யாழ்ப்பாணம் இந்துக் கல்லூரி
முதலாம் தவணைப் பரீட்சை - 2023
Jaffna Hindu College
1st Term Examination - 2023

பௌதிகவியல் Physics	Three Hours Gr. 12 (2025)	01	E	I

01) A unit of a derived quantity does **not** exist is.

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

02) The Velocity of a freely falling body is a resisting medium at any time "t" is given by $V = \frac{A}{B[1-e^{Bt}]}$ The dimension of "A" are

(1) L (2) LT^{-2} (3) LT^{-1} (4) LT (5) $L^{-1}T$

03) A vernier caliper has 20 divisions on the vernier.scale which coincide with 19 on the main scale. The least count of the instrument is 0.1 mm. The main scale devisions are of

(1) 0.5 mm (2) 1.0 mm (3) 2.0 mm (4) 4.0 mm (5) 6.0 mm

04) The radius of a ball bearing measured by screw gauge is 3.75 mm. The pitch of the screw is 1 mm and it has 100 divisions on its head scale. What is the percentage error in the volume of the ball hearing which can be assumed to be a perfact sphere?

(1) 2 % (2) 1.5 % (3) 0.8 % (4) 1 % (5) 0.6 %

05) The vander waal's equations of state for some gases can be expressed as $\left(P + \frac{a}{V^2}\right)(V - b) = RT$ Where P is the pressure, V the molor volume and T is the absolute temperature of the given sample of gas and a, b and R constants. Which of the following does not have the same dimensional formula as that for RT?

(1) PV (2) Pb (3) $\frac{a}{V^2}$ (4) $\frac{ab}{V^2}$ (5) $\frac{a}{V}$

06) A Physical quantity X is given by $X = \frac{2K^3\ell^2}{m\sqrt{n}}$ The percentage error in the measurements of K, ℓ, m and n are 1%, 2%, 3% and 4% respectively. the Value of "X" is uncertain by

(1) 4 % (2) 6 % (3) 8 % (4) 10 % (5) 12 %

07) In equation $V = K\sqrt{\frac{T}{M}}$, when velocity V is measured in ms^{-1}, tension T is $kgms^{-1}$ and linear density m in kgm^{-1} then $K = 1$. Now If velocity is measured in $cm\ s^{-1}$, tension in $gcms^{-2}$ and linear density in $mg\ mm^{-1}$. What is the value of K.

(1) 10 (2) 1 (3) 0.1 (4) 0.01 (5) 0.001

08) The potential energy of a particle varies with distance x from a fixed origin as $U = \frac{A\sqrt{x}}{x+B}$ where A and B are constants. The diminution of AB are .

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

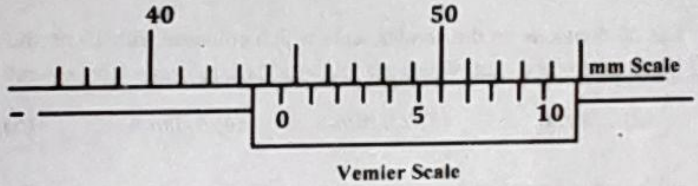
(4) $ML^{7/2}T^{-2}$ (5) $M^2L^2T^{-2}$

09) From the dimensional consideration which of the following equations in correct?

(1) $T = 2\pi\sqrt{\frac{g}{\ell}}$ (2) $T = 2\pi\sqrt{\ell g}$ (3) $T = 2\pi\frac{\ell}{g}$

(4) $T = 2\pi\sqrt{\frac{\ell}{g}}$ (5) $T = 2\pi\frac{g}{\ell}$

10) A pupil used a micrometer screw gauge of 0.5 mm pitch and 50 head scale divisions. Write the correct reading of the micrometer screw gauge shown below



(1) 44.6 mm (2) 44.5 mm (3) 48.5 mm (4) 45.5 mm (5) 46.6

11) What is the reading of vernier scale shown is fig.

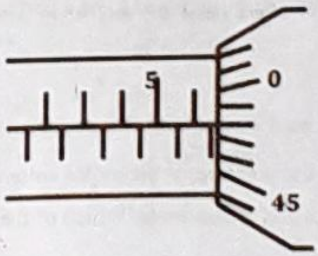
(1) 6.48 mm

(2) 7.48 mm

(3) 6.98 mm

(4) 7.98 mm

(5) 8.48 mm



12) A body initially at rest is moving with uniform acceleration. Its velocity after n seconds is V. The displacement of body in the last $2s$ is .

(1) $\frac{2V(n-1)}{n}$ (2) $\frac{V(n-1)}{n}$ (3) $\frac{V(n+1)}{n}$

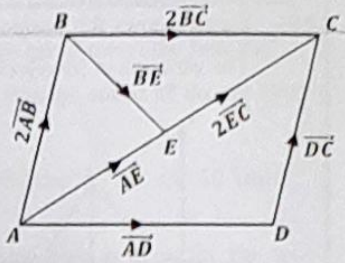
(4) $\frac{2V(n+1)}{n}$ (5) $n(n+1)V$

13) A car, starting from rest acceleration at the rate a through a distance s, then continuous at velocity for time t and then decelerates as rate $\frac{a}{2}$ to come to rest. If the total distance travelled in $15s$; then.

(1) $S = at$ (2) $S = \frac{1}{6}at^2$ (3) $S = \frac{1}{72}at^2$

(4) $S = \frac{1}{75}at^2$ (5) $S = \frac{1}{4}at^2$

14) Find the resultant vector of the vector system shown in figure.



