G.C.E (A/L) Examination March - 2018

Conducted by Field Work Centre, Thondaimanaru

In collaboration with

Provincial Department of Education Northern Province

FWC

Grade:- 12 (2019)	*Physics*	*Three hours*

Part – I

Select most appropriate answer

1) Dimension of work done in an unit time.

1. ML^2T^{-2} 2. ML^2T^{-1} 3. ML^2T^{-3} 4. ML^3T^{-2} 5. MLT^{-2}

2) A student adjust two positions of the travelling microscope's cross wire to measure inner diameter of capillary tube as shown in figure. Vertical readings and horizontal readings of two positions are 70.43mm, 71.55mm and 63.46mm, 62.31mm respectively. Inner diameter of capillary tube is

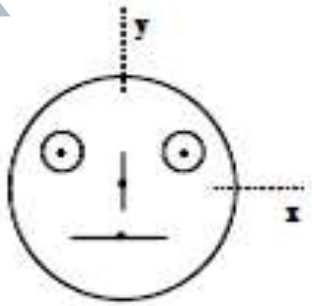
1. 1.135 mm 2. 1.14 mm 3. 8.105 mm
4. 8.10 mm 5. 0.57 mm

3) A ladder 2.5 m long and of weight 150 N has its centre of gravity 1m from its bottom. A weight of 40 N is attached to the top end. The work required to raise the ladder from the horizontal position to the vertical position is.

1. 190J 2. 250J 3. 285J 4. 325J 5. 425J

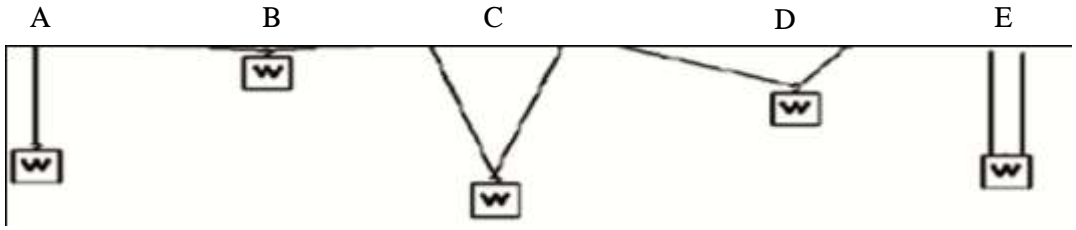
agaram.lk

4) Look at the drawing given in the figure which has drawn with ink of uniform line – thickness. The mass of ink used to draw each of the two inner circles, and each of the two line segments is m. The mass of the ink used to draw the outer circle is 6m. The coordinates of the centers of the different parts are : outer circle $(0,0)$, left inner circle $(-a,a)$, right inner circle (a, a), vertical line $(0,0)$, and horizontal line $(0,-a)$. They Y – coordinate of the centre of mass the ink this drawings is



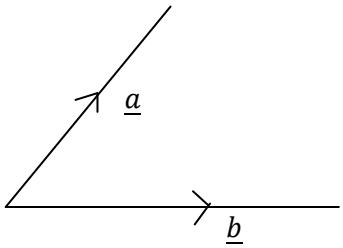
1. $^a/_{10}$ 2. $^a/_8$ 3. $^a/_{12}$ 4. $^a/_3$ 5. $^a/_4$

5) A weight can be hung in any of the following five ways. In which case is the string most likely to break?



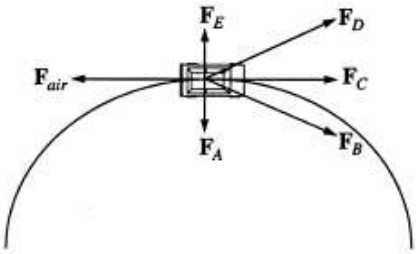
1. A 2. B 3. C 4. D 5. E

6) Magnitude of two different vectors a and b are same what is the angle between vector c and vector d where vector c is resultant of adding of vector a and vector b , vector d is resultant of subtracting of vector a and vector b



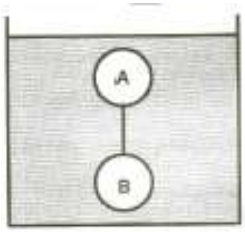
1. 0° 2. 45° 3. 60°
4. 90° 5. 180°

7) A car travels with constant speed on a circular road on level ground. In the diagram above, F_{air} is the force of air resistance on the car. Which of the other forces shown best represents the horizontal force of the road on the car's tires?



1. F_A 2. F_B 3. F_C 4. F_D 5. F_E

8) Two solid spheres A and B equal volumes but of different densities d_A and d_B are connected by a string. They are fully immersed in a fluid of density d_F. They get arranged into an equilibrium state as shown in the figure with a tension in the string. The arrangement is possible



A) $d_A < d_F$ B) $d_B > d_F$ C) $d_A + d_B = 2d_F$

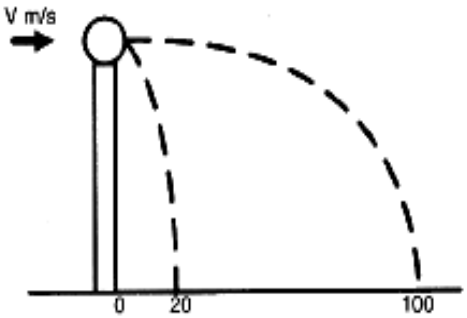
1. Only A enough 2. Only B enough 3. Only A and C enough
4. Only B and C enough 5. All A, B and C are enough

agaram.lk

9) A prograssive wave in a medium is represented by the equation $Y = 0.1\text{Sin}\,(10\pi t - \frac{5}{11}\pi x)$ Where Y and x are in cm and t in seconds. The maximum speed of a particle of the medium due to the wave is.

