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Provincial Department of Education - NWP

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First Term Test - Grade 12 - 2019

Index No. ..... Physics I 2 hours

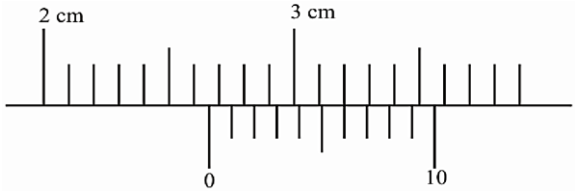
- **This paper consists of 50 questions and Answer all the questions.**
- **Use of calculator is not allowed.**
- **Write your index number in the space provided in the answer sheet.**
- **In each of the questions 1 to 50 pick one of the alternatives from (1), (2),(3),(4),(5) which is correct or most appropriate and mark your response on the answer sheet with a cross (x) in the answer sheet.**

01. SI unit of temperature is
(1) k (2) C (3) °C (4) K (5) F

02. Which of the following instruments can be the best to use to determine the diameter of a sonometer wire (small metal wire)?
(1) Traveling microscope (2) vernier caliper. (3) Meter ruler
(4) Micrometer screwgauge. (5) spherometer.

03. To get a resultant displacement 10 cm, two displacement vectors of magnitude 6 cm and 8 cm must be combined
(1) Parallel to each other.
(2) Perpendicular to each other.
(3) At an angle of 60°.
(4) Anti-parallel to each other.
(5) It is impossible to have 10 cm resultant from 6 cm and 8 cm vectors.

04. 9 equal divisions that is 9 mm of the main scale shown in the figure coincide with 10 equal divisions on the vernier scale. The reading shown in the figure is



(1) 3.2 mm (2) 2.66 mm (3) 26.6 cm (4) 26.6 mm (5) 2.6 cm

05. The projectile goes farthest away from the earth , when the angle of projection is
(1) 180° (2) 45° (3) 75° (4) 0° (5) 90°

06. The relation $F = \frac{Z}{\sqrt{d}}$ provides the relationship between the force F the density d under certain conditions. The dimensions of Z must be

(1) $M^{\frac{3}{2}}L^{\frac{1}{2}}T^{-2}$ (2) $M^{-\frac{3}{2}}L^{-\frac{1}{2}}T^{2}$ (3) $M^{\frac{1}{2}}L^{\frac{1}{2}}T^{-2}$ (4) $M^{\frac{3}{2}}L^{-\frac{1}{2}}T^{-2}$ (5) $M^{\frac{3}{2}}L^{-\frac{1}{2}}T^{2}$

07. Diameter of a sonometer wire as measured with a micrometer screw gauge is 0.80 mm. Its error in mm is

(1) 1.25 (2) 0.125 (3) 0.01 (4)0.1 (5) 1.00

08. A force of 12 N gives an object an acceleration of 4 m s^{-2}. The force required to give it an acceleration of 12 m s^{-2} is

(1) 36 N (2) 30 N (3) 15 N (4) 18N (5) 4 N

09. If the units of velocity, acceleration and force are denoted by α, β and γ respectively, the units of momentum would be

(1) $\alpha\beta\gamma$ (2) $\frac{\alpha\gamma}{\beta}$ (3) $\frac{\gamma\beta}{\alpha}$ (4) $\frac{\alpha\beta}{\gamma}$ (5) $\frac{\alpha^2\gamma}{\beta}$

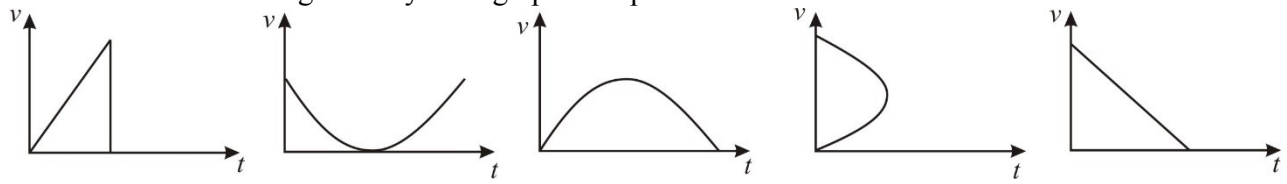
10. A sphere falling in a viscous medium experience a force which is called viscous force F. It is found to be depend on the speed v of the sphere radius of the sphere a and the coefficient of viscosity η of the medium. Which of the following gives the dimensionally correct relation for the viscous force F?
$[\eta] = ML^{-1}T^{-1}$

(1) $F = 6\pi\eta av$ (2) $F = \frac{6\pi\eta}{a^2v}$ (3) $F = 6\pi\eta a^4v$ (4) $F = \frac{6\pi\eta}{a^4v}$ (5) $F = 6\pi\eta av^4$

11. Two equal forces $\vec{F}$ are acting on a particle yield a resultant force of magnitude $\left|\vec{F}\right|$. the angle between forces is

(1) 0° (2) 30° (3) 60° (4) 90° (5) 120°

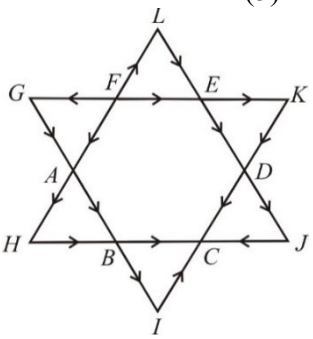
12. Which of the following velocity-time graph is impossible?



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

13. A system of 18 vectors is shown in the figure. The resultant of the system is

(1) $\overrightarrow{AI}$ (2) $\overrightarrow{2AI}$ (3) $\overrightarrow{4AF}$
(4) $\overrightarrow{4CF}$ (5) $\overrightarrow{4FC}$



14. A bomb is dropped from an aircraft flying horizontally with a uniform velocity. If the air resistance can be neglected, the positin of the aircraft when the bomb fall on the ground is

(1) beyond the bomb. (2) before the bomb.
(3) right above the bomb (4) Depend in the velocity of the aircraft.
(5) It is hard to predict.

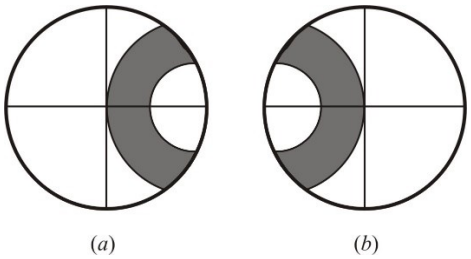
15. percentage error when measuring 1 cm and 50 cm by a meter ruler
(1) 10 % and 10 % respectively. (2) 1 % and 1 % respectively.
(3) 0.2 % and 0.2 % respectively. (4) 10 % and 0.2 % respectively.
(5) 1 % and 10 % respectively.

16. Dimensions of $\text{force} \times \frac{\text{displacement}}{\text{time}}$ is same as
(1) energy (2) force (3) pressure (4) power (5) momentum.

17. Consider the following statements
(A) Inertia of a body is the reluctance to change the state of motion.
(B) The force required to push an object on a smooth horizontal surface is affected by the gravitational mass of the object.
(C) A spring balance measures the inertial mass.
Of the above statements
(1) Only (A) is true (2) Only (B) is true (3) Only (C) is true
(4) ony (A) and (C) are true (5) all (A), (B) and (C) are true.

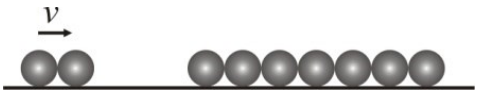
18. When the velocity of a body is doubled, which of the followings is true?
(1) Its kinetic energy is doubled. (2) Its potential energy is doubled.
(3) Its momentum is doubled. (4) Its acceleration is doubled.
(5) Non of above.

19. Outer diameter of a usual rubber tube in the laboratory is measured with a travelling microscope. Reading corresponding to figure (*a*) is 16.213 cm.


(*a*) (*b*)

Which of the followings could be the reading corresponding to the figure (*b*) ?
(1) 10 .658 cm (2) 15.275 cm (3) 16.003 cm. (4) 17. 193 cm (5) 25.175 cm

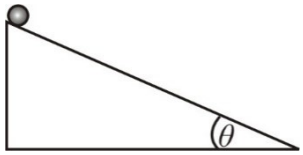
20. Six identical steel balls are lined up in a straight frictionless horizontal surface. Two similar balls moving with speed v collide elastically with the row of 6 balls from the left.



Then
(1) One ball from the row will move with a speed $2v$, other balls remaining at rest.
(2) Two balls from the row will move with a speed v and other balls remaining at rest.
(3) All the 6 balls in the row will move with a speed $\frac{v}{6}$ and the two incident balls will come to rest.
(4) Four balls from the row will move with a speed $\frac{v}{2}$ and other balls remaining at rest.
(5) All the 8 balls move with a speed $\frac{v}{8}$.

