St. Peter's College- Colombo 04

First Mid Term Test – 2024

Grade 12 (2025) **1.30 hours**

PART - I

Choose the most appropriate answer for the following questions.

1) The unit of, energy per unit volume is

(1) Nm (2) Nm^{-1} (3) Nm^{-2} (4) Ns (5) Nms^{-1}

2) When two masses M and m are separated by a distance r, the force exerted by one on the other is given by the formula $F = \frac{GMm}{r2}$, where G=6.67x10^{-11} Nm^2kg^{-2}. If G=X$cm^3s^{-2}g^{-1}$, what should be the value of X?

(1) 6.67×10^{-8} (2) 6.67×10^{-11} (3) 6.67×10^{-5}

(4) 6.67×10^{8} (5) 6.67×10^{5}

3) If the relationship between force (F) and density (d) is given by $F = \frac{a}{2b+\sqrt{d}} + 3c$, where a, b and c are constants. The dimension of a should be

(1) $M^{3}/_{2}\ L^{-1}/_{2}\ T^{-1}$ (2) $M^{3}\ L^{-1}/_{2}\ T^{-3}$ (3) $M^{2}\ L^{2}\ T^{-3}$

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

4) The length and breadth of a rectangular lamina when measured by a metre rule found to be 5.8 cm and 3.5 cm respectively. What is the maximum percentage of error when calculating its area? (Use the relation $\frac{\Delta A}{A} = \frac{\Delta l}{l} + \frac{\Delta b}{b}$)

(1) 3.6% (2) 4.5% (3) 4.6% (4) 4.8% (5) 4.9%

5) The length of the minute hand of a clock is 4.5 cm. The average displacement undergone by the tip of the minute hand from the time 6.00 to 6.15 is

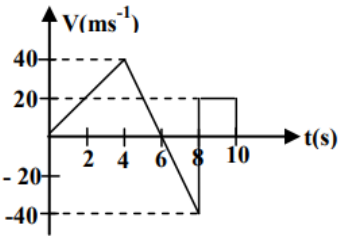
(1) $6.30\ cm$ (2) $6\ cm$ (3) $4.5\sqrt{2}\ cm$ (4) $4.5\ cm$ (5) Zero

6) In the above question the magnitude of the average velocity of the tip of the minutehand is

(1) $7.07 \times 10^{-3} cm\ s^{-1}$ (2) $7.07 \times 10^{-5} cm\ s^{-1}$ (3) $7 \times 10^{-3} cm\ s^{-1}$

(4) $7 \times 10^{-5} cm\ s^{-1}$ (5) $5 \times 10^{-5} cm\ s^{-1}$

7) The velocity – time graph of a particle moving in a straight path is given below. The particle's displacement and distance respectively from the graph is



(1) 120m, 120m

(2) 200m, 120m

(3) 175m, 175m

(4) 120m, 200m

(5) 200m, 200m

8) A motor car moves with uniform acceleration α from rest and then immediately continues with uniform retardationβ and comes to rest in time t. The maximum velocity of the car is

(1) $\left(\frac{\alpha^2+\beta^2}{\alpha\beta}\right) t$

(2) $\left(\frac{\alpha^2-\beta^2}{\alpha\beta}\right) t$

(3) $\left(\frac{\alpha+\beta}{\alpha\beta}\right) t$

(4) $\left(\frac{\alpha\beta}{\alpha+\beta}\right) t$

(5) $\left(\frac{\alpha+\beta}{\alpha\beta}\right)^2 t$

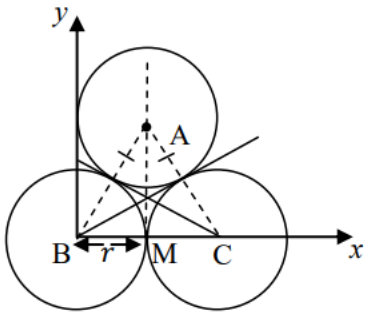
9) (A) Angstrom (B) Lightyear (C) Fermi

From the above, the unit /units which is/are used to measure length is given by

(1) A only (2) B only (3) A and B only

(4) B and C only (5) A, B, C all

10) Three identical cylinders each of mass *m* and radius *r* are placed on a rough horizontal surface to be in equilibrium. The co-ordinate of the centre of gravity of the composite of the cylinders in equilibrium is