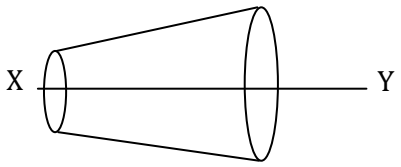
1. $1cms^{-1}$ 2. $10cms^{-1}$ 3. πcms^{-1} 4. $10\pi cms^{-1}$ 5. $100\pi cms^{-1}$

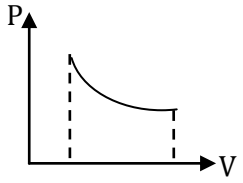
10) A ball of mass $0.2\,kg$ rests on a vertical post of height $5\,m$. A bullet of mass $0.01\,kg$, travelling with a velocity Vms^{-1} in a horizontal direction, hits the centre of the ball. After the collision, the ball and bullet travel independently. The ball hits the ground at a distance of $20m$ and the bullet at a distance of $100m$ from the foot of the post. The initial velocity V of the bullet is

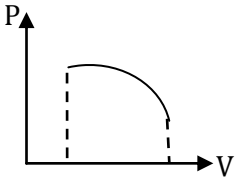


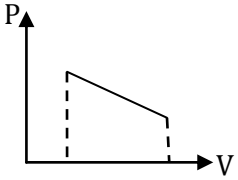
1. $250ms^{-1}$ 2. $250\sqrt{2}\,ms^{-1}$ 3. $400ms^{-1}$ 4. $500ms^{-1}$ 5. $500\sqrt{2}\,ms^{-1}$

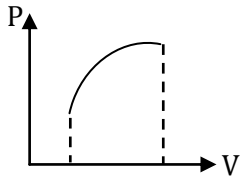
11) A Non – viscous incompressible fluid is in steady flow which of the following represent the variation of pressure (P) with speed (V) of flow along the line XY

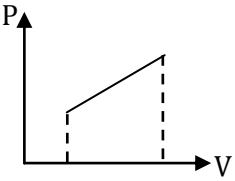


1.


2.


3.


4.


5.


12)

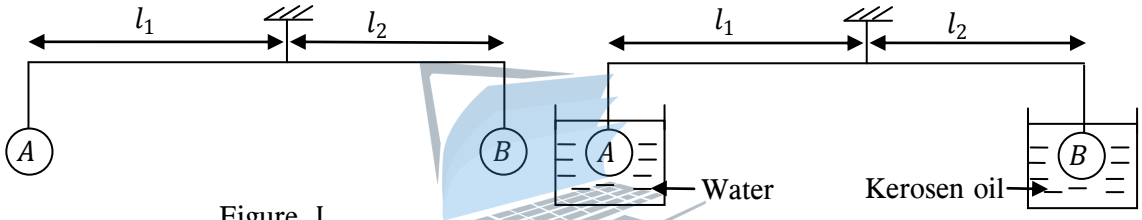


Figure I

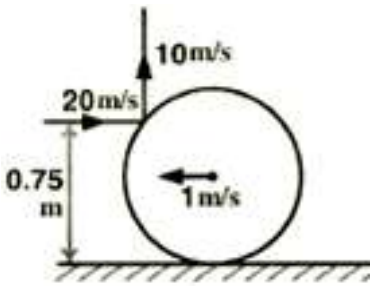
Figure II

Figure I shows the balanced position of light rod carrying two spheres A and B in two ends. When two spheres A and B are immersed in water and 0.9 relative density kerosene oil. Balanced position do not change as shown in figure II.

$$\frac{\text{Density of Material made B}}{\text{Density of Material made A}}$$

1. 0.9
2. 1
3. $^{10}/_{9}$
4. $^{1}/_{2}$
5. $^{1}/_{10}$

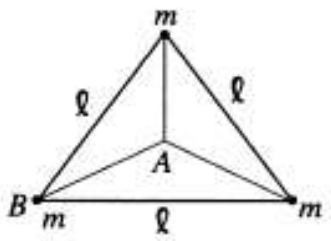
13) A thin ring of mass $2\,kg$ and radius $0.5\,m$ is rolling without slipping on a horizontal plane with velocity $1\,ms^{-1}$. A small ball of mass, $0.1\,kg$, moving with velocity $20\,ms^{-1}$ in the opposite direction, hits the ring at a height of $0.75\,m$ and goes vertically up with velocity $10\,ms^{-1}$. Immediately after the collision.



1. The ring comes to a complete stop.
2. Friction between the ring and the ground is to the left.
3. Friction between the ring and the ground is to the right.
4. There is no friction between the ring and the ground.
5. The ring has not rotational motion.

