De Mazenod College - Kandana. | E | 01 | I

G.C.E. Advanced Level-Term Test – March 2018

Physics –Part (I) | **Grade 12** | **Time-1 hou**

Answer all the questions

1. In the equation $v = at + \frac{b}{t+c}$, v is velocity and t is time.The dimensions of a,b ,c are

	a	b	c
1)	L^2	T	LT^{-2}
2)	LT^{-2}	LT	T
3)	LT^{-2}	L	T
4)	L	LT	T^2
5)	LT^{-1}	L	T

2. If the percentage error of measuring the radius of a sphere is 1%, what is the percentage error of its volume?

   1) 1% 2) 2% 3) 3% 4) 4% 5) 5%

3. The length of a rod is measured using a ruler and its diameter is measured using a venire caliper.The correct volume of the rod is given as,

   1) 16.2481 cm^3 2) 16.248 cm^3 3) 16.24 cm^3 4) 16.2 cm^3 5) 16 cm^3

4. The correct dimension of a light year is,

   1) M^0L^0T 2) $M^0 LT^{-1}$ 3) $M^0 LT^0$ 4) $M^0 L^0 T^{-1}$ 5) MLT^{-1}

5. The displacement of a particle which undergoes simple harmonic motion is given by y=0.3sin(220t+0.64) .t and y are measured in seconds and meters respectively. The frequency and the maximum velocity of the motion would be,

   (1) $35H_z$, $66ms^{-1}$ (2) $45H_z$, $66ms^{-1}$ (3) $58H_z$, $113ms^{-1}$

   (4) $35H_z$, $132ms^{-1}$ (5) $35H_z$, $135ms^{-1}$

6. The best instrument to measure the diameter of a smooth rubber tube if its' outer diameter is approximately 1cm,

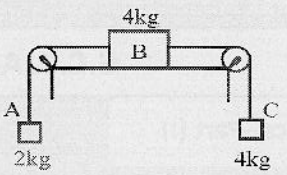
   1) Micrometer screw gauge 2) traveling telescope 3) venire caliper

   4) meter ruler 5) centimeter ruler

7. What is the frictional force between B and the table if the coefficient of friction is 0.8

1) 40N 2) 20 N 3) 32N

4) 16N 5) 48N



8. A circular disk in a horizontal plane is rotated about a vertical axis trough the center of the disk.If the angular speed is varying, which quantity and the direction of the following will be varied in a point which is at the circumference of the disk.

1) Angular velocity 2) angular acceleration 3) angular momentum

4) centripetal acceleration 5) resultant acceleration

9. If the number **56** is observed by a telescope, you would see,

1) 92 2) 95 3) 95 4) 95 5) 95

10. An object of mass 9kg explodes in to two particles. The mass of one particle is double of the other particle. If the speed of the small particle is $10ms^{-1}$ what is the kinetic energy of the other particle.

1) 30 J 2) 25J 3) 40J 4) 75 J 5) 45J

11. A body is in equilibrium under the action of three coplanar forces. Then,

A) They must meet in a point.

B) their horizontal and vertical components must be equal.

C) Total moment of forces around any point in the plane is zero.

True sentences from the above

1) A only 2) B only 3) C only 4) A and C only 5) none

12. person is riding a bicycle and stops paddling suddenly. Then,

1) The direction of frictional force acting on wheels will be changed.

2) The direction of frictional force on front wheel will be changed .

3) The direction of frictional force on back wheel will be changed.

