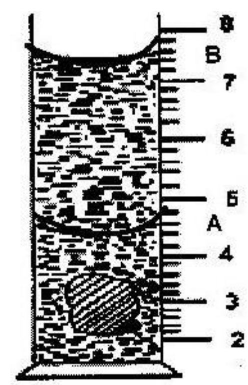
FORM ONE WORK

INTRODUCTION TO PHYSICS

<u>PAST KCSE QUESTIONS ON THE TOPIC</u>

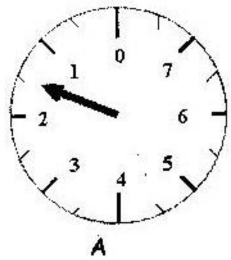
1. State two factors that should be controlled in manufacturing a cylindrical container of uniform thickness, which should normally be in a standing position.
2. The figure shows a measuring cylinder which contains water initially at level A. A solid mass 11g is immersed in the water, the level rises to B.



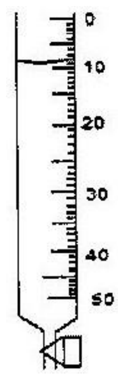
Determine the density of the solid. (Give your answer to 1 decimal point)

A butcher has a beam balance and masses 0.5 kg and 2 kg. How would he measure 1.5 kg of meat on the balance at once?

3. The number of molecules in 18cm^3 of a liquid is 6 x 10^{23}. Assuming that the diameter of the molecules is equivalent to the side of a cube having the same length as the molecule. Determine the diameter of the molecule.
4. Determine the density in kg/m^3 of a solid whose mass is 40g and whose dimensions in cm are 30 x 4 x 3
5. Record as accurately as possible the masses indicated by the pointer in figures A.



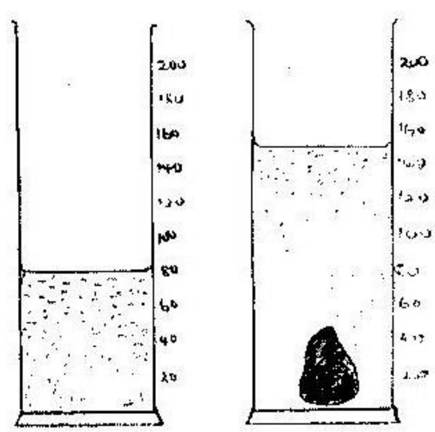
6. Figure 1 shows the reading on a burette after 55 drops of a liquid have been used.



If the initial reading was at 0cm mark, determine the volume of one drop.

(2 marks)

7. Fig. 1 shows the change in volume of water in a measuring cylinder when an irregular solid is immersed in it.



Given that the mass of the solid is 567g, determine the density of the solid in gcm^{-3}. (Give your answer correct to 2 decimal places.

8. A thin wire was wound 30 times closely over a boiling tube. The total length of the windings was found to be 9.3 mm. Calculate the radius of the wire.
9. (a) Given that a kilogram of copper contains about 10^{25} atoms and that density of copper is about $9000kg/m^3$/ estimate the diameter of the copper atom?

   (b) State the assumption made in (9a) above.
10. A drop of oil of volume 1.0×10^{-3} spreads out on clean water surface to a film of area $10cm^2$. Calculate the thickness of the film.
11. A small drop of oil has a volume of $5 \times 10^{-8}m^3$. When it is put on the surface of some clean water, it forms a circular film of $0.lm^2$ in area;

    (i) What is the size of a molecule of oil?

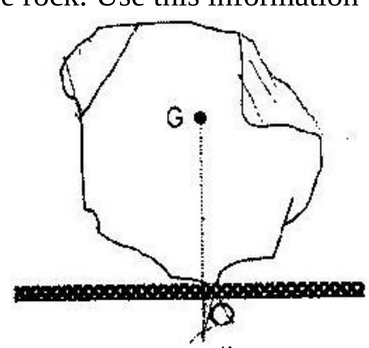
    (ii) State two assumptions you make in your calculations?
12. The density of concentrated Sulphuric acid is $1.8gcm^{-3}$. Calculate the volume of 3.6kg of the acid.
13. 1600 cm^3 of fresh water of density l g/cm^3 are mixed with $1400cm^3$ of seawater of density $1.25g/cm^3$. Determine the density of the mixture.