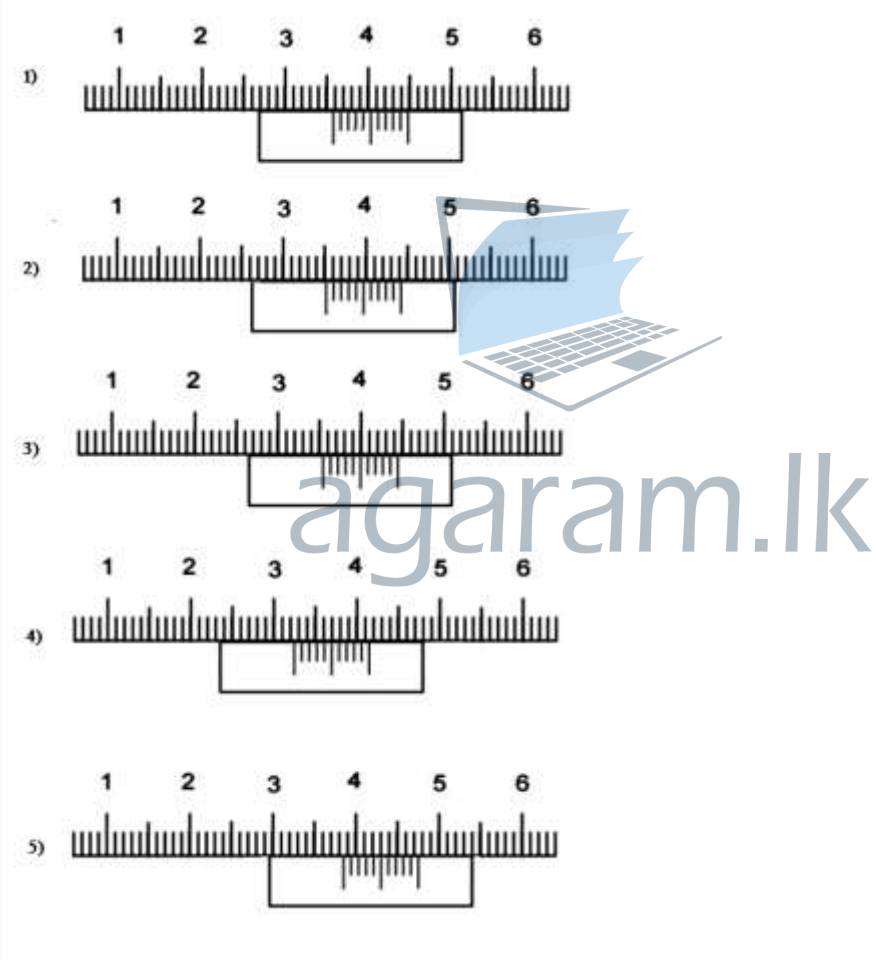
agaram.lk

14) Three equal masses m are rigidly connected to each other by massless rods of length ℓ forming an equilateral triangle, as shown figure. The assembly is to be given an angular velocity ω about an axis perpendicular to the triangle. For tixed ω , the ratio of the kinetic energy of the assembly for an axis through B compared with that for an axis through A is equal to,



1. 3 2. 2 3. 1 4. $^1/_2$ 5. $^1/_3$

15) Actual reading of inner diameter of test tube measured using venire caliper is 3.55 cm. Instrument has 0.03 cm positive zero error. obtained reading using instrument.

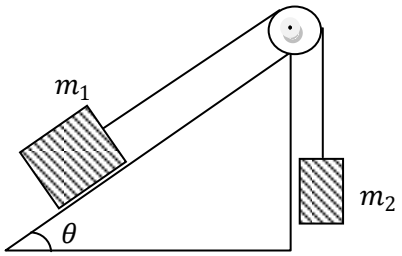


agaram.lk

16) In the resonance tube experiment for determining the speed of sound in air using a tuning fork of frequency $480Hz$, the first resonance was observed at $17.7cm$ of air column and the second at $53.1cm$. The speed of sound in air with absolute error is

1. $(339.84 \pm 1.92)ms^{-1}$ 2. $(339.84 \pm 0.96)ms^{-1}$ 3. $(169.92 \pm 1.92)ms^{-1}$
4. $(169.92 \pm 0.96)ms^{-1}$ 5. $(339.84 \pm 0.1)ms^{-1}$

17) Two blocks of masses $m_1 = 5kg$ and $m_2 = 6kg$ are connected by a light string passing over a light frictionless pulley as shown in figure. The mass m_1 is at rest on the inclined plane and mass m_2 hangs vertically. If the angle of incline $\theta = 30°$ what is the magnitude and direction of the force of friction on the $5kg$ block?

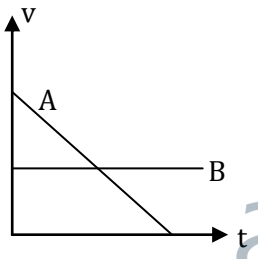


1. $35N$ up the plane
2. $35N$ down the plane
3. $85N$ up the plane
4. $85N$ down the plane
5. $15N$ up the plane

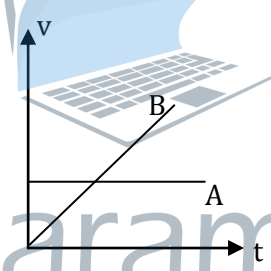
18)

Car A moves a straight line path behind the Car B apart d. Impossible velocity – time graph for Car A over the Car B.

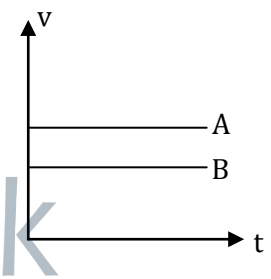
1.



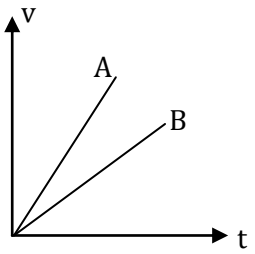
2.



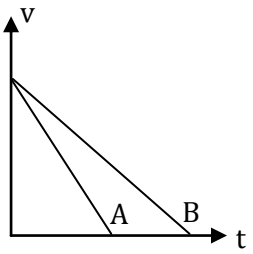
3.



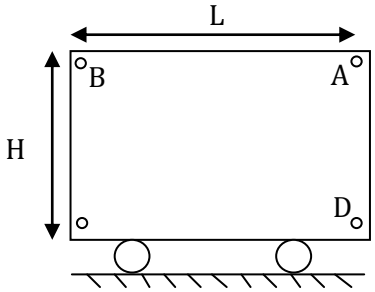
4.



5.



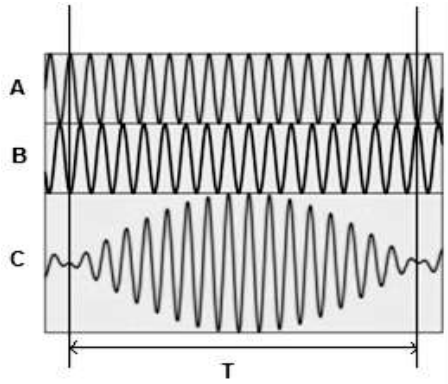
19) A liquid of density p is completely filled in a rectangular box. The box is accelerating horizontally with acceleration 'a' If pressures at B and D are equal magnitude of 'a' is



1. Lg/H
2. Hg/L
3. g
4. $(H+L)\,g/L$
5. $Lg/(H+L)$

agaram.lk

20)



Wave C shows resultant wave of waves A and B. Consider the following statements.

X) If $T = 0.25s$ frequency of A and B are $70Hz$ *and* $66Hz$ respectively.

Y) If frequency of A is $100Hz$ and frequency of B is $90Hz$, $T = 0.1\ s$

Z) If frequency difference between A and B is $5Hz$, $T = 0.1\ s$

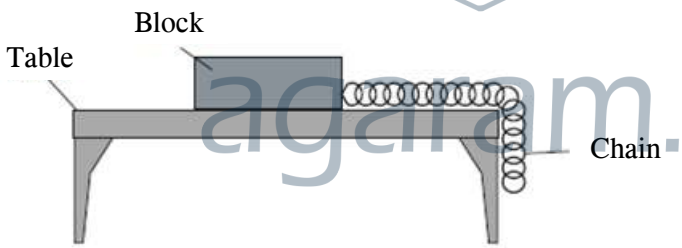
of the above statement / statements.