(1) (r, r)

(2) $(r, \frac{r}{\sqrt{3}})$

(3) $(r, 2r)$

(4) $(2r, 2r)$

(5) $(r, \sqrt{3}r)$

11) When a unit force acts on a body, the ratio of the force $\frac{SI\ unit}{c.g.s\ unit}$ is given by

(1) 10^5

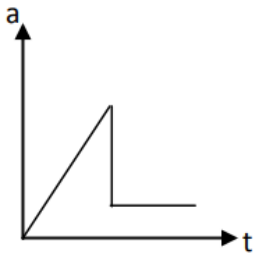
(2) 10^{-5}

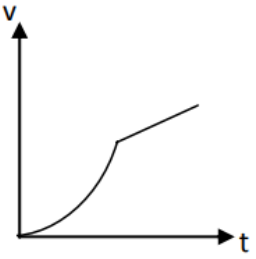
(3) 10^7

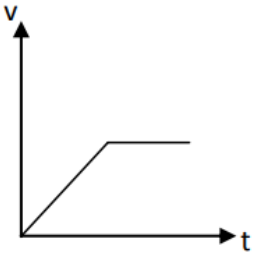
(4) 10^{-7}

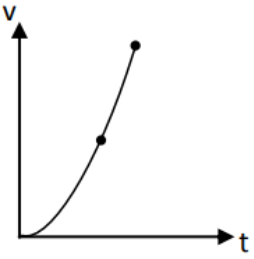
(5) 10^6

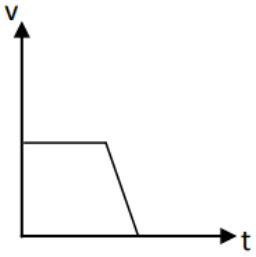
12) The acceleration - time curve of a particle is shown below. The corresponding velocity – time curve of the particle is best shown by

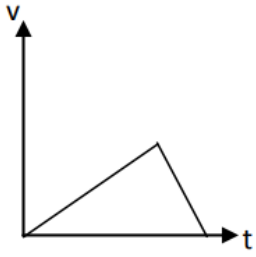


(1) 

(2) 

(3) 

(4) 

(5) 

13) The internal and external diameters of a uniform hollow rigid cylinder were measured using Vernier caliper. The measurements are $3.87 \pm 0.01 cm$ *and* $4.23 \pm 0.01\ cm$ respectively. The thickness of the wall of the cylinder is.

1) $0.36 \pm 0.01\ cm$ *2)* $0.18 \pm 0.01\ cm$ *3)* $0.36 \pm 0.02\ cm$

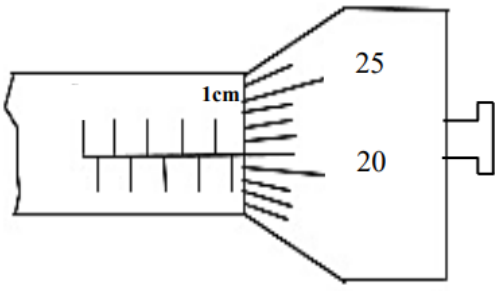
4) $0.18 \pm 0.02\ cm$ *5)* $0.36 \pm 0.04\ cm$

14) What is the reading of the micrometer screw gauge shown here if the total number of the divisions on its circular scale is *50*?

1) $1.021\ cm$ *2)* $1.071\ cm$

3) $1.099\ cm$ *4)* $1.521\ cm$

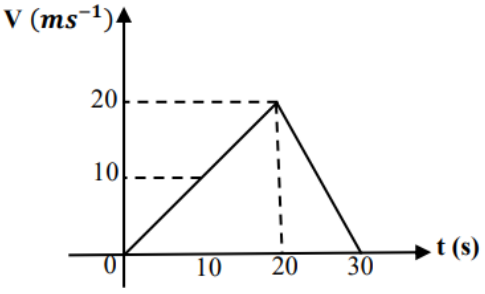
5) $1.549 cm$



15) The resultant vector of two vectors $\overline{A}$ *and* $\overline{B}$ is at right angle to vector $\overline{A}$ and having magnitude equal to half of the magnitude of vector $\overline{B}$, then the angle in between $\overline{A}$ *and* $\overline{B}$ is

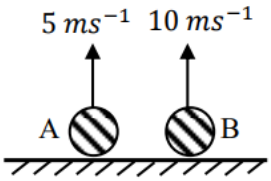
1) 30° *2)* 60° *3)* 90° *4)* 120° *5)* 150°

16) The graph given in the figure shows the variation of velocity V of a body of mass $1kg$ with time t. Which one of the following statements is faulty?