(1) $\overrightarrow{AC}$

(2) $2\overrightarrow{AC}$

(3) $3\overrightarrow{AC}$

(4) $4\overrightarrow{AC}$

(5) Zero

15) The maximum horizontal range of a projectile is 400 m. The maximum height attained by it well be

(1) 100 m (2) 200 m (3) 400 m

(4) 500 m (5) 1000 m

16) Two cars A and B are travelling in the some direction with velocities V_A and V_B $(V_A > V_B)$ when car A is at a distance d behind the car B the driver of the car A applies breaks producing a uniform deceleration "a". There will be no coolision

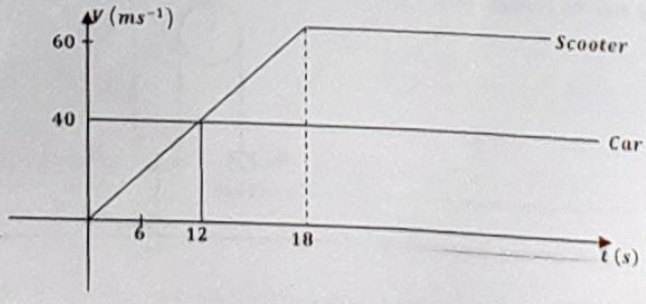
(1) $d < \frac{(V_A - V_B)^2}{2a}$ (2) $d < \frac{V_A^2 - V_B^2}{2a}$ (3) $d > \frac{(V_A - V_B)^2}{2a}$

(4) $d > \frac{(V_A - V_B)^2}{2a}$ (5) $d = \frac{V_A^2 - V_B^2}{2a}$

17) A ball is projected horizontally with a velocity of 6 ms^{-1} from the top of a tower. The velocity of the ball after 0.8 s is $(g = 10\ ms^{-2})$

(1) 6 ms^{-1} (2) 8 ms^{-1} (3) 10 ms^{-1} (4) 12 ms^{-1} (5) 16 ms^{-1}

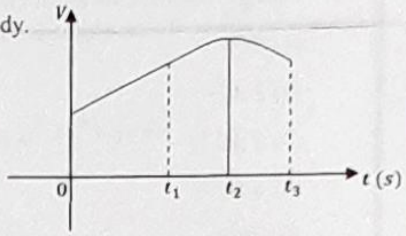
18)



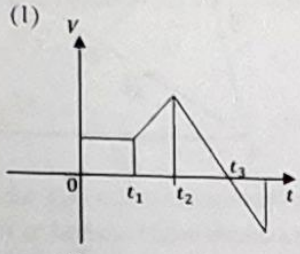
A scooter starts from rest at the same time car moving with uniform velocity overtakes the scooter, both moving in same direction same initial position. The velocity - time graphs both of them are shown. in the following figure. The time after which they meet?

(1) 6 s (2) 12 s (3) 18 s (4) 27 s (5) 36 s

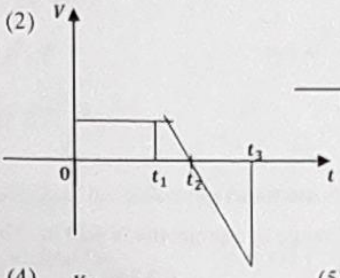
19) Figure shows the position s verius time curve time for body. The variation of its velocity (v) with time (t) graph.



(1)



(2)



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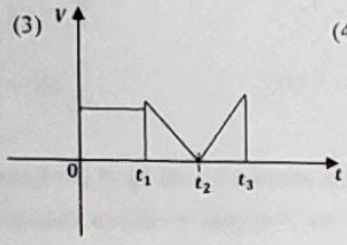
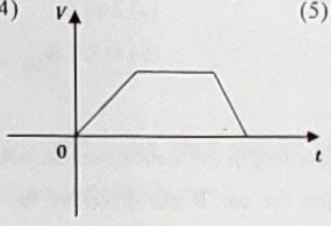
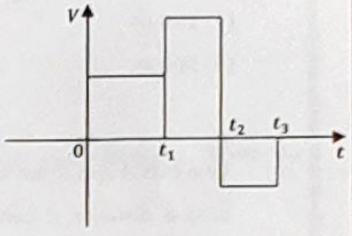


(4)



(5)



20) Determine the force F needed to hold in the position shown

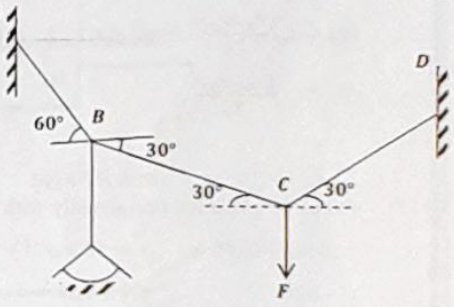
(1) 40 N

(2) 68 N

(3) 34 N

(4) 19.5 N

(5) 42 N



21) Find the acceleration of 1 kg. Neglect fraction and the masses of the string and the pallegs. (ms^{-2})

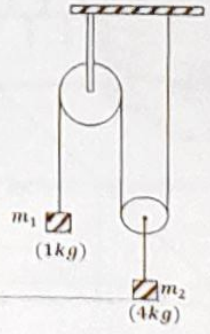
(1) 2.0

(2) 2.5

(3) 4.0

(4) 5.0

(5) 4.5



22) A ball is projected upwards from a height h above surface of the earth with velocity "V". The time at which the ball strikes the ground is

(1) $\frac{V}{g}+\frac{2gh}{\sqrt{2}}$ (2) $\frac{V}{g}\left[1-\sqrt{1+\frac{2h}{g}}\right]$ (3) $\frac{V}{g}\left[1+\sqrt{1+\frac{2gh}{V^2}}\right]$

(4) $\frac{V}{g}\left[1+\sqrt{V^2+\frac{2g}{h}}\right]$ (5) $\frac{V}{g}-\frac{2gh}{\sqrt{2}}$

23) A car travels half its total path at 60 kmh^{-1}, half the time it takes the car to travel the final half of its path at 15 kmh^{-1} and the final part of its path at 45 kmh^{-1}, the average speed of the car over its total path. is

(1) 20 kmh^{-1} (2) 30 kmh^{-1} (3) 40 kmh^{-1} (4) 45 kmh^{-1} (5) 50 kmh^{-1}

24) The first carriage of a Train past an observer standing on the plat from is $t_1 = 1s$, the second carriage in $t_2 = 1.5s$. The carriage length ℓ is 12 m the train's motion to be uniformly its deceleration "a" and its velocity "U" at initial moment of observer.