1. X only is true
2. Y only is true
3. X and Y only are true
4. X and Z only are true
5. All X, Y and Z are true.

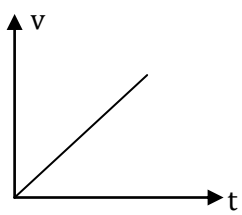
21) A knife – edge divides a sonometer wire into two parts. The fundamental frequencies of the two parts F_1 and F_2 . The fundamental frequency of the sonometer wire when the knife – edge is removed will be.

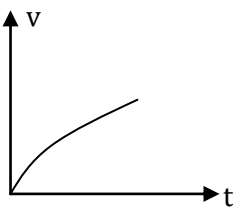
1. $F_1 + F_2$
2. $\frac{F_1+F_2}{2}$
3. $\sqrt{F_1 F_2}$
4. $\frac{F_1 F_2}{F_1+F_2}$
5. $\frac{{F_1}^2+{F_2}^2}{F_1+F_2}$

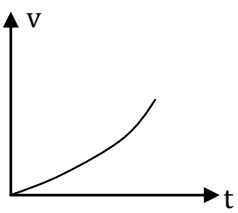
22)

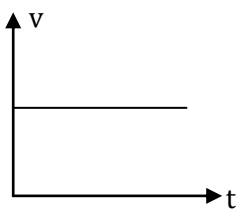


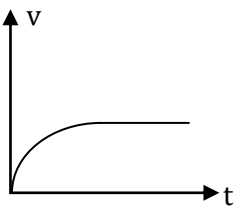
A block of mass M is held at rest on a horizontal table. A heavy chain is attached to the block with part of the chain hanging over the table. The block and the chain can slide without friction. The block is released. Which one of the following graphs best represent the variation with time t of the speed V of the block as it moves on the table.

1.


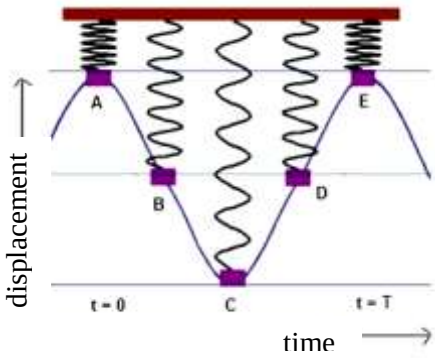
2.


3.


4.


5.


23) Stated variation of displacement with time of oscillating (S.H.M) spring – mass system as shown in figure, Consider the following statements.



A) Kinetic energy is maximum at A, C and E

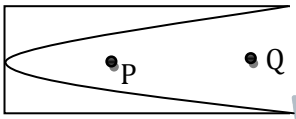
B) Acceleration is maximum at B and D.

C) When mass increase, oscillation time increases

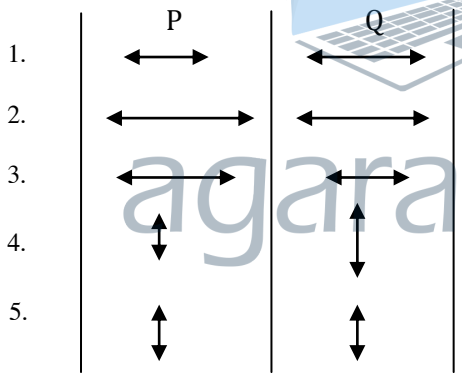
of the above statement / statements.

1. X only is true
2. Y only is true
3. Z only is true
4. X and Y only are true
5. Y and Z only are true

24) Fundamental stationary wave pattern of sound wave inside the tube is shown below figure.

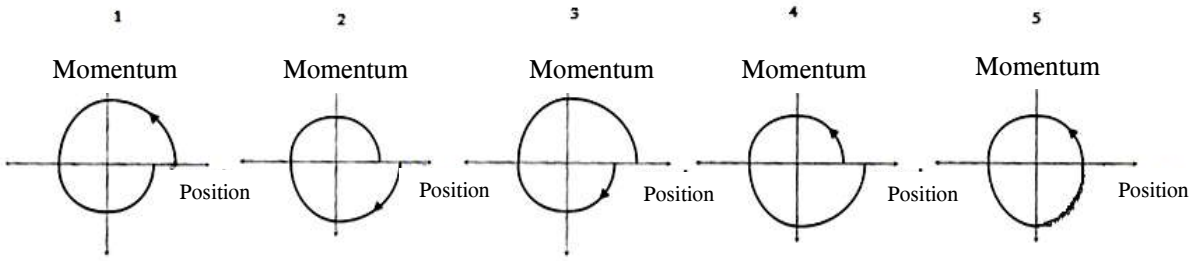


Which of the following diagram correctly represent the Displacement of air molecular at P and Q.



agaram.lk

25) Consider the spring – mass system, with the mass submerged in water, as shown in the figure. The momentum change with position for one cycle of this system is,



G.C.E (A/L) Examination March - 2018

Conducted by Field Work Centre, Thondaimanaru

In collaboration with

Provincial Department of Education Northern Province

FWC

Grade:- 12 (2019)	*Physics*	

Part - II

Structured Essay

Answer the four question in this question paper

01) A students used the following procedure to measure the density of mercury. He took a small amount of mercury into a capillary tube and measured the length and inner diameter of tube using the travelling microscope.

(a) What should he do before taking the mercury into the tube?

.....