21. The radioactive decay law reads as $N = N_0 e^{\lambda t}$. Where N_0 is the number of radioactive nuclei at the beginning and N is the number of radioactive nuclei after time t. e is a dimensionless constant. The dimensions of the decay constant λ are
(1) MLT^{-1} (2) MT^{-1} (3) T^{-1} (4) M^2LT^{-1} (5) no dimensions.

22. An object is released from rest on a smooth inclined plane as shown in the figure. If the vertical height of the inclined plane is h the velocity of the object when reach to the bottom of the plane is



(1) $2gh$ (2) $2gh \sin\theta$ (3) $2gh \cos\theta$ (4) $\sqrt{2gh}$ (5) $\sqrt{2gh\sin\theta}$

23. Consider the following statements about errors
(A) If the circular scale zero and linear scale zero of micrometer screw gauge doesn't come together when spindle and anvil touches, it's a systematic error.
(B) Systematic error can be minimized by taking several readings and considering the average.
(C) If the scale reading was read out wrong by mistake, it's a random error.
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 **wrong.**

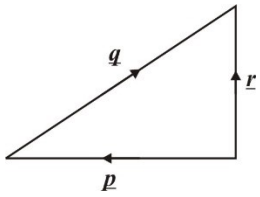
24. The tangent to the displacement - time graph of a particle moving with a constant acceleration makes an angle of 45° with the time axis at a certain instant. After one second it makes an angle of 60°. If axis are marked in SI units, the acceleration of the particle is

(1) $\sqrt{3}$ m s^{-2} (2) $\sqrt{3}+1$ m s^{-2} (3) $\sqrt{3}-1$ m s^{-2} (4) $\frac{\sqrt{3}}{2}$ m s^{-2} (5) $\frac{1}{\sqrt{3}}$ m s^{-2}

25. A body is projected up along a 45° rough incline plane. If the coefficient of friction is 0.5, then the retardation of the block is

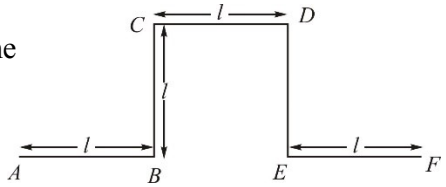
(1) $\frac{g}{2\sqrt{2}}$ (2) $\frac{g}{\sqrt{2}}$ (3) $\frac{g}{2}$ (4) $\frac{3g}{2\sqrt{2}}$ (5) $\frac{3g}{\sqrt{2}}$

26. In the given vector diagram, it is shown that $r \perp p$ and $|r| = |q|/2$. Then the angle between vector ***p*** and ***q*** is



(1) 30^0 (2) 60^0 (3) 45^0 (4) 120^0 (5) 150^0

27. A uniform wire is bent as shown in the figure. Then distance to the center of gravity of the whole wire from CD is



(1) $\frac{l}{10}$ (2) $\frac{3l}{10}$ (3) $\frac{2l}{5}$ (4) $\frac{3l}{5}$ (5) $\frac{7l}{10}$

28. A train of 150 m long is going towards north with a speed of 10 m s^{-1}. A parrot flies at a speed of 5 m s^{-1} towards south parallel to the railway track. The time taken by the parrot to pass the train is equal to
(1) 8 s (2) 10 s (3) 12 s (4) 14 s (5) 16 s

29. A monkey of mass 10 kg climbs on a light inelastic rope of breaking strength 150 N. The rope will break if the monkey
(1) climbs up with a uniform speed of 5 m s^{-1}.
(2) climbs up with an acceleration of 6 m s^{-2}.
(3) climbs down with an acceleration of 6 m s^{-2}.
(4) climbs down with an acceleration of 4 m s^{-2}.
(5) climbs down with a uniform speed of 5 m s^{-1}.

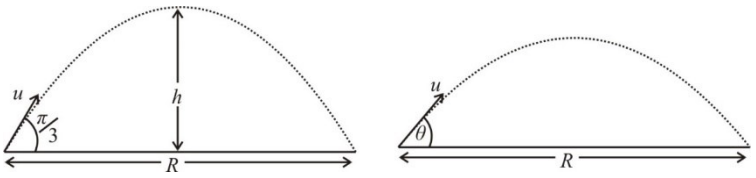
30. A 0.3 kg apple falls from rest through a height of 20 m onto the head of a person. Upon impact, the apple comes to rest in 0.1 s, and 4 cm^2 of the apple comes into contact with the head during the impact. What is the average pressure exerted on the apple during the impact? Ignore air resistance.
(1) 600 000 Pa (2) 150 000 Pa (3) 60 000 Pa (4) 2100 Pa (5) 600 Pa

31. A bomb of mass 12 kg, initially at rest, explodes into two pieces of masses 4 kg and 8 kg. The speed of the 8 kg mass is 6 m s^{-1}. The kinetic energy of the 4 kg mass is
(1) 32 J (2) 48 J (3) 96 J (4) 144 J (5) 288 J

32. One of the two forces is double the other and their resultant is equal to the greater force. The angle between them is.
(1) $\cos^{-1}\left(\frac{1}{2}\right)$ (2) $\cos^{-1}\left(-\frac{1}{2}\right)$ (3) $\cos^{-1}\left(\frac{1}{4}\right)$ (4) $\cos^{-1}\left(-\frac{1}{4}\right)$ (5) $\cos^{-1}\left(-\frac{1}{3}\right)$

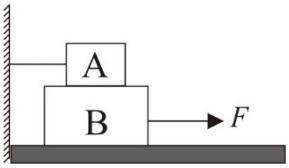
33. A stone was dropped from the top of a vertical cliff of 30 m height. At the same instant another stone was thrown vertically upwards from the ground with initial velocity 30 m s^{-1}. Two stones will cross each other after time.
(1) 5 s (2) 4 s (3) 3 s (4) 2 s (5) 1 s

34. Two objects are projected as shown in the figure with same velocity but with different angles so that both have the same range. The angle of projection of one is $\pi/3$ and its maximum height is *h*. Then the maximum height of the second projectile is



(1) 3 *h* (2) 2 *h* (3) $h/2$ (4) $h/3$ (5) $2h/3$

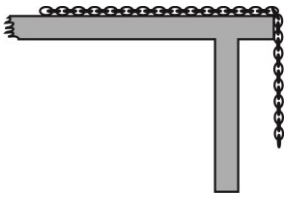
35. A block *A* of mass 200 kg rests on a block *B* of mass 300 kg. *A* is tied with a horizontal string to a wall. Coefficient of friction between *A* and *B* is 0.25 and that between *B* and floor is 0.2. the horizontal force *F* needed to move the block *B* is



(1) 550 N (2) 500 N (3) 1500 N (4) 2000 N (5) 2200N

36. A stone dropped from a tower, travels 25 m in the last second of its journey. The height of the tower is,
(1) 90 m (2) 135 m (3) 100 m (4) 72 m (5) 45 m

37. A uniform heavy chain is on a rough table. The coefficient of friction between the table and the chain is 0.25. What maximum percentage of the total length of the chain can be over hanging by the edge of the table without slipping?

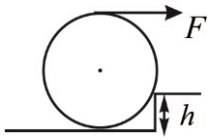


(1) 20 % (2) 25% (3) 35% (4) 15% (5) 50%

38. An aero plane flying horizontally at a height of 500 m with a speed of 360 km h^{-1} . A bomb is to be dropped on an enemy target on the ground. At what horizontal distance from the target should it be released?
(1) 500 m (2) 750 m (3) 1000 m (4) 1500 m (5) 2000 m

39. A body is in equilibrium under the action of three coplanar forces. Then
(A) they can be acting on a straight line
(B) they can be passing through a single point.
(C) they must obey the triangular law of forces.
Of these statements,
(1) only (A) is true. (2) only (B) is true. (3) only (C) is true.
(4) only (A) and (B) are true (5) all (A), (B) and (C) are thue .

40. A sphere of mass m and radius R is to be brought out of a step of height h by applying a horizontal Force F as shown in the figure below. The minimum value of F is

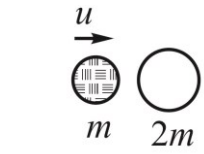


(1) $\frac{mg\sqrt{2Rh+h^2}}{2R-h}$ (2) $\frac{mg\sqrt{2Rh+h^2}}{2R+h}$ (3) $\frac{mg\sqrt{h^2-2Rh}}{2R-h}$
(4) $\frac{mg\sqrt{2Rh-h^2}}{2R-h}$ (5) $\frac{mgh}{2R}$

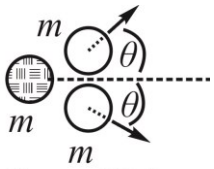
41. A particle A is projected vertically upwards. Another particle B is projected at an angle of 45°. Both A and B reach the same height. The ratio of the initial kinetic energy of A to that of B is
(1) 1 : 2 (2) 2 : 1 (3) $1:\sqrt{2}$ (4) $\sqrt{2}:1$ (5) non of these.