(1) 3.0 ms^{-2}, 13.6 ms^{-1}

(2) 3.2 ms^{-2}, 13.6 ms^{-1}

(3) 3.2 ms^{-2}, 14.3 ms^{-1}

(4) 3.6 ms^{-2}, 13.6 ms^{-1}

(5) 4.2 ms^{-2}, 16.4ms^{-1}

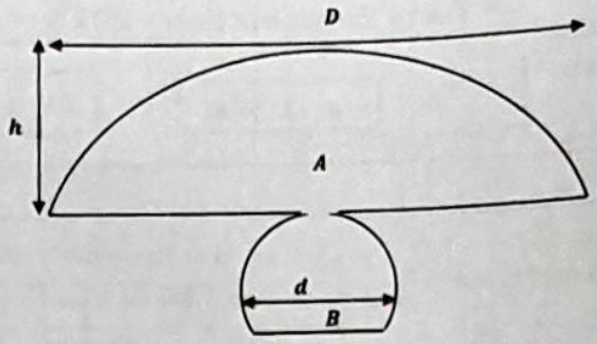
25) When a ball is thrown up vertically with velocity V_0 it reaches a maximum height of h. If one wishes to triple the maximum height the hall should thrown with velocity

(1) $\sqrt{3}\,V_0$ (2) $\sqrt{3}\,V_0$ (3) $\sqrt{9}\,V_0$ (4) $\sqrt{\frac{3}{2}}\,V_0$ (5) $\sqrt{\frac{5}{2}}\,V_0$

Part - II(A)

Structured Essay

01)



A paper weight made of glass is shown below. It is necessary to take its measurements to find the volume of glass used to make it.

(a) State the measuring instruments used to obtain the following measurements.

D : .....

d : .....

(b) Write down the steps you follow to measure *d* with a high accuracy.

.....

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(c) State the measuring instruments used to measure the height h of the spherical part A. Draw the setup you use when it is measured.

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(d) Volume of the spherical part B is 80% of the volume of the sphere of diameter d. Write down an expression for the volume of part B.

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(e) Calculate the fractional error $\left(\frac{\Delta V}{V}\right)$ of the volume of part B. $(d = 5\,cm)$

(f) Write down an expression for total volume of the paper weight. If the volume of part A(V_A) is given by $V_A = h\left(\frac{D^2}{8} + \frac{h^2}{6}\right)$

(g) Find the volume of the paper weight if $d = 5\,cm\ D = 10\,cm\ h = 4cm$

(h) Write down an expression for the mass of above paper weight. Name the other quantities if there are any.

(i) (1) State a more accurate method to measure the volume of the paper weight instead of the above method.

(2) Explain why it is the more accurate method.

02) 49 main divisions align with 50 vernier divisions. It is used to measure internal diameter of a capillary tube.

(a) (i) What is the least count of the travelling microscope?

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.....

(ii) Write two measurements except above mention measurement that can be obtained using travelling microscope.

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(iii) Zero error is not very important in travelling microscope: Why is that?

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.....

(iv) To get the readings, there is a special arrangement inside the microscope other than scales. What is it?

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(v) In this experiment, student record the following readings. Write the letter of the reading in the correct position of the given diagram.

Horizontal diameter

Vertical diameter.

$x = 6.520$

$y = 6.018\ cm$

$p = 14.501\ cm$

$q = 15.011\ cm$

(vi) Find the internal diameter using above readings

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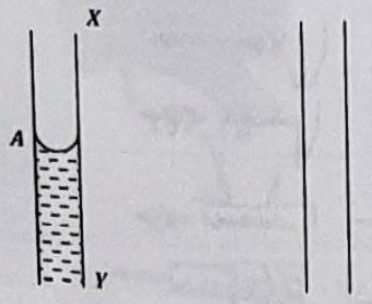
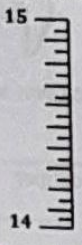
(vii) This travelling microscope is used to measure the height of a liquid column inside a capillary tube.

(a) Draw the image of the meniscus and the position of the wire that you use to record the reading



The measurement of A is 14.541 *cm*. Draw how vernier zero align with the main scale in the following diagram at this situation.



(b) Which vernier division aligns with the main scale at this situation.

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03) The following measuring instruments are given to determine the volume of a small uniform cylindrical container of the form shown in figure.

(1) A vernier caliper.

(a) Before using a vernier caliper for taking measurements, what is the first stop that you should take?

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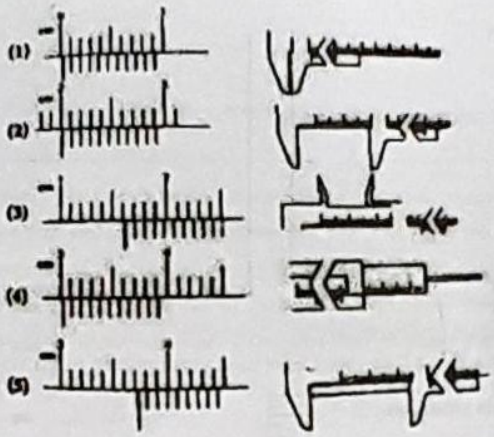
(b) In addition to the two measurements, the outer diameter and the inner diameter of the container, state the other measurements that you would take using the vernier caliper to determine the volume of the material.

.....

(c) The figures (i) to (v) below show all the relevant positions of the main and the vernier scales pertaining to one set of measurements that has been taken in order to determine the volume of the material of the container. Relevant jaws/depth rods etc. that have been used to take each measurement are shown on the right hand side of the figure.

Note: Height of the container is greater than its outer diameter.



Identify the figures correctly and relate them to the measurements that have been indicated in (c), and fill in the table given below.

Figure	Reading of the vernier caliper	Corrected reading	Name of the measurements
(i)	.....		.....
(ii)	.....	..... (say x_1)	.....
(iii)	.....	..... (say x_2)	.....
(iv)	.....	..... (say x_3)	.....
(v)	.....	..... (say x_4)	.....

(d) (i) Write down an expression for the volume v of the material of the container in terms of the symbols(X_1, X_2, X_3, X_4) given in the table above.

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(ii) Using the expression written under d(i) above and readings that you have given in the above table in (d), calculate v (Take $\pi = 3$)

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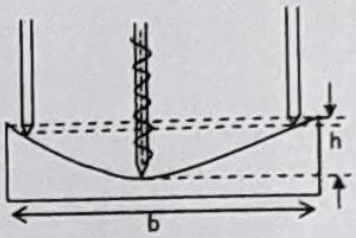
04) Figure 1 show a spherometer used in a laboratory. Number of the divisions in the circular scale is 50. Linear progress made by the circular scale on the vertical scale in two complete rotations is 1mm.