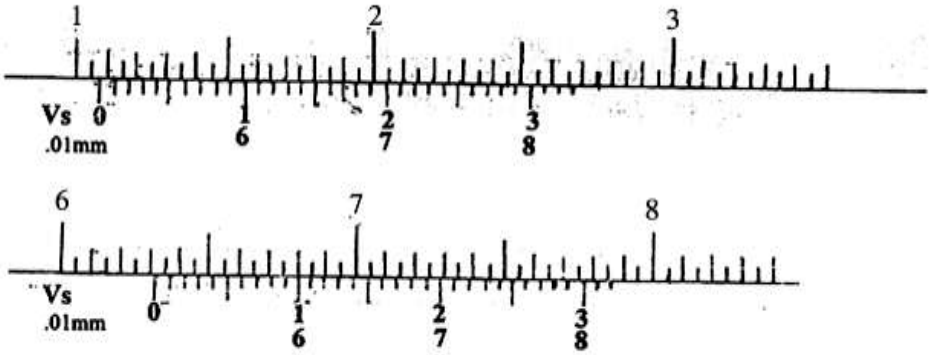
(b) What is the method you use to take the mercury into the capillary tube?

.....

.....

(c) Two focused reading of the travelling microscope are shown below to measure the length of mercury column.

agaram.lk



i. What is length (L) of mercury column?

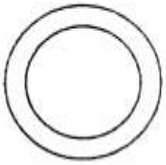
.....

ii. What is the percentage error for the reading of the length of the mercury column?

.....

(d) (i) Indicate the focused positions of the travelling microscope's cross wire to measure the inner diameter (d) of the capillary tube below.

Horizontal Stage



Vertical Stage

(ii) If the readings of horizontal stage and vertical stage respectively $35.77mm$, $37.68mm$, $10.45mm$, $8.56m$. What's the inner diameter (d) of the capillary tube?

.....

.....

(e) Obtained readings to calculate the mass of mercury column are m_1 , m_2 ($m_2 > m_1$) respectively. Identify these two readings.

m_1 - .....

m_2 - .....

(f) Obtain an expression for density of mercury interms of L, d, m_1, m_2 ?

.....

.....

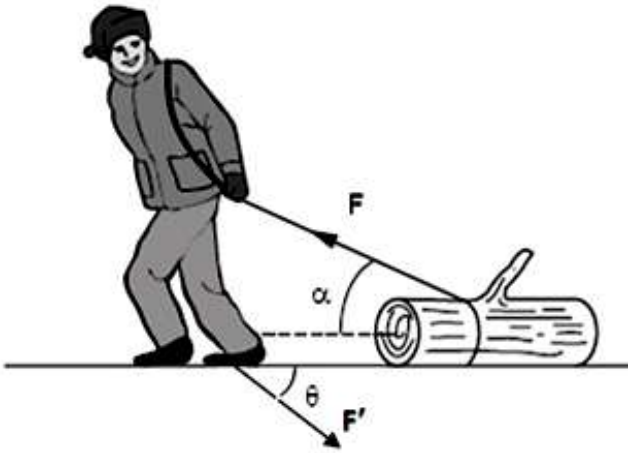
(g) If $m_1 = 15.220g$, $m_2 = 17.240g$ Calculate the density of mercury.

.....

.....

.....

02) A 60 kg man pulls a 90 kg tree trunk as shown in figure.



agaram.lk

F_f – Frictioned force acting on tree trunk.

F_{GM} – Force enerted on man by the ground.

(a) Indicate the forces in the figure.

(b) Indentify the F.

.....

(c) If $\propto = 60°, F = 600N$, If the tree trunk do not move what is the magnitude of F_f ?

.....

.....

(d) As $\propto = 30°, F = 600N$, the tree trunk moves constant velocity.

i. Calculate the magnitude of θ .

.....

.....

.....

ii. Calculate the magnitude of F_f.

.....

.....

.....

iii. Calculate the kinetic frictional coefficient between ground and the tree trunk.

.....

.....

.....

iv. What is the work done on the tree trunk by the man to move tree trunk $50m$?

.....

.....

v. From where does the man get energy for doing the above d(iv).

.....

(e) If the wire bearable maximum tension is 700 N and $\propto = 30°$, Can a 105 kg mass tree trunk move ? Explain with calculations.

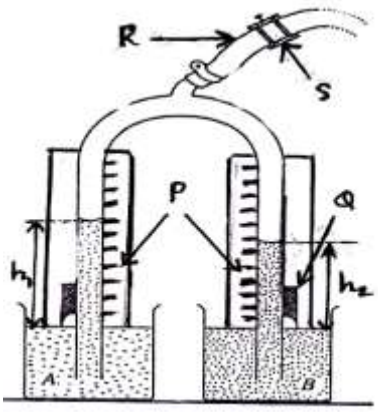
.....

.....

.....

agaram.lk

03) Figure shows an experimental setup of hare's apparatus used in a school laboratory to measure the density of kerosen oil.



i. Identify the liquids A and B.

A - ..... B - .....

ii. Name the P, Q, R, S.

P - ..... Q - .....

R - ..... S - .....

iii. What is the reason of using hare's apparatus without using the u – tube to determine density of kerosen oil?

.....

.....

agaram.lk

iv. State clearly how you would establish and maintain water and kerosen oil columns in the arms of hare's apparatus?

.....

.....

.....

v. To be the percentage error of height of liquid column over 1% what will be the least height of liquid column? of which liquid is the height ?

.....

.....

.....

vi. If density water and kerosen oil are ρ_w , ρ_k respectively. derive an expression for h_2 interms of h_1 , ρ_w , ρ_k

.....

.....

.....

vii. If density of kerosen oil is determined using graph as h_2 dependent variable. Draw expected curve in the below graph. Lable the axes clearly.

viii. If gradient of graph is 0.85 what is the density of kerosen oil?

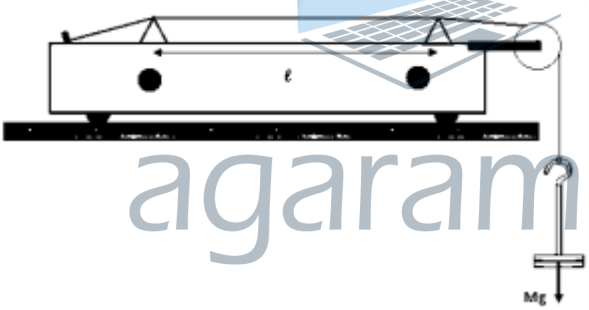
……

……

……

ix. If the axes is taken changing h_1 into h_2 , h_2 into h_1 , draw expecting graph by dotted line in same graph.