42. A pump can pump 36000 kg of water per hour from a 100 m deep well. If the efficiency of the pump is 50 %, its power is
(1) 10 kW (2) 15 kW (3) 20 kW (4) 25 kW (5) 30kW

43. A particle of mass m is moving along the x-axis with speed u when it collides with a particle of mass $2m$ initially at rest. After the collision, the first particle has come to rest, and the second particle has split into two equal-mass pieces that move at equal angles θ with the x-axis, as shown in the figure. Which of the following statements correctly describes the speeds of the two pieces?



Before collision

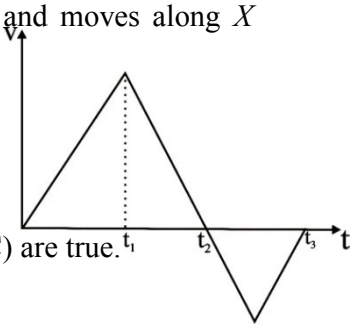


After collision

(1) Each piece moves with speed u.
(2) One of the pieces moves with speed u, the other moves with speed less than u.
(3) Each piece moves with speed $u/2$.
(4) One of the pieces moves with speed $u/2$, the other moves with speed greater than $u/2$.
(5) Each piece moves with speed greater than $u/2$.

44. Mass of an object measured by a spring balance in a lift at rest is found to be m. If the lift is moving up with an acceleration a, will read as
(1) $m\left(1-\frac{a}{g}\right)$ (2) $m\left(1+\frac{a}{g}\right)$ (3) $m(a+g)$ (4) $m(a-g)$ (5) non of these

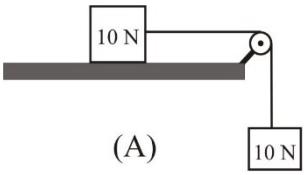
45. The figure shows the velocity-time graph for a particle which starts from rest and moves along X direction. According to this graph,

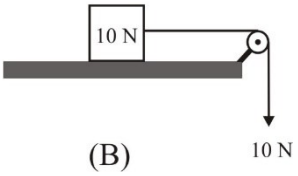


(A) at $t = t_2$ the direction of motion of particle changes.
(B) at $t = t_2$ the direction of acceleration changes.
(C) Between t_1 - t_2 the direction of acceleration is along the direction of velocity.
Of the above statements,
(1) Only (A) is true. (2) Only (B) is true. (3) Only (A) and (C) are true.
(4) Only (A) and (B) are true. (5) All (A) ,(B) and (C) are false.

46. A ball is thrown at an angle θ with the horizontal. Its horizontal range is equal to its maximum height. This is possible when
(1) $\tan\theta = 4$ (2) $\tan\theta = 2$ (3) $\tan\theta = 1$ (4) $\tan\theta = 1.5$
(5) $\tan\theta = 0.5$

47. Figure (A) and (B) shows two identical blocks of weight 10 N resting on a frictionless table. In Figure (A) it is pulled down by another block of weight 10 N, and the Figure (B) the block is pulled by a force of 10 N. choose the most correct statement about the acceleration of these two systems.



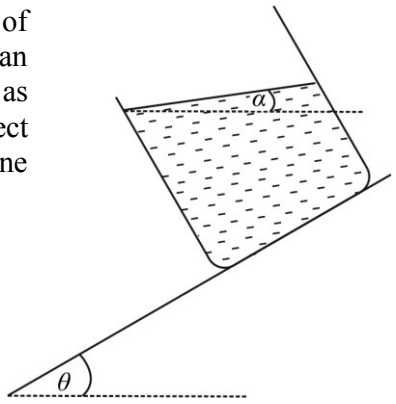


(1) In (B) the block is accelerated towards the pulley whereas in (A) the block stands still.
(2) Blocks are accelerated towards the pulley in both (A) and (B) .
(3) (A) has higher acceleration.
(4) (B) has higher acceleration.
(5) Both (A) and (B) have same acceleration.

48. The length of the second's hand in a watch is 1 cm. The magnitude of the change in the velocity vector of its tip in 15 s is
(1) zero (2) $\frac{\pi}{30}$ cm s^{-1} (3) $\frac{\pi}{30}\sqrt{2}$ (4) $\frac{\pi}{30\sqrt{2}}$ (5) $\frac{\pi}{15}$

49. The accelerations due to gravity at two different places are g_1 and g_2. A body is thrown upward with the same speed at both the places. If t_1 and t_2 are respective times taken by them to return back to the ground, then which of the followings is true?
(1) $g_1 t_1 = g_2 t_2$ (2) $g_1 t_2 = g_2 t_1$ (3) $t_1 t_2 = g_1 g_2$ (4) $g_1 t_1^2 = g_2 t_2^2$ (5) $g_2 t_1^2 = g_1 t_2^2$

50. A beaker of water is released from the top of an inclined plane of inclination θ. assume that the beaker slip along the plane with an acceleration. The water surface becomes α inclined to the horizontal as shown in the figure. If α and θ are compared what is the correct comparison between them when the plane is smooth and when the plane is rough?



	smooth plane	**rough plane**
(1)	$\alpha = \theta$	$\alpha < \theta$
(2)	$\alpha = \theta$	$\alpha = \theta$
(3)	$\alpha > \theta$	$\alpha > \theta$
(4)	$\alpha = \theta$	$\alpha > \theta$
(5)	$\alpha < \theta$	$\alpha < \theta$

01	E	II

First Term Test - Grade 12 - 2019

Index No. ..... Physics II 3 hours

- This paper consists of two parts A and B allowed time for both parts is 3 (three) hours.
- Answer all the questions of **part A** on this paper itself. You must use th given space to answer. No lengthy answers are expected.
- **Part B** consists of 6 questions. Answer only four of them. After the exam, attach part A and part B and hand over to the staff.
- Use of calculators is not allowed.

Part - A (Structured Essay)

(g = 10 N kg^{-1})

01. A student plans to determine the density of a small metal ball using a laboratory micrometer screw gauge.

a) What is the other physical quantity you should measure for this purpose except the quantity measured using the micrometer screw gauge?

.....

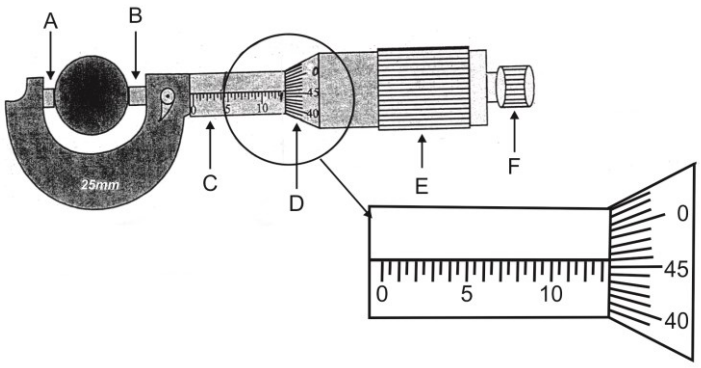
b) What is the measuring instrument used to measure it?

.....

c) Write down an expression for the density of the metal ball in terms of the measurements you obtained.

.....

d) The following diagram shows the micrometer screw gauge used by the student. Name the parts of it labelled as A, B, C, D, E and F.



A - ..... D - .....

B - ..... E - .....

C - ..... F - .....

e) How would you identify whether the object is fixed between the anvil and spindle in the correct manner?

.....

.....

.....

f) i. What is meant by screw pitch?

.....

.....

ii. What is the screw pitch in the given instrument above.

.....

g) Find the least count of the instrument?

.....

h) What is the reading shown above?

.....

i) i) How would you find the zero error of the instrument?

.....

.....

ii) The following figure shows a situation in which the micrometer screw gauge is adjusted to determine the zero error. Find the value of the zero error.

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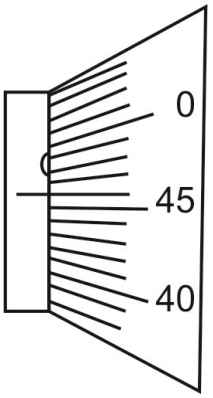


iii) State the correct value of the measurement mentioned in (h) above.

.....

.....

iv) Write down the fractional error of the measurement.

.....

j) i) How would you increase the accuracy of the measurement?

.....

.....

ii) What is the name given for the error which can be minimized by taking the above step?