1) The amount of work done on the body up to 30 s is zero.
2) The mean acceleration of the body is zero.
3) The mean velocity of the body is zero.
4) The mean value of force acted on the body is zero.
5) The mean value of impulse acted on the body is zero.

17) From a horizontal ground two particles A and B are projected, side by side at the same time, Vertically upwards with velocities $5\,ms^{-1}$ *and* $10\,ms^{-1}$ respectively. The separation between particles 1 second after the projection is.

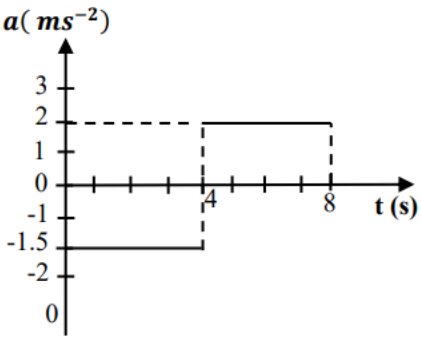


1) Zero 2) $2.5m$ 3) $5m$
4) $7.5m$ 5) $10m$

18) A car driver takes 2 hours to cover a distance of $75km$ he used to travel. As usual he started his journey today and on his way he spent 30 minutes to repair the fault of the engine, and 15 minutes for taking tea. If he has completed his journey in the usual time, what is the average speed at which the car was driven.

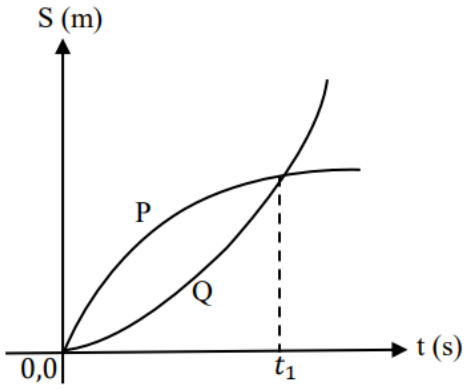
1) $37.5\ km\ h^{-1}$ 2) $50\ km\ h^{-1}$ 3) $60\ km\ h^{-1}$ 4) $75\ km\ h^{-1}$ 5) $80\ km\ h^{-1}$

19) The acceleration (a) vs time (t) graph of an object is shown beside. The time at which the object will have its initial velocity once again is.



1) $t = 3s$ 2) $t = 4s$ 3) $t = 7s$
4) $t = 8s$ 5) *can not be calculate*

20) The $(s-t)$ graphs of two motor cycles P and Q travelling in a straight line are shown beside. Which of the following statements is wrong about the motion of P and Q



1) Up to $t = t_1$, the distance travelled by both are equal.
2) While P is moving with deceleration, Q is moving with acceleration.
3) The motion up $t = t_1$, the average velocities of both are equal.
4) At $t = t_1$, the velocity of Q is more than that of P.
5) After $t = t_1$, they can meet each other once again.

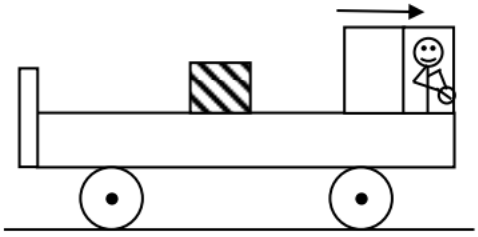
21) A projectile is thrown at a certain angle with the horizontal. Which of the following statements is wrong when it is at its highest point of its trajectory?

1) Its speed is zero *2)* Its speed is minimum
3) Its kinetic energy is minimum *4)* Its potential energy is maximum
5) The magnitude of its acceleration is g.