TOPIC 2

FORCES

<u>PAST KCSE QUESTIONS ON THE TOPIC</u>

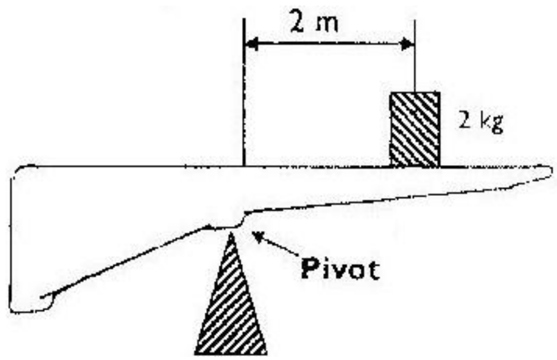
1. A student was heard saying "the mass of a ball on the moon is one sixth its mass on earth". Give a reason why this statement is wrong.
2. In the study of a free fall, it is assumed that the force *f* acting on a given body of mass *m* is gravitational, given by F= mg. State two other forces that act on the same body.
3. State how a lubricant reduces friction in the bearings of moving part of a machine.
4. Distinguish between mass and weight of a body stating the units for each.
5. State with reason the purpose of the oil that circulates in a motorcar engine.
6. Name two types of forces which can act between objects without contact.
7. A house in which a cylinder containing cooking gas is kept unfortunately catches fire. The cylinder explodes. Give a reason for the explosion.
8. Give a reason why the weight of a body varies from place to place
9. State why a pin floating on water sinks when a detergent is added.
10. The figure below represents a rock balanced at point O. G is the center of gravity of the rock. Use this information to answer the following questions:



(a) Draw and label on the figure the forces acting on the rock

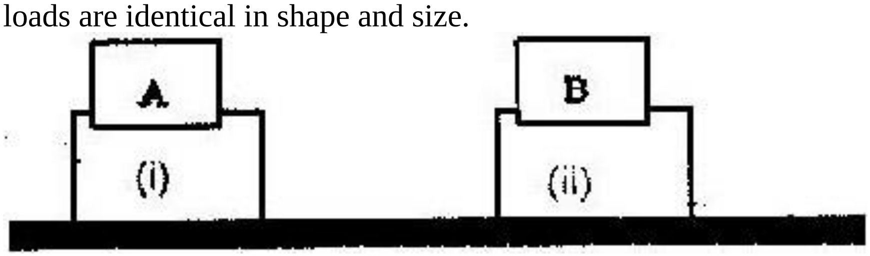
(b) If the portion of the rock represented by the shaded part is chopped off, explain why the rock may topple to the right.

11. The figure shows a non- uniform log of mass 100kg balanced on a pivot by a 2 kg mass placed as shown.



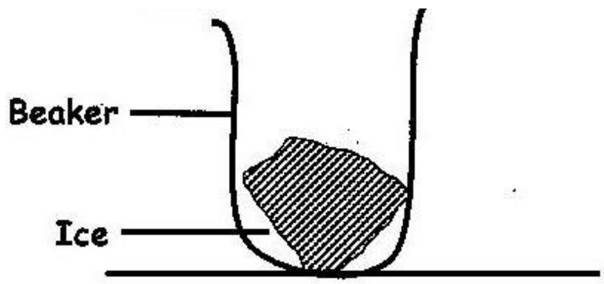
Determine the distance of the centre of gravity of the log from the pivot

12. 2003: The figure below show two identical trolleys with loads A and B. The loads are identical in shape and size.



Given that the density of A is greater than that of B, explain why the trolley in figure 3 (ii) is more stable.