Spherometer is used to determine the radius of curvature of the curved surface of a plano-concave lens. In such a determination, spherometer is placed on the curved surface of the lens as shown in figure 2. After obtaining the measurements h and b which are shown in the figure, the radius of curvature (R) can be determined by the following formula.

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

a) What is the least count of this spherometer?

.....

.....

.....

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

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c) Then the spherometer is placed on the curved surface of the lens

(i) What adjustment would you make before taking the next measurement in order to determine h?

.....

.....

.....

(ii) What is the reading that you would take from the spherometer after the above mentioned adjustment?

.....

.....

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

.....

.....

e) In order to determine R^1 you need to measure the mean distance between the spherometer legs.

(i) What measuring instrument would you use to determine b?

.....

(ii) What experimental steps would you follow in order to determine b?

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f) Give another use of a spherometer except the measurement of radius of curvature.

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g) Suggest a method to further decrease the least count of the spherometer given above.

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முதலாம் தவணைப் பரீட்சை - 2023

Jaffna Hindu College
1st Term Examination - 2023

விளதிகவியல் Physics	Gr. 12 (2025)	01	T	II (B)

Part - II (B)

Essay Questions

❖ **Answer to any two questions only**

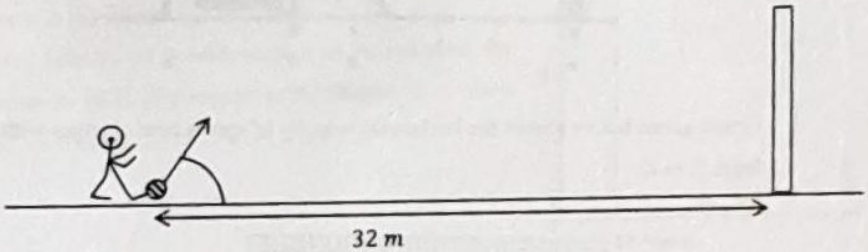
01) (a) (i) Explain the term 'Projectile motion'

(ii) Give 3 examples to projectile motion.

(iii) State 2 quantities which are equal in initial and final position of a projectile motion which does not consist air resistance.

(iv) Obtain the velocity change, motion time between initial and final positions at same horizontal level in a projectile motion, Hence deduct the resultant acceleration.

(v)



A small ball which is at rest, moves in $20ms^{-1}$ velocity under the gravity when it was kicked at 37^0 with horizontal, as shown in figure above. Ball more towards 2.5m height of a barrier located at a distance of 32m.

(Neglect the air resistance, $\sin 37^0 = 0.60$, $\cos 37^0 = 0.80$, $\tan 37^0 = 0.75$)

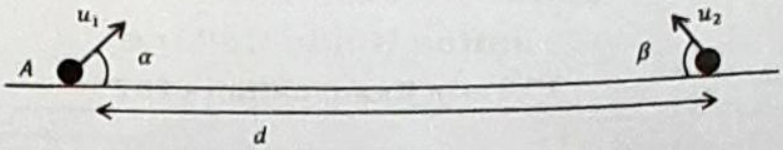
(1) Calculate the time taken by ball to reach the barrier.

(2) At the above calculated time, find the vertical height of ball.

(3) Does ball hits the barrier or it pass over the barrier.

(4) Separately draw the horizontal, vertical velocity graph of ball with time.

(b) Particles A, B are thrown in same vertical plane towards each other as shown in the figure.

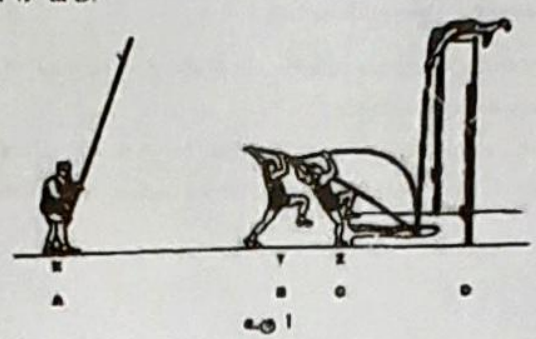


(i) Find the relative velocity of B in respect to A.

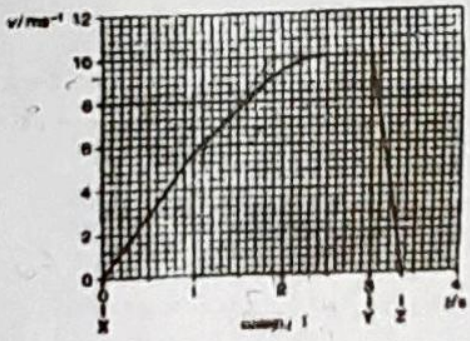
(ii) If the vertical relative velocity is zero, calculate the time taken to meet.

02) (a) During pole vault, 70kg mass of a sports man use an pole with elastic nature to jump over the post.

As shown in the figure 1 sports men at the starting point A. while passing through B, he placed the end of the pole in land. Elastic nature of pole helps to reach rest slowly at C and to jump the post of height 'h' at D.



Graph given below shows the horizontal velocity of sports men changes with time while he run from X to Z.



(i) Using the graph, calculate the length of running track from X to Z.

(ii) Calculate the maximum kinetic energy of sports men. ($K.E = \frac{1}{2} MV^2$)

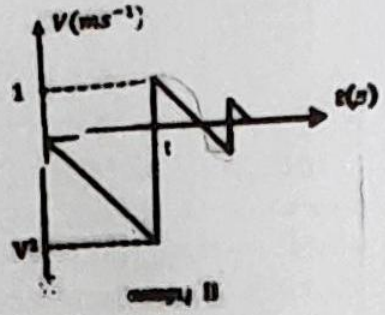
(iii) If the whole kinetic energy is converted to potential energy, find the height 'h' reached by sports men. ($mgh = \frac{1}{2} MV^2$)

(iv) While he passing the post, turn the side and bend his body (figure – 1 D)

Explain how the above process beneficial to him?

(b) 0.5m height of bed is located in the landing place of sports men. He falls from height 'h' and collides with bed then moves up vertically.

Velocity – time graph shown below.



(i) Find the V¹,t ($\sqrt{10} = 3.1$)

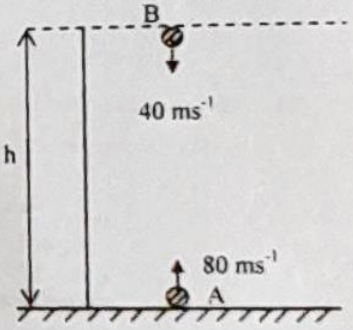
(ii) Calculate the velocity change during time duration 't'

(iii) An assumption taken to draw the graph. What is that assumption?