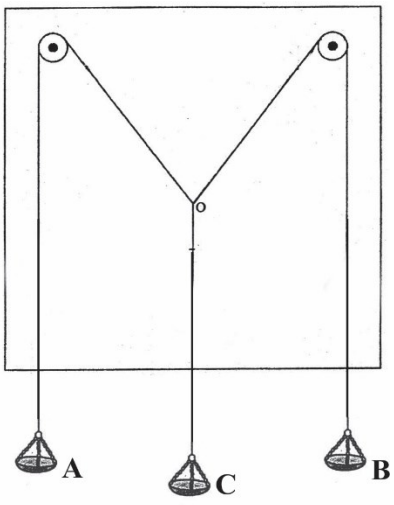
.....

k) If the mass of the metal ball is 8.624g, calculate its density in $kg\ m^{-3}$.

.....

.....

02. The following diagram shows the apparatus setup used in the school laboratory to determine the mass of a stone using the principle of parallelogram of forces.



a) State the parallelogram law of forces.

.....

.....

.....

b) Which scale pan is used to keep the unknown mass?

.....

c) Show a A_4 sized white paper pinned on the vertical drawing board.

d) Give a list of other items needed to carry out this experiment accurately.

.....

.....

e) How do you test whether the pulleys have friction.

.....

.....

.....

f) In order to carry out this experiment light strings should be used. What is the reason for this?

.....

.....

.....

g) If the scale pans are not light, what should you do in order to carry out the experiment correctly?

.....

.....

.....

h) To mark the positions of the strings, you can use two items (item- 1 and item - 2). How would you mark the positions of the strings using each item.

Item - 1 .....

.....

.....

Item - 2 .....

.....

.....

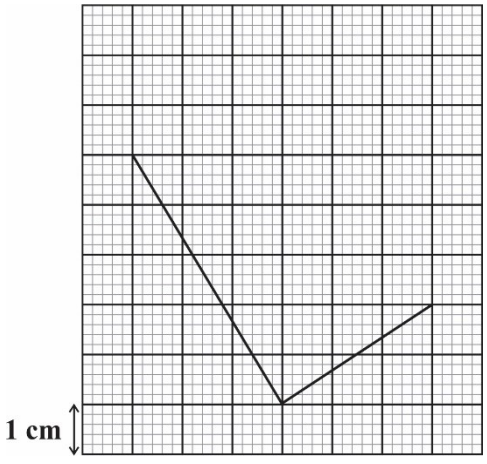
i) The white paper is pinned on the drawing board after the system has come to rest. What is the reason for this?

.....

.....

.....

j) The set-up is used by a student to find the mass of a stone. The relevant sides of the force parallelogram are shown in the figure. (1cm = 20g)



i) Evaluate the mass of the stone.

.....

.....

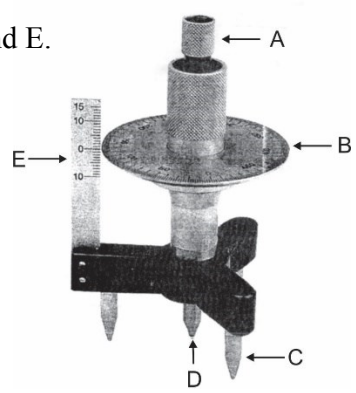
ii) After completing the parallelogram correctly, if the direction of the relevant diagonal is not exactly vertical, what is the reason for that?

.....

.....

03. You are supplied a spherometer used in the laboratory and a flat glass plate to determine the radius of curvature of a watch glass.

a) Name the parts of the given spherometer labelled as A,B,C,D and E.



A- .....

B- .....

C- .....

D- .....

E- .....

b) Number of divisions in the circular scale is 100 and the screw pitch is 1mm. Find the least count of the instrument.

.....

.....

c) The radius of curvature (R) can be determined by the following formula.

$R = \frac{a^2}{6h} + \frac{h}{2}$

i) Identify a and h .

a .....

h .....

ii) What measuring instrument would you use to determine a ?

.....

.....

.....

iii) What experimental steps would you follow in order to determine a ?

.....

.....

d) i) For measuring h, before placing the spherometer on the curved surface, you have to bring the tip of the screw and tips of the legs of the spherometer to one plane. Explain how you do this experimentally.

.....

.....

.....

ii) What experimental difficulty would you expect if the instrument is placed on a plane mirror when taking the first reading?

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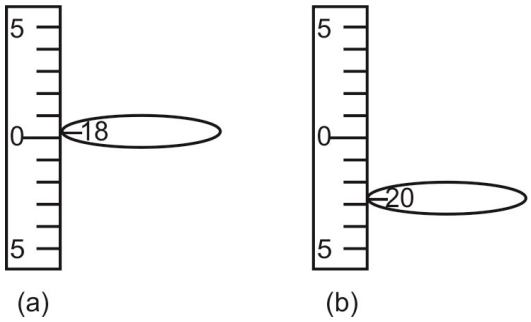
e) Figure (a) shows the scale reading when the tip of the screw just touches the flat glass plate.
Figure (b) shows the scale reading when the tip of the screw just touches the curved surface.



i) Find the value of h

.....

.....

ii) If $a = 3.0\ cm$, substitute the values of a and h to calculate R.
R = ____ + ____ cm

iii) Find the value of R .

.....

.....

.....

f) Can the spherometer be used to determine the radius of curvature of the eye piece of the travelling microscope? Give the reason for your answer.

.....

.....

.....

04. a) i) Define the force according to the Newton's first law.

.....

.....

ii) Define the standard SI unit of measuring force.

.....

.....

.....

iii) What is meant by the inertia?

.....

.....

.....

iv) What is an inertial frame?

.....

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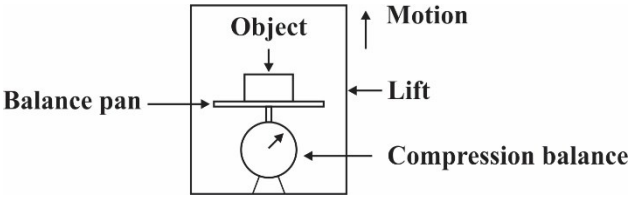
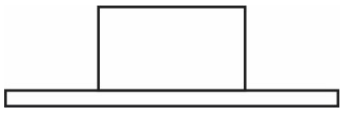
.....

b) The figure shows an object of mass $10kg$ resting on a compression balance placed inside a lift. The lift starts its vertical upward motion from rest. In the first 8 seconds it accelerates with $2\ ms^{-2}$. It then maintains a constant speed for $20s$. In the next $10s$, it comes to rest.



i) Mark the force exerted by the object on the pan.



ii) Find the total displacement of the lift by using a velocity - time graph.

.....
.....
.....
.....
.....

iii) What is the reading of the balance when the lift accelerates upward?

.....
.....
.....

iv) What is the reading of the balance when it moves with a constant velocity?

.....
.....
.....

v) Find the reading when the lift decelerates upwards assuming deceleration is uniform.

.....
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.....

vi) What is the reading of the balance when the lift falls under gravity?

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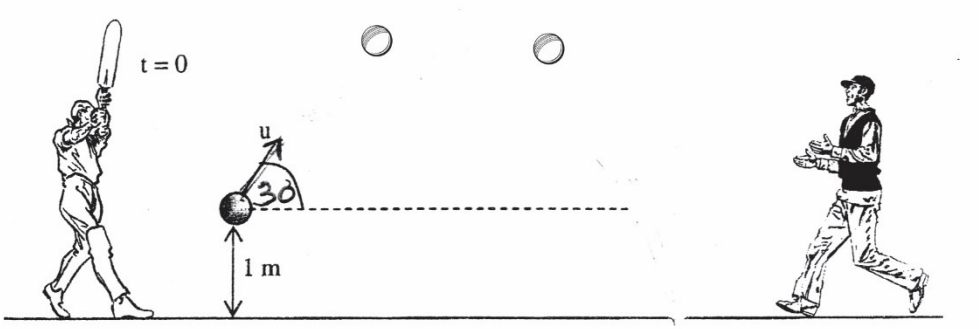
First Term Test - 2019
Physics Part II - Grade 12
Part B (Essay)

- **Answer only four questions.**

05.



In a cricket match, A batsman strikes a ball at a height of $1m$ above the ground. The ball leaves the bat at a speed of $20\ ms^{-1}$ making an angle 30^0 with the horizontal. At the same instance, a fielder at rest starts running with an acceleration of $4\ ms^{-2}$ towards the ball to catch it. He catches the bell at a vertical height of $0.5m$ from the ground. Neglect the air resistance through out the whole motion and calculate the followings.

i) The maximum height reached by the ball from the ground.

ii) The vertical and horizontal components of velocity of the ball at the instance the fielder catches it. $\sqrt{1.1} = 1.05\ ,\ \sqrt{3} = 1.73$

iii) The velocity (magnitude and direction) of the ball when it hits the palms of the fielder.
$\sqrt{4.1} = 2.03\ , \tan^{-1} 0.6055 = \ 31^0 11'$

iv) The time taken by the ball to reach the fielder after releasing from the bat $\sqrt{4.4} = 2.1$

v) The horizontal distance travelled by the ball.

