?

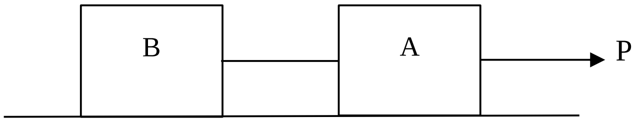
ii. Mark the vertical & horizontal forces act on the elbow and find the forces?

iii. Find the reaction force (R) that acts on the elbow?

iv. To lift up the ball further 10cm height, how much least work does he want to do?

(07)

A)



A,B are two blocks of mass 60kg & 40kg respectively connected horizontally by an inelastic, massless string. The coefficient of dynamic and static friction between the blocks and the surface is 0.5 and 0.6. P is the horizontal force which acts on the block A perpendicularly.

i. Find the limiting frictional forces act on block A and B?

ii. Calculate the maximum tension acts on the string when the block slightly moves?

iii. Find the minimum horizontal P which acts on the block A by moving the blocks?

B)

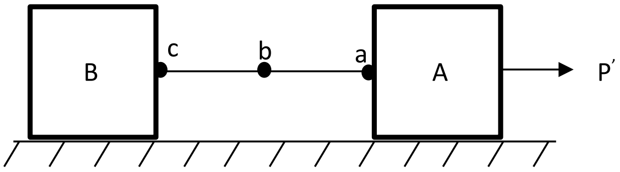


figure (2)

The string which connects both blocks is inextensible and horizontal but it weighs 2kg. The maximum tension bears by the string is 40N. Now a force P’ with constant acceleration is given to the blocks.

i. When moving with acceleration which point in the string will break. State the reason?

ii. What is the maximum acceleration that can make the blocks move without breaking the string?

iii. Calculate the horizontal force needed to make the blocks move with the acceleration you gain in the question (ii)

C)

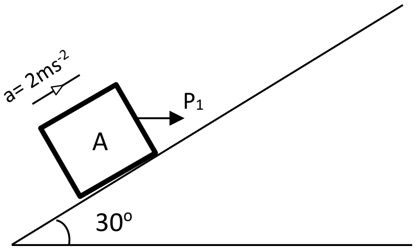


Fig (3)

The coefficient of dynamic friction of rough inclined plane which makes 30^O with horizontal is 0.5. In the inclined plane, the block A moves up along the inclined plane with $2ms^{-2}$ acceleration by applying the force P_1.

Take root $\sqrt{3} = 1.7$

i. Find the horizontal force P1 applied on the box.
ii. Calculate the increase of kinetic energy when this horizontal force P1 applied to the box which is at rest for 10s.
iii. Calculate the potential energy increase in this time period?
iv. Find the work done by the external force?
v. Find the power given to the block for making it moves during this time period?