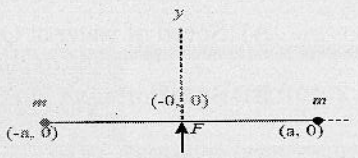
4) The direction of frictional force on both the wheels will be changed

5) None of the above

13. Two objects of each mass m are placed at (-a, 0) and (+a,0).The masses are connected with a string. A force F is applied on a point point as shown in the figure so that the masses move towards each other.In an instant where the masses at (-x, 0) and (+x,0)what is the acceleration of each object,

1) $\frac{F}{m}\frac{x}{\sqrt{a^2-x^2}}$ 2) $\frac{F}{m}\frac{\sqrt{a^2-x^2}}{x}$ 3) $\frac{Fx}{2m\sqrt{a^2-x^2}}$

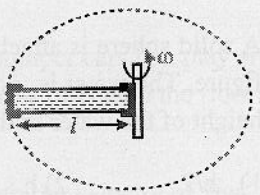
4) $\frac{F}{2m}\sqrt{\frac{a^2-x^2}{x}}$ 5) $\frac{F}{m}\frac{(a^2-x^2)}{x}$



14. A closed straight tube of length L with a liquid of mass M rotates around an end as shown in the figure. If the angular velocity of the tube is ω, what is the force acting on the other end of the tube ,

1) $\frac{ML\omega^2}{2}$ 2) $2ML\omega^2$ 3) $\frac{ML\omega^2}{4}$

4) $ML\omega^2$ 5) $4ML\omega^2$

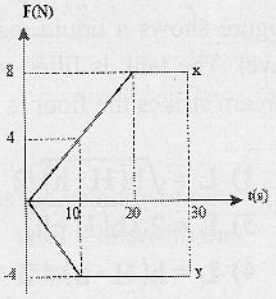


15. The variation of horizontal force acting on an object of mass 2kg which is on a rough surface is given by the line *x* as shown in the figure. Then the variation of frictional force on the object with time is given by *y*.

The velocity of the object at 20s is,

1) $10ms^{-1}$ 2) $20\ ms^{-1}$ 3) $30\ ms^{-1}$

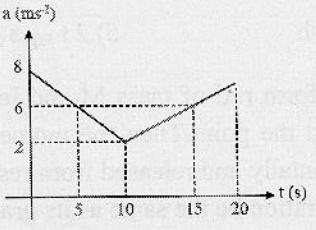
4) $40\ ms^{-1}$ 5) $45\ ms^{-1}$



16. The diagram shows the variation of acceleration with the time.If the velocity at 5s is $5ms^{-1}$ what is the velocity at 15s,

1) $5\ ms^{-1}$ 2) $20\ ms^{-1}$ 3) $25\ ms^{-1}$

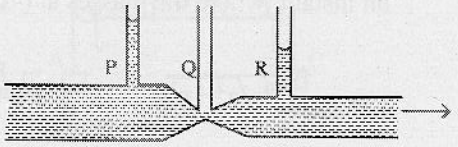
4) 40 m 5) $45\ ms^{-1}$



17. A motor cycle of mass 200kg with the rider starts from the rest and moves with a uniform acceleration.The velocity of the motor cycle after 20s is $10ms^{-1}$. If the frictional force against the motion is 50N what is the efficiency of the engine after 10s.

1) 0.15kW 2) 0.60 kW 3) 0.75kW 4) 1.5 kW 5) 7.5 kW

18. A steady flow of water in a horizontal tube of varying cross sectional area is shown below. The water level in vertical tube P and R are shown and the water level in Q is not shown.



Consider the following statements.

A) Speed of water at Q is greater than at P and R.

B) Speed of water at P is greater than the speed at R.

C) The water level in the vertical tube at Q is greater than that at P and R.

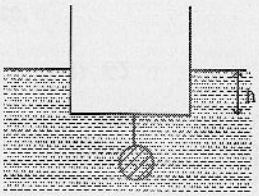
1) A is true 2) A and B are true 3) A and C are true

4) B and C are true 5) A,B, and C are true

19. A solid sphere is attached to the bottom of the container of height 2h is half-immersed as shown in the figure. The water is poured into the container so that it will immerse completely in the water.Then the height of the water in the container is,

1) h/2 2) h 3) 2h

4) 2h/3 5) h/4

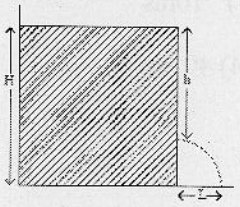


20. Figure shows a liquid discharging in a large tank from hole punched at a distance h below the water level .The tank is filled with water to a height H. The distance from the foot of the tank at which the stream strikes the floor is L. The value of L is,