04)



agaram.lk

In order to determine the unknown frequency (f) of given tuning fork using graph method. A sonometer is arranged as shown in figure.

(a) What is the purpose of keeping tuning fork on the sonometer box to get resonance.

……

……...

(b) What is the experimental procedure to be followed in order to obtain fundamental resonance state.

……

……

(c) What is the experimental steps to follow to detect the optimum resonance state ?

……

……

……..

(d) Draw the wave pattern between bridges at resonance state in figure.

(e) If m is the mass per unit length of sonometer wire write down an expression for f.

.....

.....

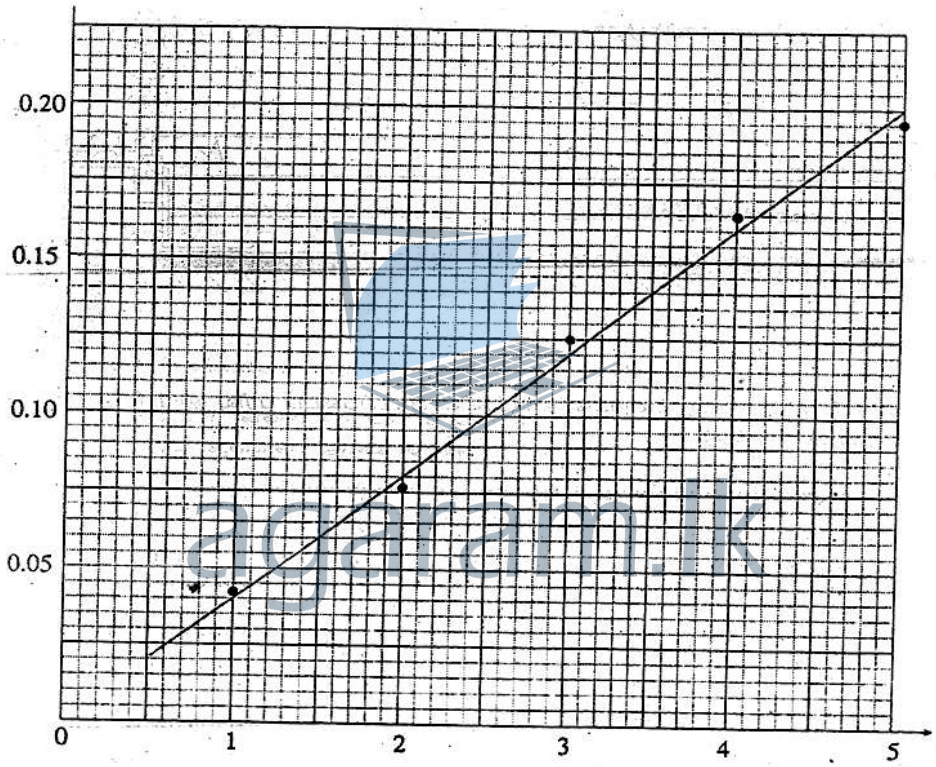
(f) Which of experimental $'\ell'$ values is considered to have the highest accuracy? Give the reason.

.....

.....

.....

(g) Graph from experiment is given below.



i. Lable the axes with SI units.

ii. Clearly indicate the points which you have used to calculate f.

iii. Calculate the gradient of graph.

.....

.....

.....

iv. If $m = 1 \times 10^{-3}\ kgm^{-1}$ Calculate the value of f .

.....

.....

.....

G.C.E (A/L) Examination March - 2018

Conducted by Field Work Centre, Thondaimanaru

In collaboration with

FWC **Provincial Department of Education, Northern Province.**

Grade:- 12 (2019)	*Physics*	

Part - II

Essay questions

Answer any two questions

05) (a)

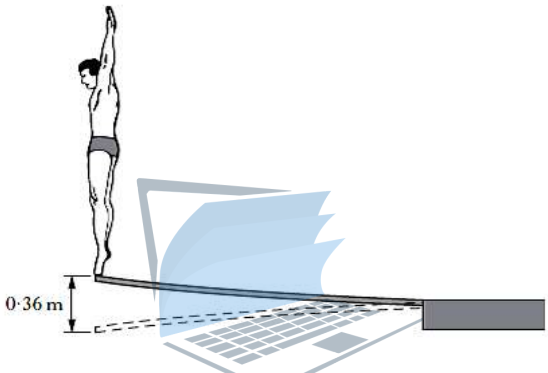


Figure I

To rest springboard a driver takes up position at the end of the board and sets up an oscillation as shown in Figure I. The oscillation approximates to simple harmonic motion. The board oscillates with a frequency of $0.70\ Hz$. The end of the board moves through a vertical distance of $0.36\ m$.

(a)

(i) Write an expression for the vertical displacement y of the end of the board as a function of time t. Include appropriate numerical values.

(ii) The driver increases the amplitude of the oscillation. The frequency remains constant. What is the amplitude when the diver just loses contact with the board ?

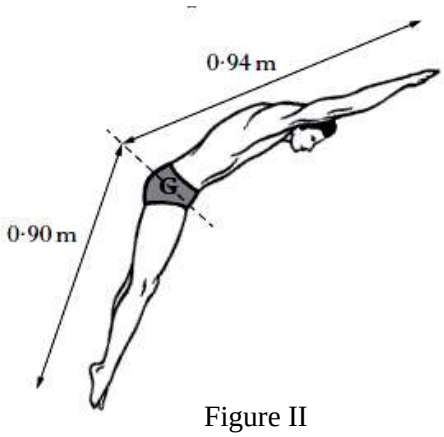


Figure II

agaram.lk

(b) A sport scientist analyses a dive. At one point during the dive, shown in Figure II, he approximates the diver's body to be two rods of equal mass rotating about point G. One rod has a length of $0.94\,m$ the other of $0.90\,m$. The diver has a mass of $66.0\,kg$.

(i) Calculate the approximate moment of inertia of the diver.

(ii) The diver's true moment of inertia about point G is found to be $10.25\,kg\,m^2$. Account for any difference between the value calculated in part b (i) and the true value.