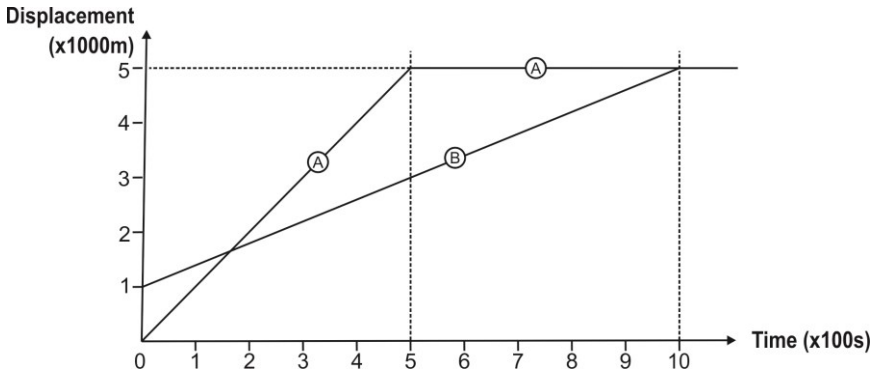
vi) The initial distance from the fielder to the batsman.

vii) The velocity of the fielder at the instance he catches the ball.

viii) Can the fielder catch the ball at the same position mentioned above if the ball leaves the bat at the same position with the velocity of $20\ ms^{-1}$ making an angle of 60^0 with the horizontal?

ix) Plot the velocity - time graphs for the vertical and horizontal components of velocity of the ball.

06. **a)** A and B are two short train engines moving on two straight parallel close tracks. Their displacement - time graphs are shown below.



i) What is the delayed engine for stopping ? Give the delayed time in seconds.
ii) Which one of the two engines comes to rest first? When it comes to rest, find the distance to the late engine.
iii) At what time from $t = 0$ does one engine pass the other ?
iv) What is the engine that has a higher velocity, when passing the other. What is that velocity ?
v) At a certain instance, the driver of the engine A sights the engine B moving at a distance of 100m ahead. What is the time taken by the engine A to reach closer to engine B ?
vi) Draw the velocity - time graphs for both A and B on the same calibrated axes.

(b) A particle at rest starts its motion along a straight line path. It travels a distance of $50m$, with a constant acceleration, next $300m$ with a constant velocity and last $25m$ with a constant retardation to rest. The total time for the whole motion is 4.5s.

Find
i) draw the velocity - time graph for the above motion.
ii) the average velocity.
iii) the maximum velocity.
iv) the acceleration.
v) the deceleration of the particle.

07. a) A disk of mass $10\ kg$ is hanging by a light inextensible cable attached to a helicopter of mass 1000 kg.

When the helicopter is moving

i) upward with a constant velocity.
ii) Upward with a constant acceleration of $1\ ms^{-2}$
iii) Downward with a constant acceleration of $1\ ms^{-2}$.

Calculate the followings for the above three situations,

a) Forces acting on the disk.
b) The upward force generated by the helicopter itself using the mechanism of the helicopter engine.

iv) For the situation (iii), draw the free body force diagrams for the disk and the helicopter.
v) The disk is an electro magnet. When an electric current is supplied, it shows magnetic properties. Assume that the helicopter is free from the influence of the magnetic property of the disk. When the helicopter in air is at rest relative to the earth, the disk is directed towards a piece of metal of mass 100kg at rest on earth. After that the disk is converted to a magnet by passing an electric current through it. If the piece of metal rises upward accelerating at $1\ ms^{-2}$ relative to the earth.

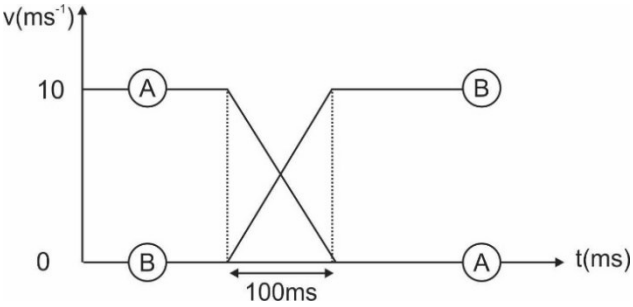
Calculate,

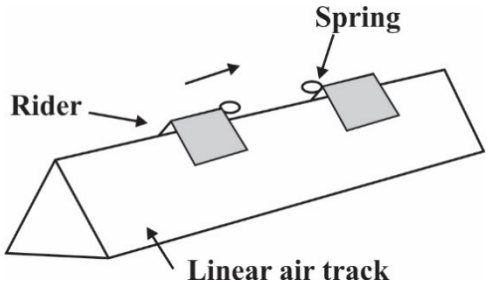
(a) the forces acting on the piece of metal.
(b) the forces acting on the magnetic disk.
(c) the upward force generated by the helicopter on it by the mechanism of the helicopter engine.

08. a) i) Write down the dimensions and SI units of linear momentum.

ii) State the principle of conservation of linear momentum.

b) The linear air track, shown in the figure below is a fixed horizontal straight line path with negligible friction and resistive forces. Two riders A and B each of mass $100g$, fitted with two elastic, circular springs having horizontal planes at the colliding ends are free to move on the track.
The graphs below show the variation of velocities of A and B with time before the impact, at the impact and after the impact of them. The time duration of the collision is 0.1s.





i) Find the amount of kinetic energy of the system before impact.

ii) Find the amount of kinetic energy of the system after impact.

iii) Is the collision perfectly elastic? Give the reason for your answer.

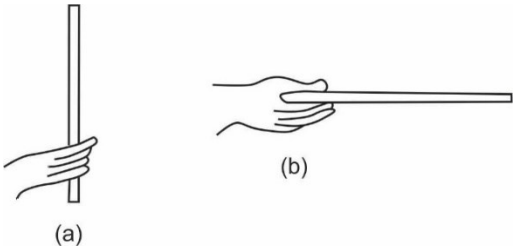
iv) At the instance that the kinetic energy is minimum, what is the maximum amount of elastic potential energy stored in springs.

v) Calculate the mean force acting on a spring by the other.

vi) Draw the shape of the springs at the above occasion.

vii) Before the impact a spider of mass $10g$ on the rider 'A' moving with $10ms^{-1}$ jumps on to the rider B. If the horizontal component of velocity of spider is $15\ ms^{-1}$ relative to the earth, find the respective final velocities of A and B.

09. **a** i) State the general conditions necessary for an object to be in equilibrium under the action of a set of coplanar forces.

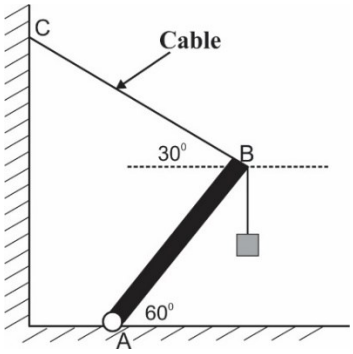


The figures (a) and (b) shows a uniform rod of weight W and length $1m$ held by a child in two different ways. The rod is in equilibrium and the coefficient of friction between the hand and the rod is μ .

ii) Mark the forces R (the force exerted by the child on the rod), W (weight of the rod) and F (frictional force) acting on the rod when the rod is in equilibrium according to the figure (a). (Draw only the rod)

iii) Obtain the relation between R and W .

iv) When the rod is in equilibrium according to the figure (b), mark the forces acting on it. Arrange the magnitudes of these forces in ascending order.

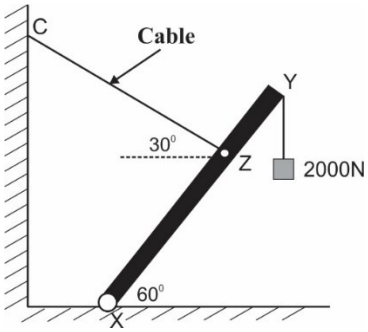


b) As shown in the figure, one end A of a uniform rod AB of length $4m$ and mass $200kg$ is smoothly pivoted to a fixed point on the ground. The end B of the rod carries a heavy load of mass $1000kg$. The rod is held in the given position by a cable joining the end B of the rod to a point C on the wall.

i) Calculate the tension in the cable.

ii) Find the horizontal and vertical components of the force exerted on the rod at A by the hinge.

c) As shown in the figure, the cable is used to raise a uniform concrete post of mass $1200\ kg$ and length L. The post is hinged at X. The cable is attached to the post such that $\frac{XZ}{ZY} = 3$. Find the tension in the cable.



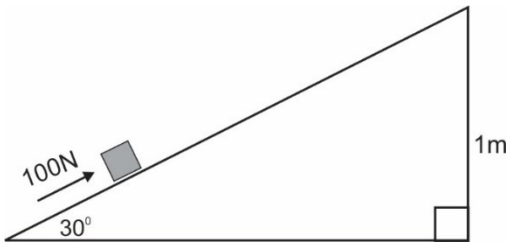
10 A) a) A weight of $100N$ is placed on a horizontal plane. The weight is on the verge of slipping when a horizontal force of $75N$ is applied. After that to maintain a constant velocity for the weight, a horizontal force of $70N$ is required.