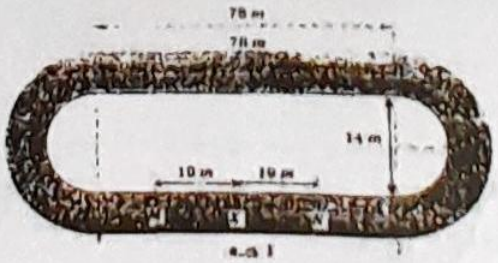
(iv) If that assumption is not taken. Draw the rough sketch of predicted graph.

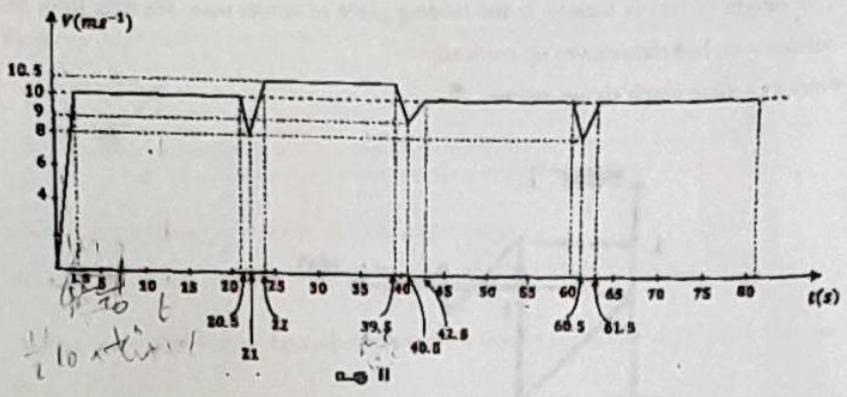
(C) Two particles are thrown at same time under the gravity as shown in the figure.

Find the velocity of B with respect to A, calculate the displacement of B with respect to A, find the time taken to meet each other.



03) 200m running track consists of two straight track and two semicircular track as shown in the figure I. midpoint X in the straight track is the initial and final points. 2 x 400m relay race takes place in this track. Figure II below shows the speed-time graph of group G participates in relay race. Portion M, N are the places in track where Batons are handover to another person. In the time 21s, 40.5s, 60.5s of the graph batons are changed.





(a) (i) Calculate the distance travelled by first three runners separately.

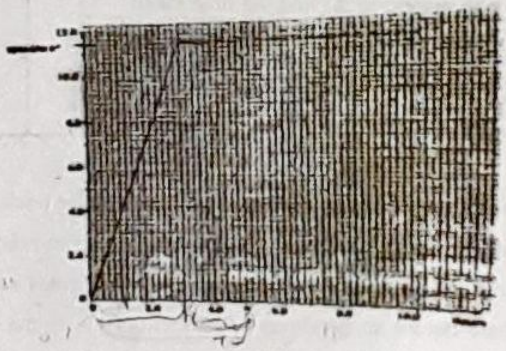
(ii) If the final runner ran 202m. Calculate the total time taken to complete the 4 x 200m relay race.

(iii) In the above four runners, which runner have high average speed?

(iv) (Consider the average velocity) Calculate the total time taken by the first runner to complete two semicircular tracks?

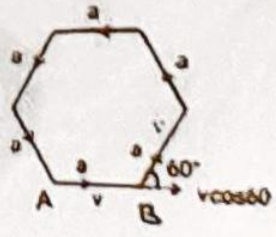
(v) If the maximum speed of above four runners are not changed. State 2 techniques that should be handled to complete the 4 x 200m race in short time.

(b) Part of speed-time graph of first runner of H group in the above relay race is given below. At which time this runner will reach the first runner of group G.



(c) Draw the magnitude of acceleration-time graph of runner who runs in constant speed in the above mentioned track. (For the time period of full track)

(d) 6 particles are placed in the edges of a regular hexagon with a side length of 'a' which is in a horizontal plane is shown in the figure, through the sides they more to adjacent edge with the constant speed V. Calculate the velocity of A relative to B, Calculate the displacement of A relative to B. Find the time taken to meet each other.



1st Term Exam - 2023 (2025 A/L)

Physics

1) a) D- Meter Bridge / மீற்றர் பாலம் (01)

d - வெளியீட்டு இடைநிலை (01)

b) வெளியீட்டு இடைநிலையின் இழுக்கி நாற்றல்.

புறத்தாடைகளிற்கு இடைப்பட்டதூரம் d யிலும் குறைந்த வெப்பமைத்தில் வைத்தல்

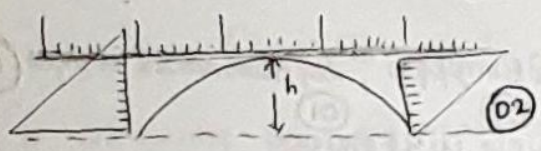
தாடைகளிற்கு இடைப்பட்டதூரம் மாறாதிருக்கும் வகையில் நகர்த்தல்

வெளியீட்டின் வாசிப்பை பெறல் (02)

c) தூண மட்டம் , மீற்றர் கோல் (01)

or கோண மானியைப் பயன்படுத்தி கணித்தல்

or பொருத்தமான ஒன்று



(02)

கணிப்பு பெயற்றல்

d) $V_B = \frac{4}{3}\pi\left(\frac{d}{2}\right)^3 \times \frac{80}{100}$ (02)

(e) $\frac{\Delta V}{V} = 3\frac{\Delta d}{d} = \frac{0.3}{50} = 6\times10^{-3}$ (02)

$\Delta d = 0.1\,mm$

$d = 50\,mm$

(f) $V = V_B + V_A$

$= \frac{4}{3}\pi d^3 + h\left(\frac{D^2}{8} + \frac{h^2}{6}\right)$ (02)

(g) $= \frac{4}{3}\cdot 3\,5^3 + 4\left(\frac{10^2}{8} + \frac{4^2}{6}\right)$

$= 300\times4\ 50 + \frac{3}{2}^{0.6} = 300.6\,m^3$

$= 300.6\,m^3$ (02)