22) Two players are standing at a distance of 60 m a part on a level ground and when one throws the ball the other one catches it after 3 seconds. The speed of projection of the ball is.

1) $10\ ms^{-1}$ *2)* $15\ ms^{-1}$ *3)* $20\ ms^{-1}$ *4)* $25\ ms^{-1}$ *5)* $30\ ms^{-1}$

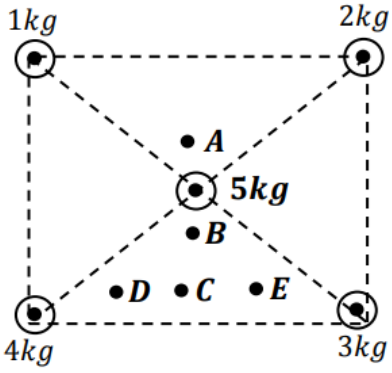
23) As shown in the figure a box was loaded into a vehicle and driven on a level road with uniform acceleration such that the box is at rest relative to the vehicle. The direction of the reaction by the floor of the vehicle on the box could be.



1)  *2)*  *3)* 

4)  *5)*

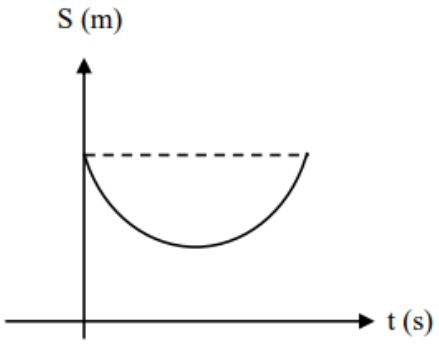
24) As shown in the figure five masses are placed at the verticies and centre of a square. The possible position of the centre of mass of these masses would be.



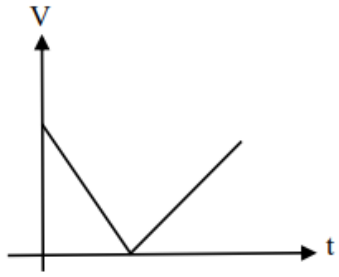
1) A 2) B 3) C
4) D 5) E

25)

. The velocity (v) – time (t) graph corresponding to the displacement – time graph. shown beside is.



1)



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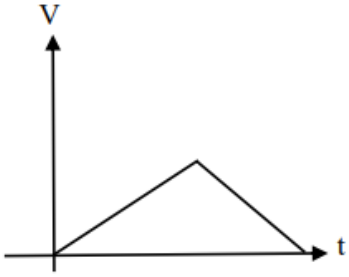
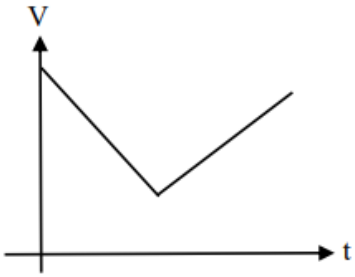


3)



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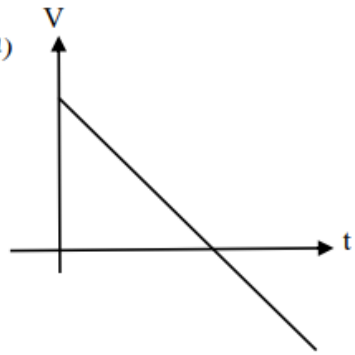
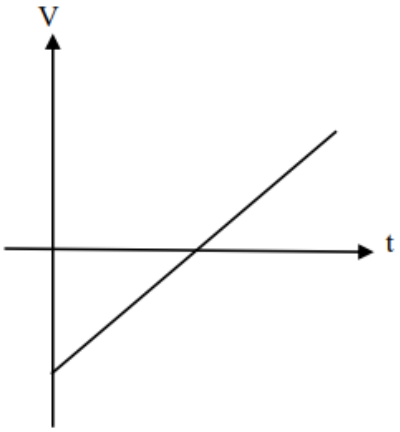


5)