Find, i) the coefficient of static friction, μ_s

ii) the coefficient of dynamic friction, μ_D

iii) How much work is required to move the weight with a constant velocity through a distance of $2m$ along the plane.

b)



A weight of $100N$ is placed on an inclined plane of inclination 30^0 to the horizontal. The weight moves up the plane very slowly with a constant velocity under the action of a force of $100N$.

Find, i) the dynamic frictional force.

ii) the coefficient of dynamic (kinetic) friction.

iii) the work done on the weight to move it through a distance of $2m$ up the plane.

iv) Calculate the increase in potential energy of the weight.

v) What is the reason for the difference between the increase in potential energy and the work done on the weight?

c) Consider the following two situations.

(A) Only the weight is moved up the plane by a man without getting on to the inclined plane.

(B) A man is carrying the weight up the plane.

At what situation does the man do more work? Explain your answer.

First Term Test - Grade 12

Physics Part - 1

1. (4)	11. (5)	21. (3)	31. (5)	41. (1)
2. (4)	12. (4)	22. (4)	32. (4)	42. (3)
3. (2)	13. (5)	23. (2)	33. (5)	43. (5)
4. (4)	14. (3)	24. (3)	34. (4)	44. (3)
5. (5)	15. (4)	25. (4)	35. (3)	45. (1)
6. (4)	16. (4)	26. (5)	36. (5)	46. (1)
7. (3)	17. (1)	27. (4)	37. (1)	47. (4)
8. (1)	18. (3)	28. (2)	38. (3)	48. (3)
9. (2)	19. (2)	29. (2)	39. (5)	49. (1)
10. (1)	20. (2)	30. (2)	40. (4)	50. (1)

Physics Part - 11

(01)

a) mass — (01)

b) Electronic balance / four beam balance — (01)

c) m/V

$= \frac{m}{\frac{4}{3}\pi\left(\frac{d}{2}\right)^3}$ — (01) d - diameter of the metal ball

d) A - Anvil D - circular scale
B - Spindle E - thimble
C - sleeve F - thimble head
all correct — (02)

e) Thimble head is used to fix the object between the anvil and spindle It gives a clicking sound when it (the ball) is gripped in the correct manner. — (02)

(f) i) The distance between two threads of the screw. — (01)

ii) 0.5 mm — (01)

(g) $\frac{0.5}{50} = 0.01$ mm — (01)

(h) $(13 + 0.01 \times 46)$ mm $= 13.46$ mm — (01)

(i) i) For correct answer — (02)

ii) 0.04 mm — (01)

iii) $(13.46 + 0.04)$ mm $= 13.50$ mm — (01)

iv) $= \frac{0.01}{13.50} = \frac{1}{1350}$ — (01)

j) i) Take several measurements (diameters) by rotating the ball (01)

ii) Random error — (01)

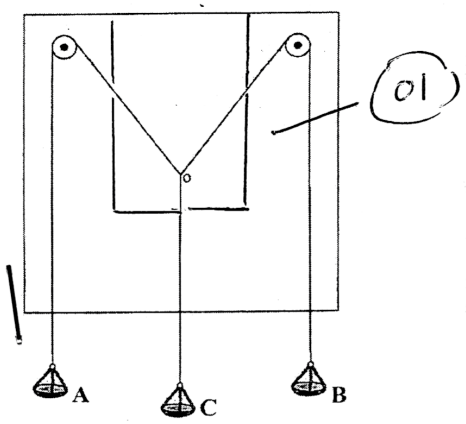
k) $\frac{m}{\frac{4}{3}\pi\left(\frac{d}{2}\right)^3} = \frac{8.624 \times 10^{-3}}{\frac{4}{3} \times \frac{22}{7} \times \left(\frac{13.50}{2} \times 10^{-3}\right)^3} =$ (01)

≈ 6692 kg m^{-3} — (01)

(02) a) For the principle :- —(02)

b) Scale pan – C —(01)

c)



d) half meter ruler or meter ruler —(01)
set square / piece of plane mirror —(01)

e) pull the middle weight slightly and check whether it returns to the original position —(02)

f) The tensions of the strings must be equal to the hanging weights or tension along a string segment must be the same —(02)

g) hang the weights without the pans directly from the strings or weigh the pans and add to the weights —(02)

h) • Using plane mirror :- place the piece of plane mirror underneath the strings and mark two dots at each end of the image while viewing straight through the strings —(02)

• Using set square :- Mark the positions of each string by marking two dots on the paper by placing the setsquare ⊾ᵉ to the string —(02)

i) To obtain a larger parallelogram —(01)

j) i) 140g —(01)

For completing for completing the parallelogram and drawing the diagonal —(01)

ii) Friction of the pulleys or friction between the strings and the pulleys. —(01)

(03) a) A - Screw head D - Screw or Screw tip.
B - circular scale E - main scale
C - legs

all correct - (02)

b) $\frac{1}{100}$ mm = 0.01 mm — (01)

c)(i) a - Separation between two legs of the spherometer — (01)

h - The distance moved by the screw from its initial position (from the plane of the plate) — (02)

ii) meter ruler — (01)

iii) place the spherometer on a sheet of paper and press to emboss its leg marks. Measure the distances between adjacent marks produced by the spherometer legs and take its mean value. — (02)

d) (i) lower the screw until the tip of the screw touches its image formed by the glass plate.

ii) The screw tip cannot be contacted with its image — (02) (02)

e) i) $(0.18 + 2.80)$ mm = 2.98 mm = h. — (01) (01) (01)

ii) $\frac{(3.0)^2}{6 \times 2.98 \times 10^{-1}} + \left(\frac{2.98 \times 10^{-1}}{2}\right)$ cm — (01)

$\Rightarrow$ R = cm — (01)

f) NO — (01)

The spherometer cannot be placed on the eye piece — (01)

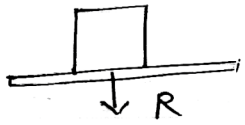
(04) (a) i) def^{n} of force — (02)

ii) def^{n} of newton — (02)

def^{2} iii) inertia — (02)

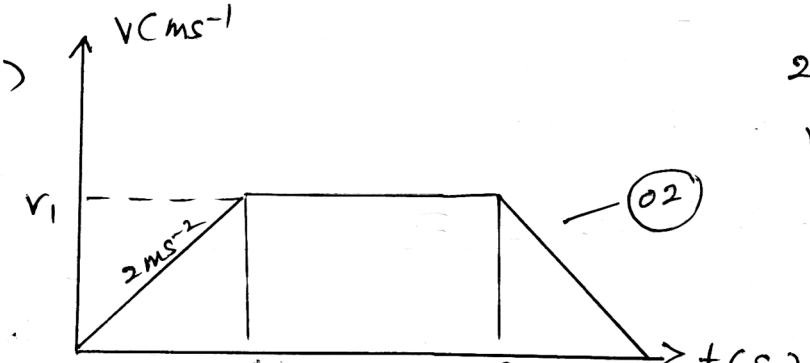
def^{2} iv) inertial frame — (02)

b) i)



— (01)

ii)



— (02)

$2 = \frac{v_1}{8}$

$v_1 = 16\ ms^{-1}$ — (01)

$s = \frac{1}{2}(38+20)16$

$= 464\ m$ — (01)

iii)

$a \uparrow 2ms^{-2}$ $\uparrow F = ma$, $R - mg = ma$, $R = m(g+a)$ — (01)

$= 10(10+2)$

$= 120N = 12kg$ — (01)

iv) $\uparrow F = ma$

$R - mg = m(0)$ — (01), $R = mg = 100N = 10kg$ — (01)

v) $\uparrow F = ma$

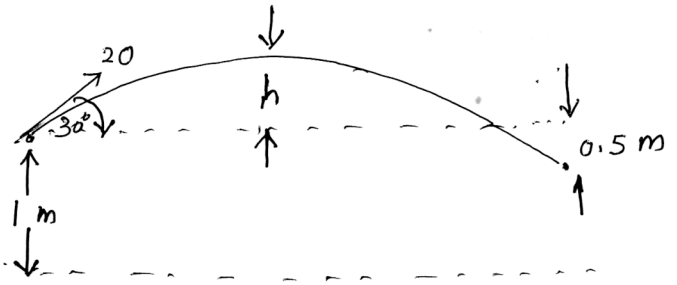
$R - mg = m\left(-\frac{8}{5}\right)$ $\quad a = \frac{0-16}{10} = -\frac{8}{5} = -1.6\ ms^{-2}$ — (01)