(iii) In the position shown in Figure II the diver has an initial angular velocity of $0.55\,rad\,s^{-1}$. He changes his position to that shown in Figure III. The diver now has a moment of inertia of $7.65\,kg\,m^2$. Calculate the angular velocity of the diver in this new position.

Figure III

agaram.lk

(c) (i) Calculate the change in rotational kinetic energy between these two positions.

(ii) Account for the difference in rotational kinetic energy.

(d) The diver performs a dive consider the motion of the centre of gravity (G) of the diver. Its path in indicated by a dotted line as shown in figure IV. The point G which is 4 m above the water surface at the beginning of the dive, enters the water surface at y after completing the path in 2 s. $XY = 2m$ (Neglect air resistance).

(i) Find the horizontal and vertical components of the initial velocity of G.

(ii) Calculate the maximum height reached by G from the water surface.

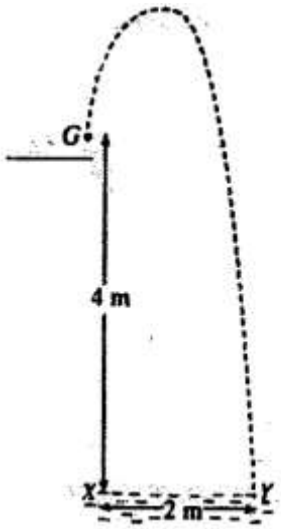


Figure IV

06) This question is about the physics of pole – vaulting. This is a sport where athletes use springy poles to project themselves over a high bar, as shown in figure I.

(a) figure I shows a 70 kg pole – vaulted standing at the beginning of his run (A), and then at the point where he pushes the end of his of pole into the ground (B). The pole then bends slowing the athlete to a stop (C). and helping him to jump over the high bar (D).

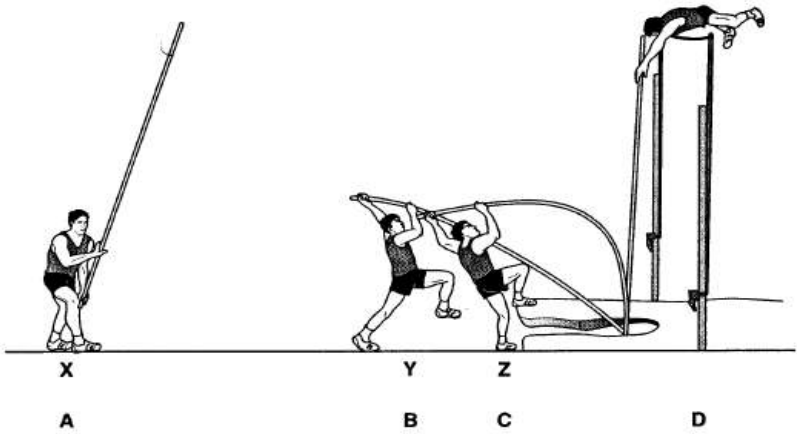
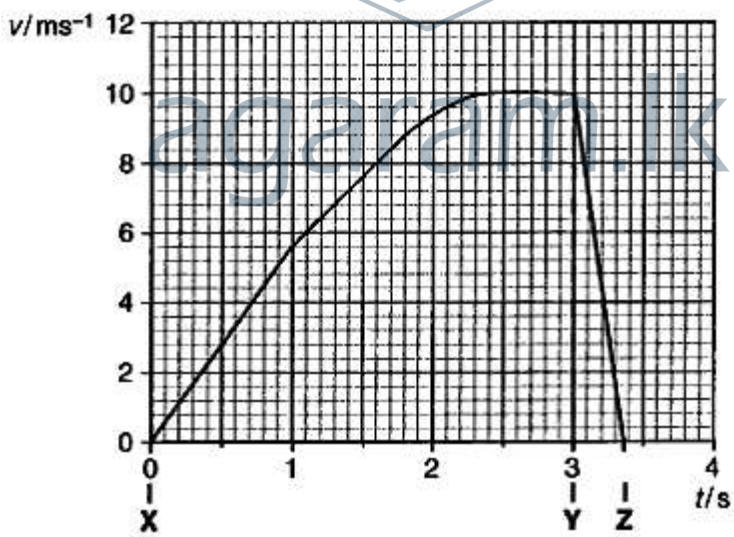


Figure I

The graph I shows how the horizontal velocity of the pole – vaulter changes during the run from X to Z.



Graph I

(i) Use the graph to estimate the length of the run from X to Z. Write clearly how you get your answer.

(ii) Calculate the maximum kinetic energy of the pole – vaulter.

(iii) Calculate the height h that he should rise. Write down the assumption. You get to calculate the h.

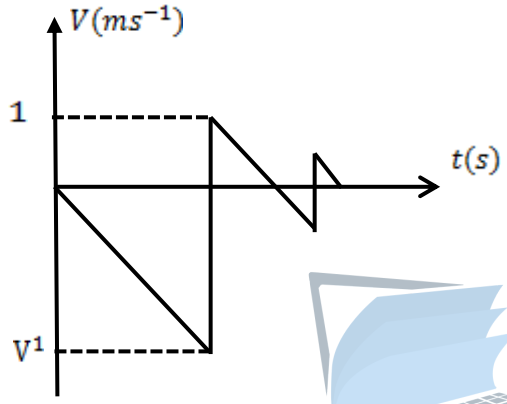
(iv) When he jumps, the pole – vaulter truns sideways (figure I – D). Explain why this helps him to pass over a high bar

(b) The graph I shows that between Y and Z the pole – vaulter rapidly decelerates as the pole becomes bent.

(i) Calculate the change in the horizontal component of momentum of the pole – vaulter as the pole bends.

(ii) Calculate the average horizontal decelerating force on the pole – vaulter. as the pole bends.

(c) $0.5\,m$ height matress is in pole – vaulter falling place. Athlete falling from height h bounces back vertically impacting with matress. Athlete velocity – time graph is shown below.



Graph II

(i) Calculate $V^1 and\ t$ (Take $\sqrt{10} = 3.1$).

(ii) After the first impact, calculate the momentum transfer to mattress.

(iii)Above graph II is drawn a neglect what is the neglect?