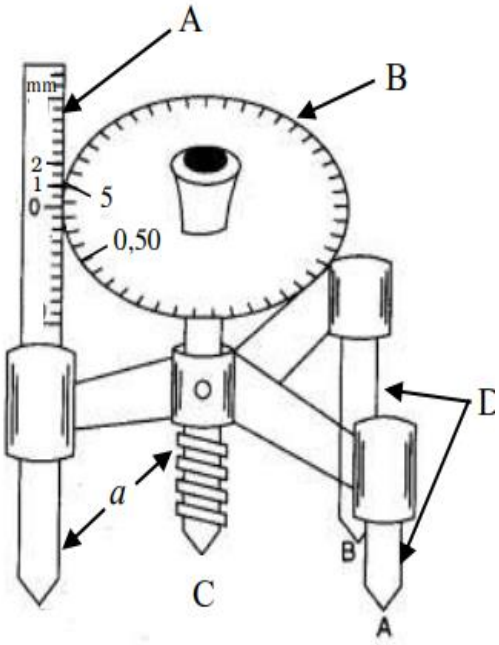


Part II

Structured Essay Questions

❖ **Answer all questions.**

01. A Spherometer is an instrument used in laboratories to measure the radius of curvature of spherical surfaces.



a)

i) Identify the components of the spherometer shown in the figure.

A - ……

B - ……

C - ……

D - ……

ii) What is the least count of the spherometer shown above?

……

b) You are provided with a watch glass and a sheet of glass. You are requested to find the radius o curvature of the given watch glass. The radius of curvature R of the spherical surface is given b $R = \frac{a^2+h^2}{2h}$, h is the height through which the screw is raised.

i) Write down the steps you would take to find a.

……

……

ii) Write down the experimental steps you would follow to find h?

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……

……

iii) In order to determine h, two positions of the spherometer are shown below.

Position I **Position II**

Write down the readings of two positions.

Position I .....

Position II.....

iv) Find h

.....

v) $a = 2.0cm,$ Find the radius of curvature of the watch glass.

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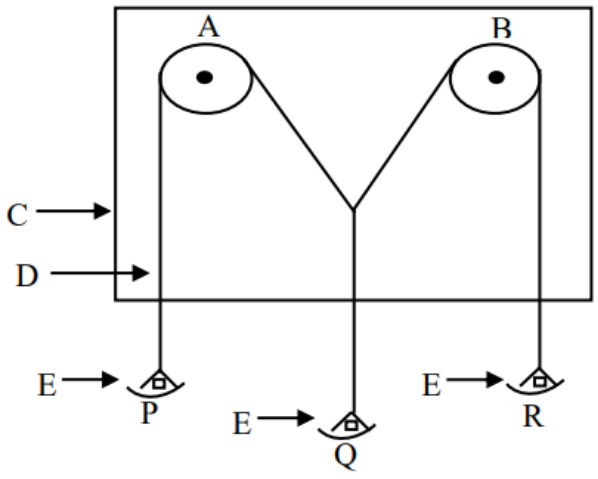
02. The figure shows the setup of an apparatus used in school laboratories for verifying parallelogram law of forces, A student wants to use this setup and verify that the resultant (Vector addition) of three coplar forces is zero when they act on a body and keep it in equilibrium.



A,B - Smooth small pulleys.

C - A vertical board carrying white sheet of paper attached to it.

D -Light string

E - Light pans

a) After setting up the apparatus and hanging the weights P,Q and R, the student pulled Q slightly downwards and then released.

i) What is the purpose for which the student did like that?

.....

ii) What observation was he expecting?

……...

b)

i) Label the point where three forces are acting as X.

ii) In the diagram mark the three forces as F_1, F_2 and F_3

iii) Write down the vector equation in terms of F_1, F_2 and F_3

……..

c) What other devices are needed to complete the experiment accurately?

……

……

d) What are the measurements to be taken by the student in order to draw the triangular forces?

……

e) $P = 8N, Q = 10N$ and $R = 6N$ Give the values of F_1, F_2, and F_3 which you have marked.

$F_1 =$ …… $F_2 =$ …… $F_3 =$ ……

f) Draw the triangular forces for the forces having above values. (It is sufficient to use approximate magnitudes)

g) When student was drawing the triangular forces, the final point didn't meet the initial point accurately. Give one reason for this.

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