1) $L=\sqrt{h(H-h)}/2$ 2) $L=\sqrt{2h(H-h)}$

3) $L=2\sqrt{h(H-h)}$ 4) $L=4\sqrt{h(H-h)}$

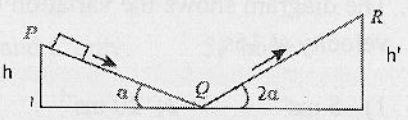
4) $L=h(H-h)/2$



21. The figure shows an object moves along PQ at an angle of α with the horizontal floor. Then it moves along the frictionless surface QR at an angle of 2α .If he collision at Q is negligible,

1) $t_{PQ}=t_{QR}$ 2) $t_{PQ}<t_{QR}$ 3) h'=2h

4) h'=h 5) $2t_{PQ}=t_{QR}$



22. A uniform rod of mass M and length L is hinged smoothly at a point so that the rod can be rotated around the point.Then the moment of inertia of the rod about the point is 1/3 ML^2 The rod is kept horizontally and released from rest. At which point on the rod away from its hinged point will the linear acceleration be the same as its gravitational acceleration.

1) 2/3L 2) 1/6L 3) 1/3L 4) 3/4L 5) L/2

23. The length of a rod is 2m . Two strings of lengths 1m and $\sqrt{3}$ m are attached to the ends of the rod and the free ends of the strings are tightened with a nail in a ceiling. If the rod is an equilibrium position, the angle inclined with the vertical axis is,

1) 12^0 2) 30^0 3) 45^0 4) 50^0 5) 60^0

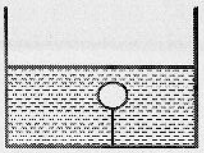
24. An object is moving in a circular path of radius 1m with a uniform velocity of V.If difference of velocities between any two points is V, how much time taken to move between two points,

1) $\pi/3v$ 2) $\pi/2v$ 3) $\pi/6v$ 4) $2\pi/v$ 5) $\pi/4v$

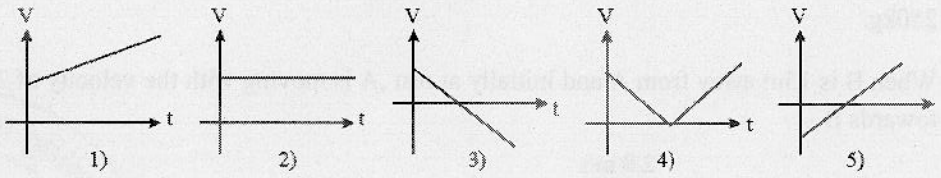
25. A solid sphere of mass 2kg is attached to the bottom of a container of water by a string and the system accelerates vertically upwards at an acceleration of 2 ms^{-1}. The tension of the string is ,(the density of water is 1000kgm^{-3} and density of material of the sphere is 500 kgm^{-3})

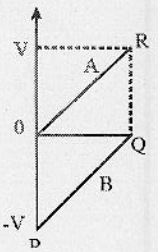
1) 20 N 2) 10N 3) 24N

4) 12 N 5) 18 N



26. The velocity time graph of objects A and B are shown in the same diagram. The velocity of A relative to B with time (t) is best represented by,

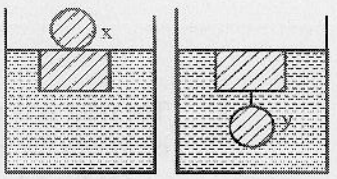




27. The diagram shows the two wooden blocks immersed in the water using two (x and y) metal spheres. If the relative density of the spheres is s the ratio of volumes of x and y is,

1) 1-s 2) (s-1)/s 3) s+1

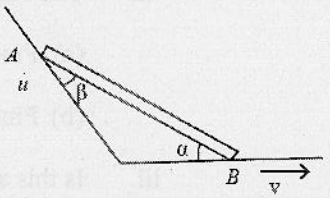
4) 1/s 5) s



28. A rod of length L is slipping freely along the incline and the horizontal surface .If the velocity at B in an instant is v , what is the velocity at A at that time.