(h) கணவாயின் அடர்த்தி (01)

i) நீர்கொண்ட அளவுசாடி or கொள்ளளவு தெரிந்த கலன்களை அளத்தல் (02)

ii) மேற்பரப்பு நீர்த்தூது எனில் அதனுள் நீரைவம் செல்வதால் நீரற்ற கலனை பெறுவது (02)

2) a) (i) L.C = 0.5/50 = 1/100 = 0.01 mm. (03)

(ii) இடையான அளவிடும் தொகுதி, நிலைக்குத்தான அளவிடற்குத் தொகுதி. (02) (01)

(iii) திருநிலை வாசிப்புகள் பெறப் படுவதால் (02)

(iv) வேணியரின் பூச்சுரையை நிறுத்தி இறுகிய வாசிப்பைப் பெறல் (02)

(v) 6.520 − 6.018 = 0.502 (01)

15.011 − 14.501 = 0.510 (01)

(vi) $d = \frac{0.502 + 0.510}{2}$

= 0.506 cm (02)

= 0.51 mm

(vii) (02)

20

b) (i) 41 அவது வேணியர் பிரிவு (02)

(ii) 145 mm பிரிவு. (02)

3) a) பூச்சியவழுவைப் பதிவுசெய்தல் or, திரிவெனனிக்கை கூறுதல் (02)

b) (i) கூடம்பின் அடிம் (ii) உயரம் (iii) பூச்சியவழு (01) (01) (01)

c)

i	0.2 mm	—	பூச்சியவழு
ii	20.2 mm	20 mm (X_1)	வெளிவிட்டம்
iii	16.02 mm	16 mm (X_2)	உள்விட்டம்
iv	30.2 mm	30 mm (X_3)	அடிம்
v	37.2 mm	37 mm (X_4)	உயரம் (02)

(2) (2)

d) i உருளையின் கனவளவு : $\pi \left(\frac{X_1}{2}\right)^2 X_4$ (02)

கூடம்பின் கனவளவு : $\frac{1}{3} \pi \left(\frac{X_2}{2}\right)^2 X_3$ (02)

கனவளவு : $\pi \frac{X_1^2 X_4}{4} - \frac{1}{12} \pi X_2^2 X_3$ (01)

ii) $\frac{\pi}{4} 20^2 \cdot 37 - \frac{1}{12} \pi 16^2 \cdot 30 = \frac{\pi}{4} \left(14800 - \frac{16^2 \times 10}{2}\right)$ (01) (01)

$= 9240 \text{ mm}^3$

$= 9240 \times 10^{-6} \text{ m}^3$ (02)

(20)

4). a) $L.C = \frac{0.5}{50} = \frac{1}{100} = 0.01mm$ (02)

b) திருகாணியின் முனையும் அதன் விம்பமும் பொருந்தும் நிலையில் வாசிப்பை பெறல் ~~(01)~~ ~~(02)~~ (03)

c) i) கோணமானியின் திருகு காலின் முனையை கோண மேற்பரப்பைத் தொடும் வரை பதித்தல் (02)

ii) வட்ட விளிம்பில் மாதாந்த அளவிடையுடன் பொருந்தும் பிரிவு வட்ட அளவிடை பிரதான அளவிடையுடன் பொருந்தும் பிரிவு எண்பவற்றை அறிதல் (02)

d) i. கோணமானியின் திருகு, புரி தேய்வடைதல், பிரதான் முனை தேய்வடைதல் (02)

e) i மீற்றர் கோல் (02) or வேனியர் இருக்கிமானி

ii வளைதாளின் மீது கோணமானி வைக்கப்படும் அருத்தி பதித்து அடையாளம் இடப்படும் அடையாளங்களிற்கு இடைப்பட்ட தூரத்தை மீற்றர் கோலினால் அளக்கப்படும (3)

f) சிறிய நாணாயக் குற்றியின் தடிப்பை அளத்தல், CD யென்ற இரு வரங்களின் நடுப்பு அளத்தல் (02)

g) வட்ட அளவிடையிலுள்ள பிரிவுகளின் எண்ணிக்கையை அதிகரித்தல் (02)

MC. Q Answer:

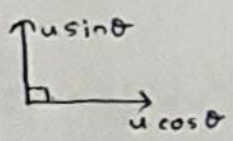
1) 3	6) 5	11) 3	16) 3	21) 2
2) 2	7) 3	12) 1	17) 3	22) 3
3) 3	8) 4	13) 3	18) 4	23) 3
4) 3	9) 4	14) 4	19) 2	24) 2
5) 3	10) 1	15) 1	20) 1	25) 1/2

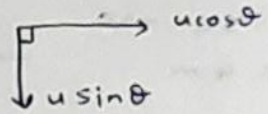
Physics - Part II-B (2015)

6) a) i) Motion that occurs under the influence of only gravity when initial velocity in an angle with horizontal. ——— (2)

ii) * Launching of missiles.
* Ball hit by batsman. ——— (3)
* Object dropped from a moving plane

iii) * Horizontal component of velocity.
* Acceleration | Resultant force acting on object ——— (2)

iv) $\Rightarrow V_i =$ 

$V_f =$ 

$\Delta V = \downarrow u\sin\theta - \uparrow u\sin\theta$

$= 2u\sin\theta \downarrow$ ——— (2)

$\Rightarrow \uparrow S = ut + \frac{1}{2}at^2$

$0 = u\sin\theta T - \frac{1}{2}gT^2$

$T = \frac{2u\sin\theta}{g}$ ——— (2)

$\Rightarrow a = \frac{\Delta V}{t}$

$= \frac{2u\sin\theta \downarrow}{T}$

$= \frac{2u\sin\theta}{\frac{2u\sin\theta}{g}} \downarrow$

$= g \downarrow$ ——— (2)

v) i) Horizontal velocity of the ball $= u\cos\theta$

$= 20ms^{-1} \times 0.8$

$= 16ms^{-1}$ ——— (2)

By using $S = vt$

$32m = 16ms^{-1} \times t$

$t = 2s.$ ——— (2)

ii) Vertical initial velocity of the ball $= u\sin\theta$

$= 20ms^{-1} \times 0.6$

$= 12ms^{-1}.$ ——— (2)