$R = mg - \frac{8m}{5} = 10\left(10 - \frac{8}{5}\right) = 10 \times \frac{42}{5} = 84\ N = 8.4\ kg$ — (01)

vi) $\downarrow F = ma$

$mg - R = mg$; $R = 0$ — (01)

5(i)



$\uparrow v^2 = u^2 + 2as$ — (01)

$0 = 10^2 - 20h$ — (01)

$h = 5\ m$ — (01)

height from the ground 6 m. — (01)

(ii) horizontal component $= V_x = 20\cos 30° = 20 \times \frac{\sqrt{3}}{2}$ — (01)

$= 10\sqrt{3} = 10 \times 1.73 = 17.3\ ms^{-1}$ — (01)

Vertical component V_y

$\uparrow v^2 = u^2 + 2as = 10^2 + 2 \times (-10) \times (-0.5)$ — (01)

$v^2 = 10^2 + 10 = 110$ — (01)

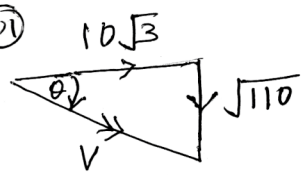
$V_y = \sqrt{110} = 10.5\ ms^{-1}$ — (01)

(iii) $V^2 = V_x^2 + V_y^2 = (10\sqrt{3})^2 + (\sqrt{110})^2 = 300 + 110$ — (01)

$V^2 = 410$

$V = \sqrt{410} = 10\sqrt{4.1} = 20.3\ ms^{-1}$ — (01)

$\tan\theta = \frac{\sqrt{110}}{10\sqrt{3}} = 0.6055$ — (01)



$\theta = 31°\ 11'$ — (01)

(iv) time taken to reach the fielder

$\uparrow s = ut + \frac{1}{2}at^2$ — (01)

$-0.5 = 10t - 5t^2$

$5t^2 - 10t - 0.5 = 0$

$t^2 - 2t - 0.1 = 0$ — (01)

$t = \frac{2 \pm \sqrt{4 - 4 \times 1 \times (-0.1)}}{2} = \frac{2 \pm \sqrt{4 + 0.4}}{2} = \frac{2 \pm 2.1}{2}$

$t = 2.05\ s$ — (02)

(v) horizontal distance travelled by the ball

$S = ut = 10\sqrt{3} \times 2.05 = 10 \times 1.73 \times 2.05$

$R = 35.46\ m$ (02)

(vi) $S = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2} \times 4 \times (2.05)^2$

dis. fielder. $= 2 \times (2.05)^2 = 8.405\ m$ (02)

initial distance $= 35.46 + 8.405 = 43.87\ m$ (02)

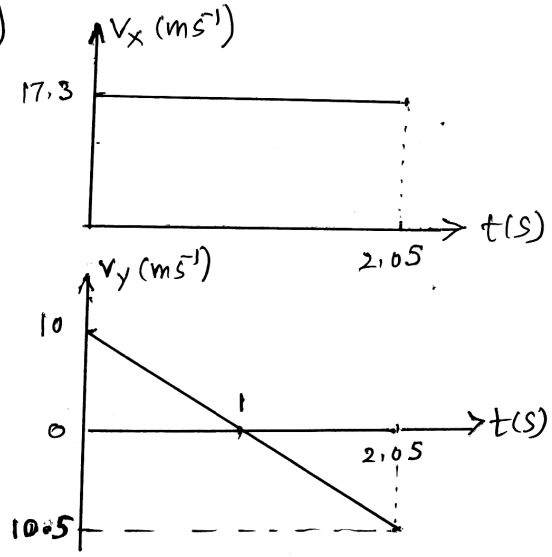
(vii) velocity of the fielder

$V = u + at = 0 + 4 \times 2.05 = 8.2\ ms^{-1}$ (02)

(viii) He <u>cannot</u> catch the ball at the same position — (01)

correct explanation — (01)

(ix)



(01)

(02)

PHY 12

6(a) (i) delayed B — (01)

delayed time 500 s — (01)

(ii) comes to rest first A — (01)

distance to B - 2000 m — (01)

(iii) $s_A = 10t$ — (01)

$s_B = 4t + 1000$ — (01)

$10t = 4t + 1000$ — (01)

$6t = 1000$

$t = 167\ s$ — (01)

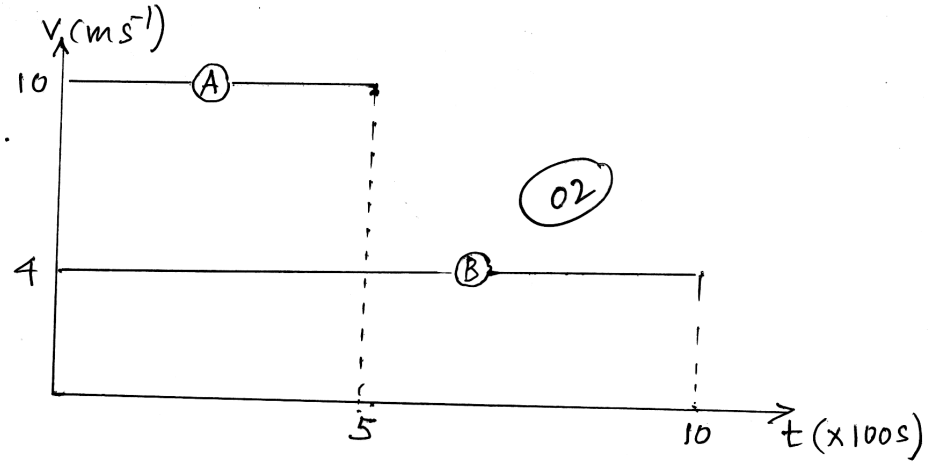
(iv) higher velocity - A

$10\ ms^{-1}$ A's velocity. — (02)

(v) $6t = 100\ m$ — (01)

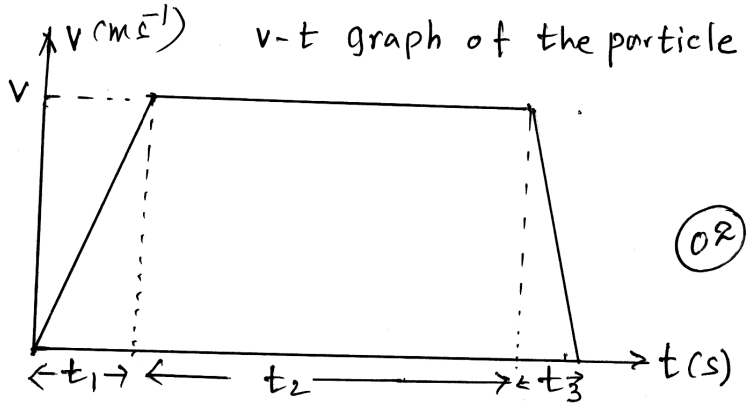
$t = 16.7\ s$ — (01)

(vi)



(02)

(b)



v-t graph of the particle

(02)

PHY 12

(i) average velocity $= \frac{\text{displacement}}{\text{time}} = \frac{375\ m}{4.5\ S}$ (02)

$= 83.3\ ms^{-1}$

(ii) acceleration period - t_1

constant velocity period - t_2

retardation period - t_3

$\frac{1}{2} V t_1 = 50$ — (01)

$V t_2 = 300$ — (01)

$\frac{1}{2} V t_3 = 25$ — (01)

$t_1 : t_2 : t_3 = 2 : 12 : 1$

$15t = 4.5$ — (01)

$t_3 = t = 0.3\ S$ — (01)

$t_2 = 3.6\ S$ — (01)

$t_1 = 0.6\ S$

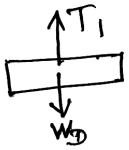
$V = \frac{300\ m}{3.6\ S} = 1080\ ms^{-1}$ (02)

(iii) aeeeleration $a_1 = \frac{1080\ ms^{-1}}{0.6S} = 1800\ ms^{-1}$ (02)

(iv) retardation $a_2 = \frac{1080\ ms^{-1}}{0.3S} = 3600\ ms^{-1}$ (02)

7 (a)(i)(a) Constant velocity $\uparrow$

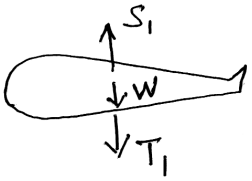
$T_1 = W_D = mg = 10 \times 10 = 100N$



forces : Weight of the disk = 100N

tention of the cable - 100N (03)

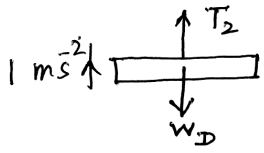
(b)



$S_1 = W_H + T_1 = m_H g + T_1$

$S_1 = 1000 \times 10 + 100 = 10100\,N$ (02)

(ii) constant acceleration $\uparrow 1\,ms^{-2}$



(a) $T_2 - W_D = m_D a$ (01)