(iv)If that neglect does not take, draw approximately expecting graph.

agaram.lk

07)

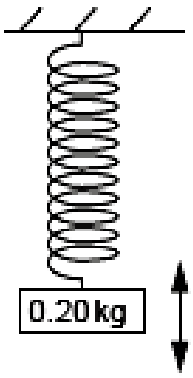
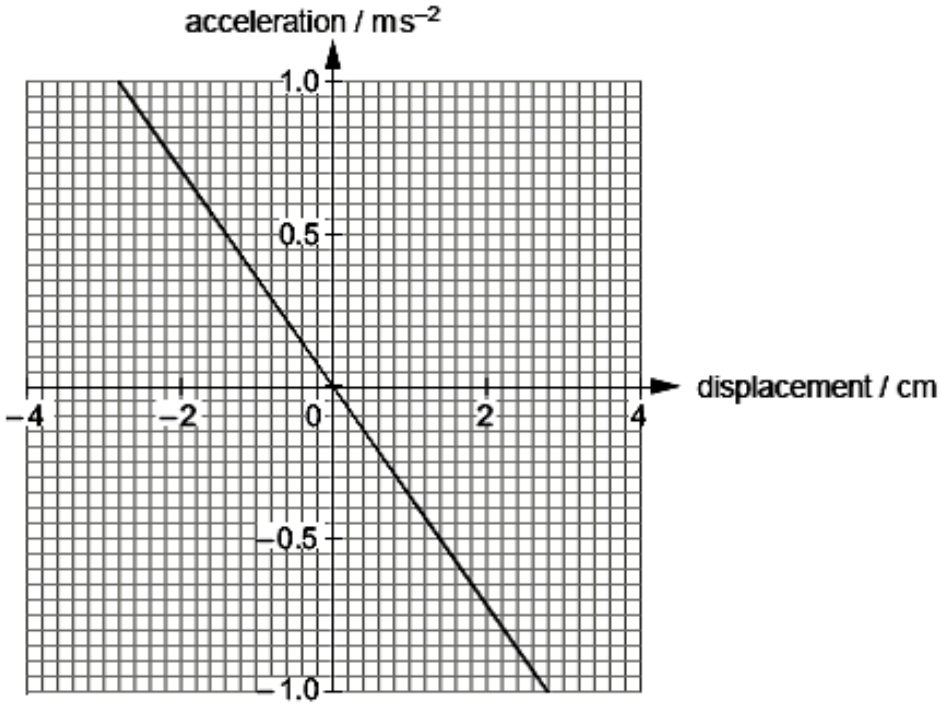


Figure I

(a) A $0.20\,kg$ mass oscillates vertically on a spring as shown in figure I. The graph shows the variation of acceleration with displacement of the mass on the spring.



(i) Explain how the graph verifies that the mass will perform simple harmonic motion.

(ii) Use the graph to show that the frequency of oscillation of the mass on the spring is approximately 1 Hz.

(iii) Calculate the maximum kinetic energy of the mass.

(iv) Calculate the spring constant.

agaram.lk

(b) Oscillation of a mass between a pair of springs as shown in the following Figure II.

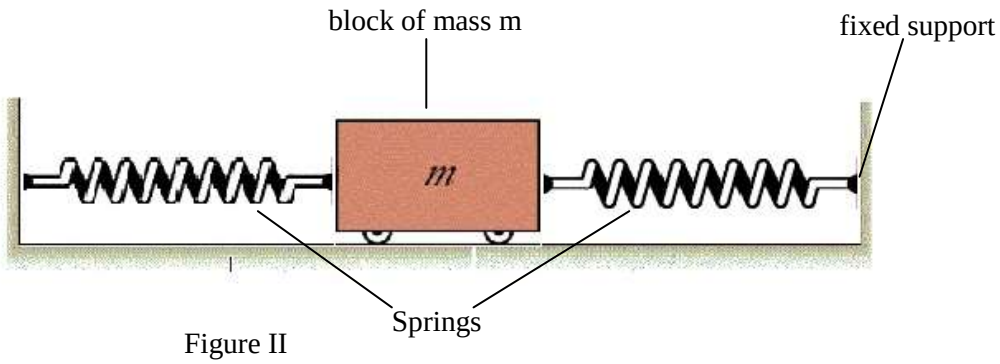


Figure II

The system obeys Hooke's Law with a stiffness constant k. The block is displaced a horizontal distance x and released.

(i) Show that the initial acceleration a of the mass m is given by $a = -\frac{kx}{m}$.

(ii) Show that frequency of oscillation $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$.

(c) Figure II system is used as a damper to reduce the movement of tall buildings in earthquakes or high winds shown in Figure III.

The system is designed to reduce the oscillations of a building which has natural frequency of $0.5\ Hz$. (Stiffness constant of the system $= 2.8 \times 10^6\ Nm^{-1}$)

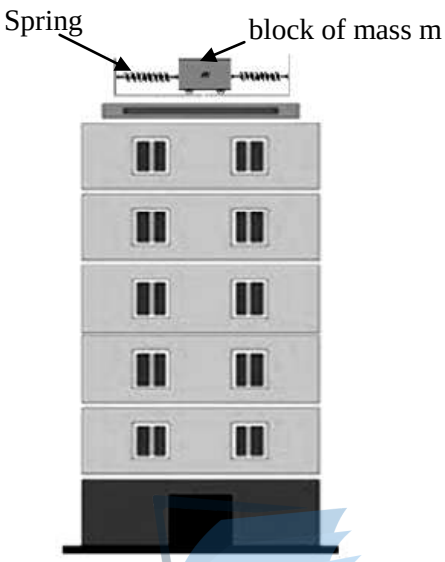


Figure III

(i) What is the value of the mass oscillating between springs matches the natural frequency of the building.

(ii) A sudden movement of the building displaces the block 0.7 m from its equilibrium position relative to the building. What is the energy transferred to the oscillator is about 700 kJ.

(iii) The oscillator is damped. It losses 50% of its energy on each oscillation. Show that the amplitude of the oscillator is reduced from 0.7 m to 0.5 m after one complete oscillation.

(iv) Suggest why dampers are more effective when placed near the top of the building.

agaram.lk