Using $S = ut + \frac{1}{2}at^2$ ↑

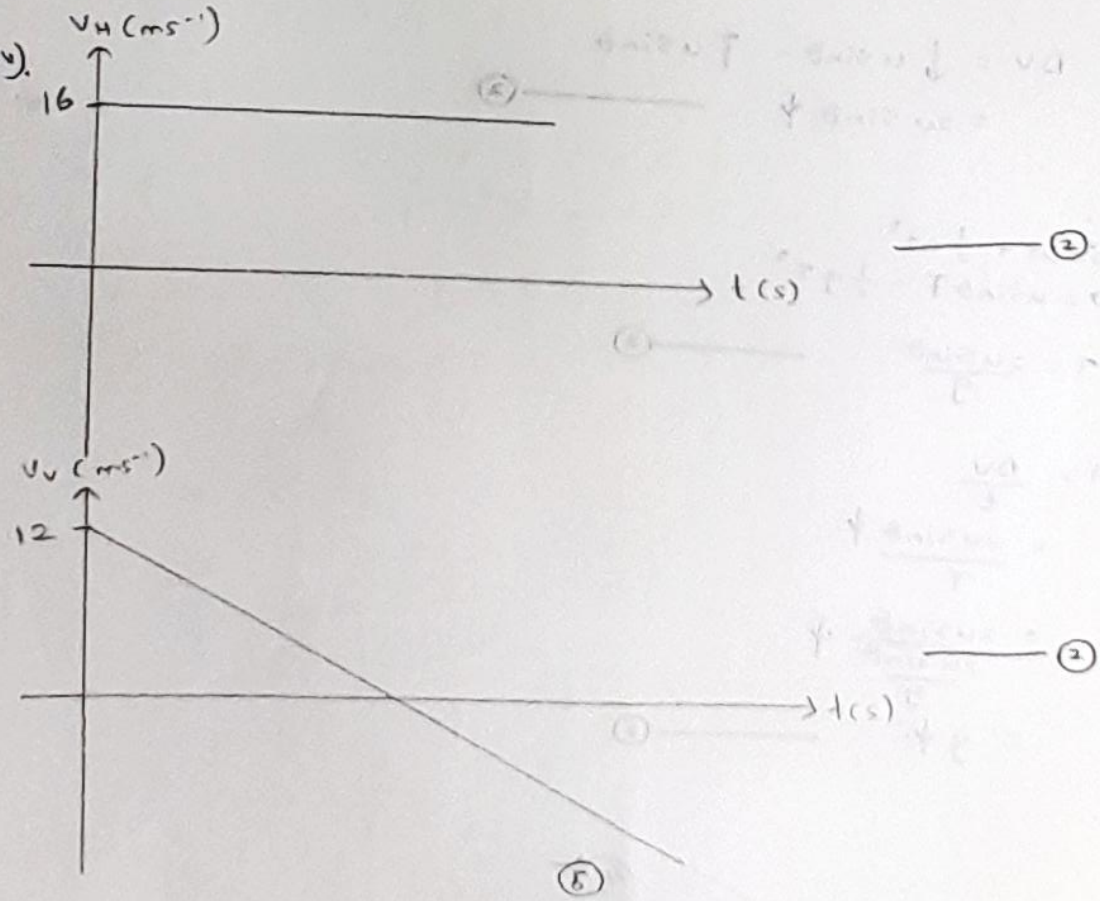
$S = (12 \times 2) + \frac{1}{2} \times (-10)4$

$= 24 - 20$

$= 4m$ ——— (2)

iii) Yes, it passes over. ——— (1)

iv).



——— (2)

——— (2)

(5)

zontal relative velocity. $= (u_2 \cos\beta + u_1 \cos\alpha)$ ——— (2)

Using $\overrightarrow{s = ut}$

$$d = (u_2 \cos\beta + u_1 \cos\alpha)\, t$$

$$t = \frac{d}{(u_2 \cos\beta + u_1 \cos\alpha)}$$ ——— (2)

02) a) i) Using the area of V vs t graph,

$= \frac{1}{2} \times (3.4 + 1.1) \times 10$

$= \frac{1}{2} \times 4.5 \times 10$

$= 22.5\,m$ ——— (3)

ii) $K.E_{max} = \frac{1}{2} m v^2$

$= \frac{1}{2} \times 70 \times 10^2$

$= 3500\,J$ ——— (3)

iii) $mgh = \frac{1}{2} m v^2$

$h = \frac{v^2}{2g}$

$= \frac{10^2}{2 \times 10}$

$= 5\,m$ ——— (3)

iv) Maximum height attained by him is 5m. So his centre of gravity will be at 5m above. So when he bent his body he easily able to cross the polevault by avoiding his lower position of the body touches it.

——— (3)

b) i) $mgh' = \frac{1}{2}mv'^2$

$70 \times 10 \times (5 - 0.5) = \frac{1}{2} \times 70 \times v'^2$

$700 \times 4.5 = 35 \times v'^2$

$90 = v'^2$

$v' = 3\sqrt{10}$

$= 3 \times 3.1$

$= 9.3 ms^{-1} \downarrow$ ——— (3)

ii) Δv = v_{final} - $v_{initial}$ at '1'