$T_2 = m_D a + W_D = m_D a + m_D g$

$= 10(1+10) = 110\,N$ (02)

$W_D = 100\,N$

$T_2 = 110\,N$

(b) $S_2 = W_H + T_2 = m_H a$ (01)

$= 1000 \times 11 + 110 = 11110\,N$ (02)

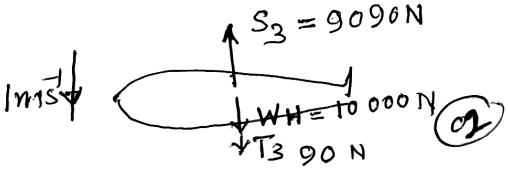
(iii) Constant acceleration $\downarrow 1\,ms^{-2}$

(a) $W_D = 100\,N$ (02)

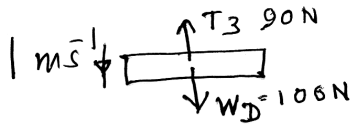
$T_3 = 90\,N$

(b) $S_3 = 9090\,N$ (03)

(iv)

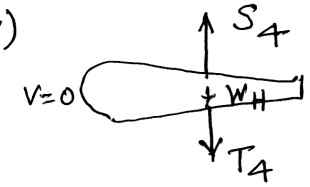


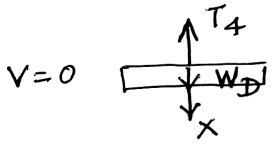
(02)

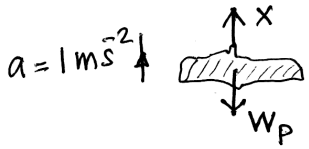


(01)

(v)







(a) $W_P = 100 \times 10 = 1000\,N$

$X = W_P + m_P a = 1000 + 100 \times 1$

$X = 1100\,N$ (04)

(b) $W_D = 100\,N$ $X = 1100\,N$

$T_4 = 1200\,N$ (03)

(c) $S_4 = W_H + T_4 = 10000 + 1200$

$= 11200\,N$ (04)

E 6

08 (a)(i) $P = kg\,ms^{-1}$ (01) MLT^{-1} (01)

(ii) principle of conservation of linear momentum (02)

(b) (i) KE before $\frac{1}{2} \times 0.1 \times 10^2 = 5J$ (02)

(ii) KE after impact $= \frac{1}{2} \times 0.1 \times 10^2 = 5J$ (02)

(iii) kinetic energy conserved - (02)
perfectly elastic -

(iv) riders are moving with $5\,ms^{-1}$ (02)
when the system has lowest KE

lowest KE $= 2 \times \frac{1}{2} \times 0.1 \times 5^2 = 2.5J$ (02)

highest Potentical energy $= 5 - 2.5 = 2.5J$ (02)

(v) mean force $= \frac{\Delta mv}{t} = \frac{0.1 \times 10}{0.1} = 10N$ (03)

(vi)  (01)

(vii) P after = P before

$0.1 V_A + 0.01 \times 15 = 0.11 \times 10$

$V_A = 9.5\,ms^{-1}$ (05)

for the rider B

$0.11\,V = 0.01 \times 15$

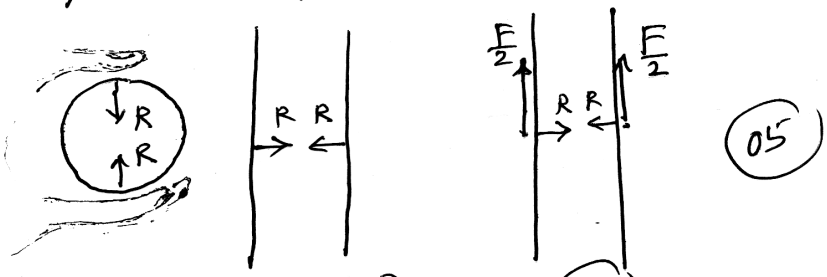
$V_B = 1.36\,ms^{-1}$ (05)

9 a (i) Conditions

vector sum of the external forces acting on it is zero. (01)

(vector) sum of the external torques acting on the body about any point is zero. (01)

(ii)

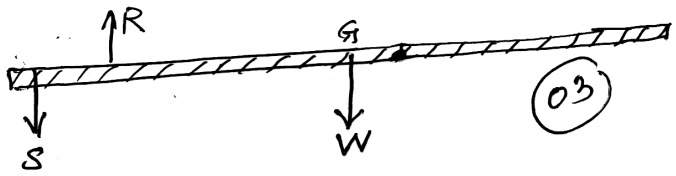


(05)

(02)

(iii) $W = F = \mu R \times 2 = 2\mu R$

(iv)



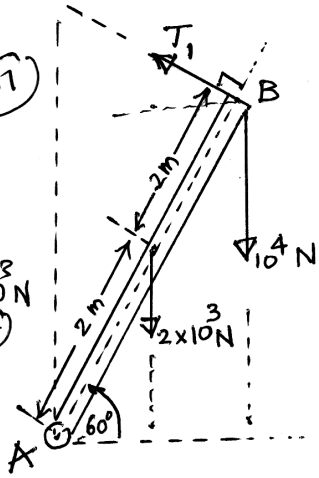
(03)

$W < S < R$ (02)

(b) (i) torque around A (01) (01) (01)

$2\times10^3 \times 2\cos60^\circ + 10^4 \times 4\cos60^\circ = 4T_1$

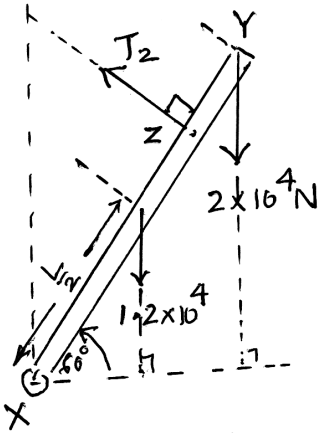
$T_1 = 5.5\times10^3\ N$ — (02)



(ii) $X_A = T_1\cos30^\circ = 5.5\times10^3 \times \frac{\sqrt{3}}{2} = 4.75\times10^3\ N$ (02)

$Y_A =$ — (02)

(c).



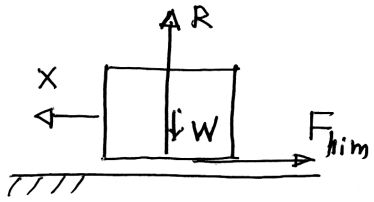
torque around (03)

$T_2 \times \frac{3L}{4} = 1.2\times10^4 \times \frac{L}{2}\cos60^\circ + 2\times10^4 \times L\cos60^\circ$

$\frac{3}{4}T_2 = \frac{1.2}{4}\times10^4 + 1\times10^4 = 1.3\times10^4$ (02)

$T_2 = \frac{1.3\times4}{3}\times10^4\ N$ (02)

10 (a)(i)

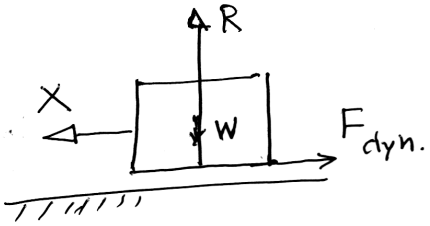


$R = W = 100N$

(05) $F_{lim} = X = 75\ N$

$\mu_s = \frac{75}{100} = 0.75$

(ii)



(03) $F_{dyn} = 70N$

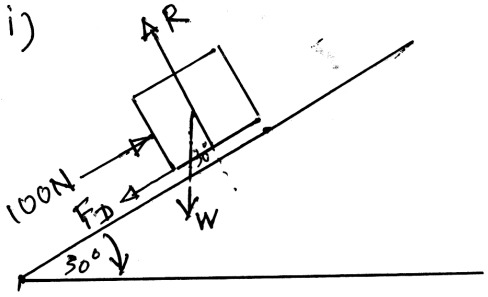
$\mu_D = \frac{70}{100} = 0.70$

(iii) $W = F.S$

(02) $= 70N \cdot 2m$

$= 140Nm$

b (i)



(i) Component of the weight along the plane

$W \sin 30°$

$100 \times \frac{1}{2} = 50\ N$

Frictional Force F_D

(03) $F_D = 100N - 50N$

$= 50N$

(ii) Nomal Reaction R

$R = W \cos 30°$

$= 100 \times \frac{\sqrt{3}}{2} = 50\sqrt{3}$ (05)

$\mu_D = \frac{50}{50\sqrt{3}} = \frac{1}{\sqrt{3}}$

$= 0.578$ (0.57-0.58)

(iii) $W = F.S$ (03)

$= 100N \times 2m = 200J$

(iv) $\Delta P.E = mgh = 100 \times 1 = 100J$ (02)

(v) For workdone against friction. = loss of energy. (03)

(c) At B situation (02)

At this situation he does some work against (02) his weight when climbing up the plane.