1) $\frac{v \sin\alpha}{\sin\beta}$ 2) $\frac{v \cos\alpha}{\cos\beta}$ 3) $v\cos(\alpha-\beta)$

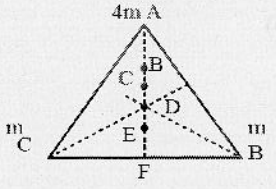
4) $v\cos(\alpha+\beta)$ 5) $V\sin\alpha\sin\beta$



29. The masses 4m , m and m are placed on the vertices of an equilateral triangle ABC. The most possible point of the center of gravity of the system is,

1) B 2) C 3) D

4) E 5) F



30. An ice cube of side 20cm which is at 0^0C is floating in water.The density of ice and water is 900kgm^{-3} and 1000kgm^{-3} respectively. The change of gravitational potential energy when the ice cube is melted completely is,

1) 0.36J 2) 0.72J 3) 0.75J 4) 0.9 J 5) 1 J

G.C.E. Advanced Level - Term Test –March 2018

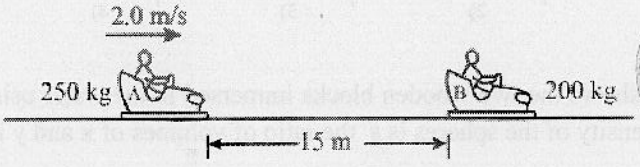
Physics -Part II | **Grade 12** | **Time-Two hours**

Part B – Essay

Answer only 2 questions

01) (a) The diagram below shows that the two students are riding bumper cars in a play area. The mass of the bumper car (A) with the rider is 200kg and the mass of B with the rider is 250kg.

When B is 15m away from A and initially at rest ,A is moving with the velocity of $2ms^{-1}$ towards B



i. The rider A is accelerating with $1.5ms^{-2}$ until it reaches the velocity of $5ms^{-1}$ Then it continues the motion with a constant velocity of $5ms^{-1}$ until it hits with the car(B).Find the total time taken by the car(A) to move 15m.

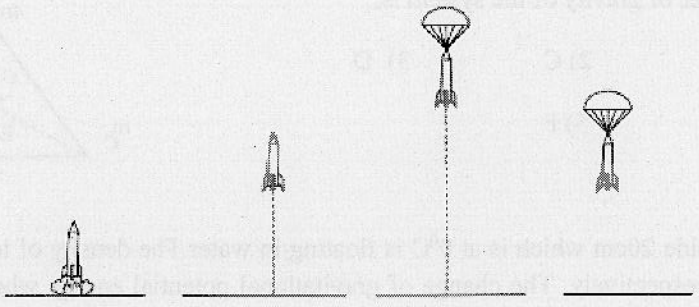
ii. The bumper car (B) moves to the right with the velocity of $4.8ms^{-1}$ after the collision.

(a) Find the velocity of A after the collision

(b) Find the direction of movement of A after the collision.

iii. Is this an elastic collision? Explain your answer.

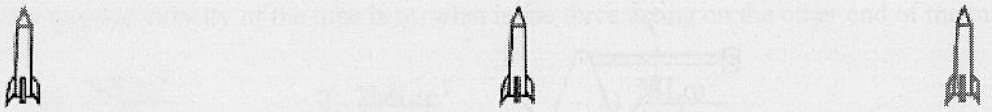
(b)



As shown in the above figure a model of rocket of mass 0.250kg starts moving upwards after the engine starts its combustion at $t=0$. The engine generates an impulse of 20Ns in the process of combustion in 2s.After reaching its maximum height the rocket starts to move back to the earth surface using a parachute.

i. To represent the following instances draw and label the forces acting on the rocket.