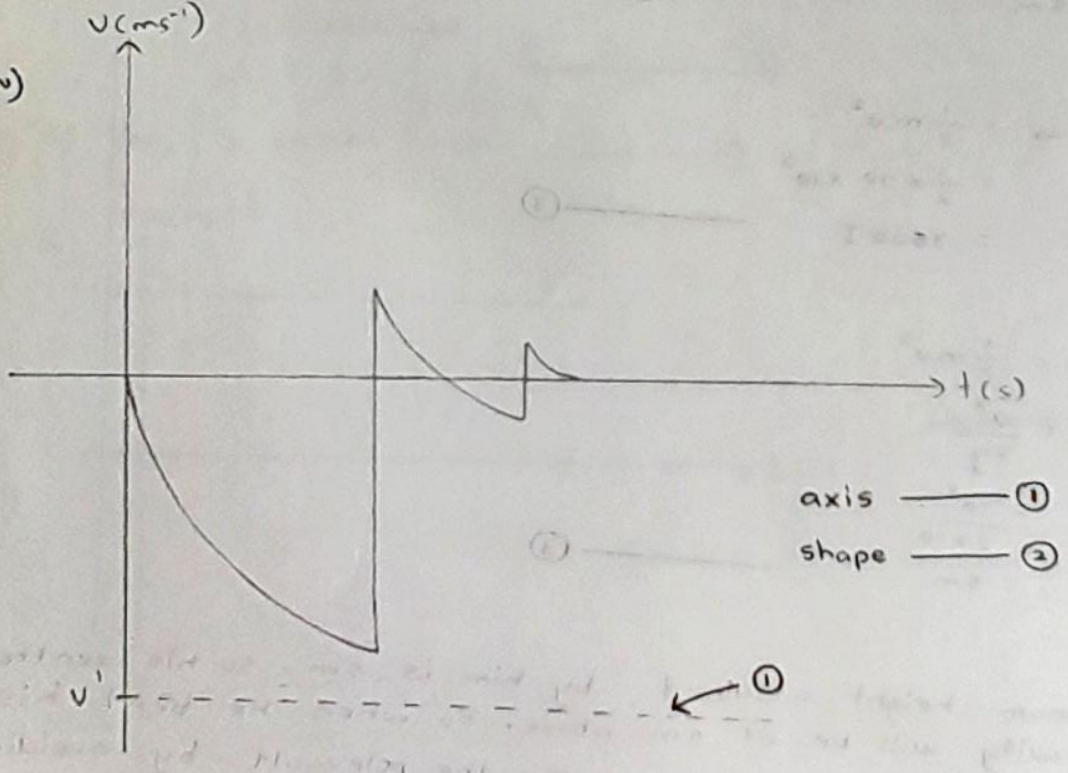
Upward positive.

$= +1 ms^{-1} - (-9.3 ms^{-1})$

$= +10.3 ms^{-1}$ ——— (3)

iii) Air resistance is neglected. ——— (2)

iv)



axis ——— (1)

shape ——— (2)

(1)

$v_{BE} + v_{EA}$

$v_{BE} - v_{AE}$

$= \downarrow 40 - \uparrow 80$

$= \downarrow 120 ms^{-1}$ ——— (2)

$s_{BA} = s_{BE} + s_{EA}$

$= h$ ——— (2)

$t = \frac{s_{BA}}{v_{BA}}$

$= \left(\frac{h}{120}\right) s$ ——— (2)

3) a) i) 1st runner $\rightarrow \frac{1}{2} \times (20.5 - 1.5 + 20.5) \times 10 + \frac{1}{2} \times 0.5 \times (10 + 8)$

$= \frac{1}{2} \times 39.5 \times 10 + 4.5$ ——— (2)

$= 202.0m$

2nd runner $\rightarrow = \frac{1}{2} \times (8 + 10.5) \times 1 + 10.5(39.5 - 22) + \frac{1}{2}(10.5 + 9) \times 1$

$= 9.25 + 183.75 + 9.75$ ——— (2)

$= 202.75m$

3rd runner $\rightarrow \frac{1}{2}(9 + 10) 2 + \frac{1}{2}(10 + 8) 0.5 + (60 - 42.5) \times 10$

$= 19 + 175 + 4.5$ ——— (2)

$= 198.5m.$

ii) $\frac{1}{2}(8 + 10) \times 1 + 10(T - 61.5) = 202$

$T = 80.85$ ——— (2)

iii) 1st $\rightarrow \frac{202}{21}$ $9.619 ms^{-1}$ ——— (1)

2nd $\rightarrow \frac{202.75}{19.5}$ $10.397 ms^{-1}$ ——— (1)

3rd $\rightarrow \frac{198.5}{20}$ $9.925 ms^{-1}$ ——— (1)

4th $\rightarrow \frac{202}{20.3}$ $9.950 ms^{-1}$ ——— (1)

2nd runner. ——— (2)

iv) $t = \frac{2 \times \frac{22}{7} \times 14}{9.62} = \frac{88}{9.62} = 9.155$ (4)

v) Change the batons when both runners are run. ——— (2)

b) $\frac{1}{2} \times (t + t - 3.2) \times 11.4 = \frac{1}{2} (t + t - 1.5) \times 10$

$(2t - 3.2) \times 11.4 = (2t - 1.5)\, 10$

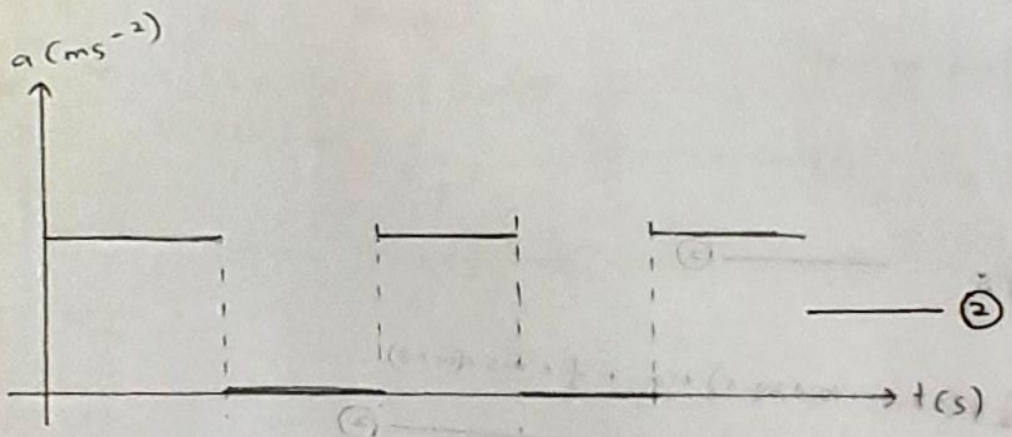
$22.8t - 3.2 \times 11.4 = 20t - 15$

~~$2.8t$~~ vs

$2.8t = 3.12 \times 11.4 - 15$

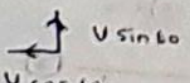
$t = 12.1671\ 5$ ——— ②

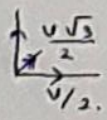
c).



——— ②

d) $V_{AB} = V_{AE} + V_{EB}$

$= \overrightarrow{V} +$ 

$=$ 

——— ②

$S_{AB} = a$ ——— ②

$t = \frac{\overrightarrow{S_{AB}}}{\overrightarrow{V_{AB}}}$

$= \frac{a}{V/2}$

$= \frac{2a}{V}$ ——— ②