At combustion of engine | before releasing the parachute | after releasing the parachute but after the engine stops

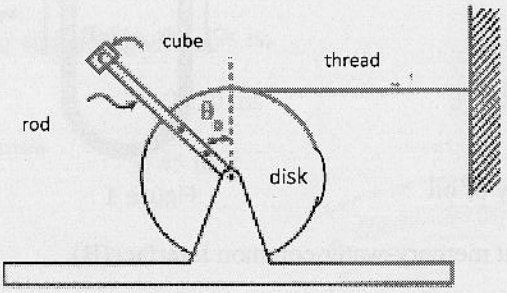


ii. Calculate the mean acceleration of the rocket during the combustion in 2s.

iii. Calculate the maximum height that the rocket reaches

iv. After how long that the rocket reaches its maximum height from t=0

(C)



As shown in the above figure a uniform disk is attached to an axel so that the disk can be rotated freely without the friction. A thin uniform rod which is attached to the disk also rotates with the disk. A cube is attached to the end of the rod so that the whole system can be rotated.

Consider the followings,

Disk – mass =3m , radius =R , moment of inertia around the centre $I_D = 1.5mR^2$

Rod – mass=m , length 2R , moment of inertia around an end $I_R = 4/3mR^2$

Cube- mass=2m

As shown in the above figure one end of a light string is attached to a wall and the other end is attached to the disk. Then system is at equilibrium so that the rod is inclined in θ_0 to the vertical direction .

Answer the following questions in terms of m,R, θ_0 ,g

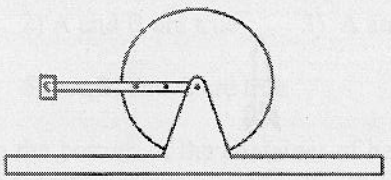
i. Tension of the string

ii. The system(disk, rod and cube) can be rotated freely when the string is cut. Find,

the angular acceleration of the disk

linear acceleration of the cube, just after cutting the string

iii. The following diagram shows the rotating disk in an instant. Find the linear acceleration of the cube at that instant.



02) a) Figure shows a modified U tube experimental set up to find the density of an oil.The diameter of the uniform U tube is 0.850cm.The level AB of mercury in the two arms of the U tube is horizontal.

(density of water -1000kgm^{-3})

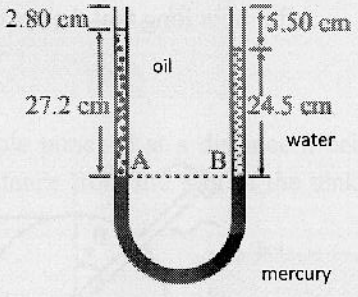


Figure 1

i. Calculate the density of oil

ii. Calculate pressure at mercury-water common interface(B)

The left arm of the above U tube now changed to a conical shape tube.
The same amount of mercury is used in the new U tube.(same levels of mercury are mentioned in figures 1 and 2 using the dotted lines).
The same amount of oil and water are now added to the left and right arm respectively.

iii. Mention the new position of B respective to the level A.

(above A, below A or same as level A)

iv. A small wooden piece(less than the density of oil)is dropped in to the left arm of the U tube.If the wooden piece floats in the tube, then the pressure in the bottom of the tube will be increased, or decreased or not changed ?

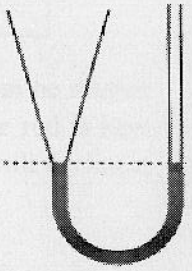


Figure 2

b)

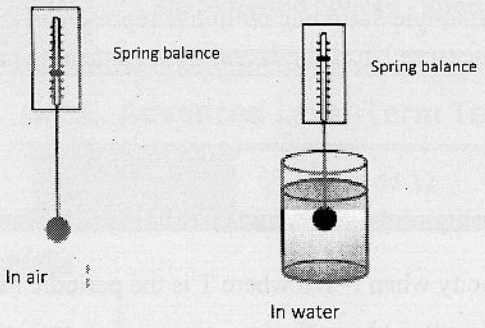


Figure 3

An object is suspended using a spring balance as shown in the above figure.The reading of the balance in the air is17.8N and the reading when the object is fully immersed in the water is 16.2N.(density of water is 1000kgm^{-3})

i. Calculate upthrust force when the object is in the water.

ii. Calculate the volume of the object.

iii. Calculate the density of the object.

iv. When the object is removed , how does it affect with the pressure at the bottom of the container. Explain your answer.

(C) The figure 4 shows a water fountain ejects water from a hole of radius 0.015m.

Water ejects vertically upwards with a velocity of 6ms^{-1}. (density of water is 1000kgm^{-3}).

i. Find the volume flow rate of water

ii. The water is supplied to the fountain by using a tube which is 2.5m below the hole of the fountain. The radius of the tube is 0.025m. Find the absolute pressure at a point of the tube which is 2.5m below the hole of the fountain.

iii. The owner needs to increase the height of the water column in the fountain up to 4m without changing the volume flow rate. This can be done by changing the radius of the hole in the fountain. Calculate the new radius of the hole of the water fountain.

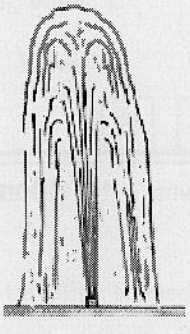


Figure 4

03) (a) An object which is executing simple harmonic motion is represented by the equation $x=10 \sin 4\pi t$ where t (time) is measured in seconds and displacement (x) is measured in cm.

Find

i. the amplitude, period, velocity of the motion when t=0

ii. the amplitude and the velocity when t=T/8 where T is the periodic time of the motion

(b) The lower end of a light helical spring(A) is attached to a mass of 0.2kg.Then the extension of the spring is 0.01m. When the spring is further extended to 0.01m distance and released, it executes simple harmonic motion.

Find

i. The equilibrium position

ii. The amplitude

iii. The period

iv. The period when the amplitude is doubled.

The lower end of another light helical spring(B) is attached to a mass of 0.4kg. Then the extension is 0.01m. Now the mass(0.02kg) of A is removed and the spring B is attached to the lower end of the spring A.

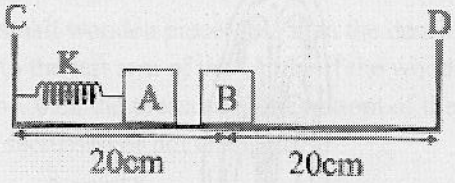
In the combined spring, Find

i. The extension

ii. Spring constant

iii. The periodic time.

(c) As shown in the diagram a mass(A) of 200g is attached to a spring of spring constant $500 Nm^{-1}$ Another mass (B) is placed in the middle of the walls C and D. The natural length of the spring is 20cm and it is compressed by 4cm and released. Assume that the collisions are fully elastic and frictionless find the time between two consecutive collisions of B and D.



De Mazenod College- Kandana | 01 | E | II

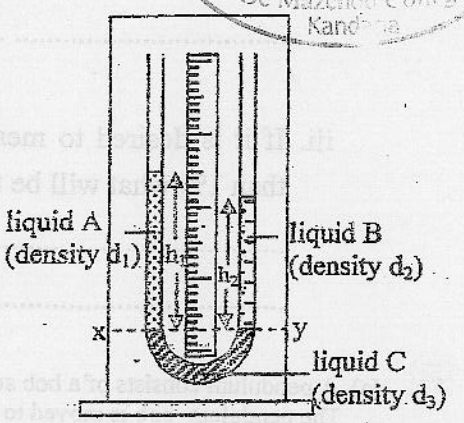
G.C.E. Advanced Level - Term Test –March 2018

Physics -Part II | Grade 12 | Time-Two hours

Part A – Structured Essay

Answer all the questions

01) Figure shows a modified U tube experimental set up to compare the densities of two liquids A and B, employing a third liquid C which is immiscible with both A and B. The level xy of the liquid C in the two arms of the U tube is horizontal.



a) Write down the inequality relationship among the densities of these liquids (d_1, d_2 and d_3)

.....

b) Suppose that the levels of liquids A and B above xy are h_1 and h_2 respectively. Write down an equation relating h_1,h_2, d_1 and d_2

.....

c) Why is it necessary to maintain xy horizontal?

.....

d) i. State the experimental procedure to determine the ratio of the densities of d_1 and d_2 using graphical method (sufficient amount of liquids are available).

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ii. Comment on the accuracy the measurements of h_1 and h_2 when the density of C differs very much than that of A or B.

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e) i. Draw a rough sketch of the straight line graph denoting h_1 and h_2 on the x and y axis respectively.

ii. The gradient of the straight line is as 0.8 when A, B and C are chosen as water (density 1000Kgm^{-3}), copper sulphate solution and mercury (density 13600kgm^{-3}) respectively. Find the density of the copper sulphate solution.

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iii. If it is desired to measure the height of the liquid column with an accuracy less than 1% what will be the minimum height of the liquid column.

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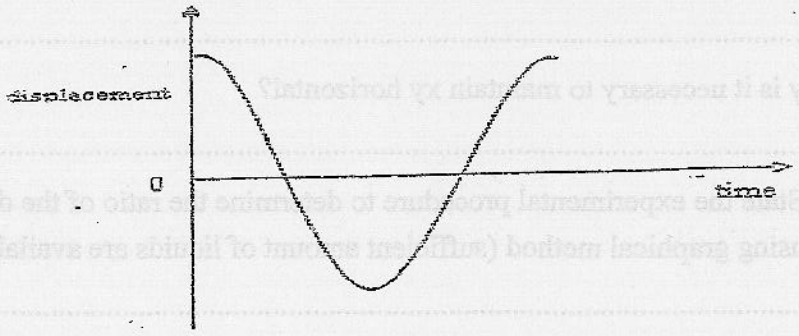
02. (a) A pendulum consists of a bob suspended by a light inextensible string from a rigid support. The pendulum bob is moved to one side and then released. The sketch graph shows how the displacement of the pendulum bob undergoing simple harmonic motion varies with time over one time period.



On the sketch graph above,

(i) Label with the letter A a point/points at which the acceleration of the pendulum bob is a maximum.

(ii) Label with the letter V a point/points at which the speed of the pendulum bob is a maximum.

(b) Explain why the magnitude of the tension in the string at the midpoint of the oscillation is grater than the weight of the pendulum bob.

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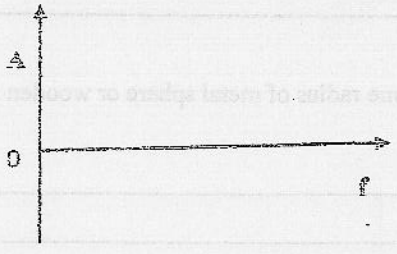
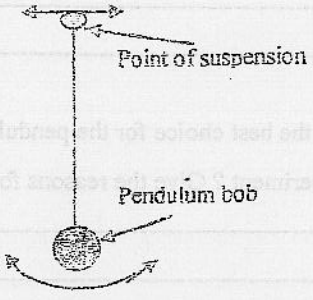
(c) The figure shows the point of suspension of the pendulum bob is moved from side to side with a small amplitude by electric vibrator in variable frequency which frequency is displayed in digital mode. For a certain frequency, the pendulum bob oscillates maximum constant amplitude.

(i) On the axes shown, sketch a graph to show variation of amplitude A with frequency f.





(ii) For a certain frequency, the pendulum bob oscillates maximum amplitude, explain the reason for this.

(iii) If the percentage error of the certain frequency measurement in the vibrator is 5% and the least count of the vibrator is 1Hz, find the frequency of the vibrator.

(d) A student decides to determine the acceleration due to gravity for this method, and he measures the frequencies(f) for maximum amplitude of variable lengths(l) of pendulum.

(i) Write down an expression for the frequency f of the simple pendulum in terms of the length l of the pendulum and the acceleration due to gravity g.

(ii) Rearrange the above expression for f^2 versus $1/l$ graph.

(iii) The student plotting the f^2 versus $1/l$ graph he found that the gradient was $0.25 ms^{-2}$. Determine g (Take $\pi = 3.1$)

(e). Which is the best choice for the pendulum bob, whether same radius of metal sphere or wooden sphere for this experiment ? Give the reasons for your choice.