13. 2004: Fig 2 shows a beaker placed on a bench. A block of ice is placed in the beaker as shown. State and explain the change in the stability of the beaker when the ice melts.



14. 2004: The system in figure 9 is in equilibrium

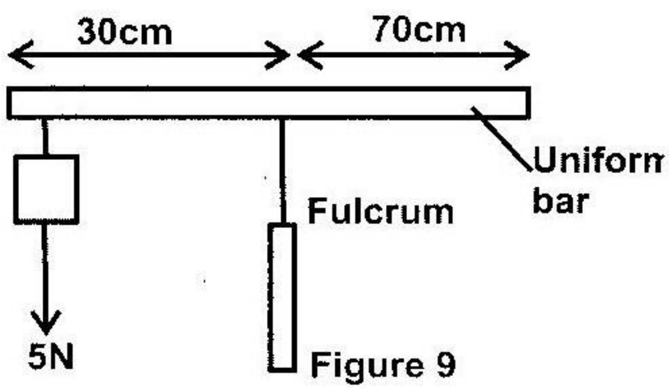


Figure 9

Determine the weight of the bar. (3 marks)

15. (a) Give a reason why water is not a suitable liquid for use in a barometer

(b) Fig. 3 is a simplified diagram of a hydraulic jack. The cross selection area A2 of the load piston is 25 times the A1 of the effort piston, A2 = 25N. F1 is the force applied (Effort) while F_2 represents A1 the load.

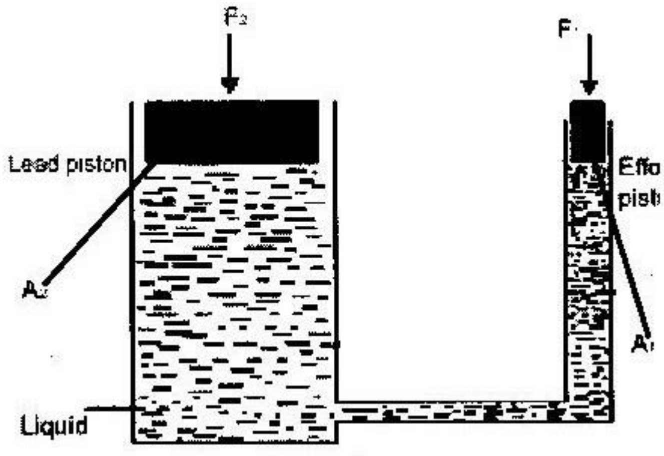


Figure 3

(i) Write an expression for the pressure exerted on the liquid by the effort piston. (1 mark)

A mechanic applies a force of 100N on the effort piston while raising the rear part of a car.

(ii) Determine the maximum load that can be raised (2 marks)

(iii) Give a reason why gas is not suitable for use in place of the liquid in the jack (1 mark)

16. 2005: Fig 2 shows a solid cylinder standing on a horizontal surface. The cylinder is in stable equilibrium

On the horizontal space provided, sketch the cylinder in neutral equilibrium. (1 mark)

17. Fig 8 shows water drops on two surfaces. In 8 (a), the glass surface is smeared with wax while in 8 (b) the glass surface is clean.

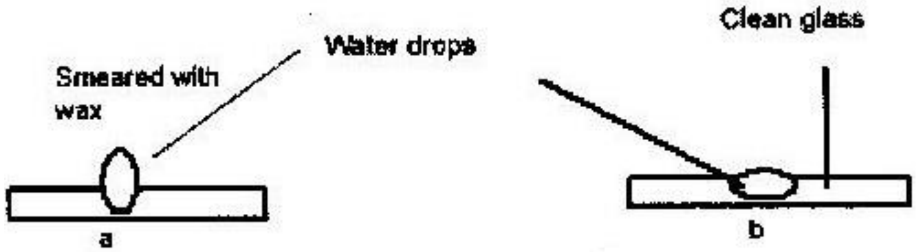


Figure 8

Explain the difference in the shapes of the drops. (2 marks)

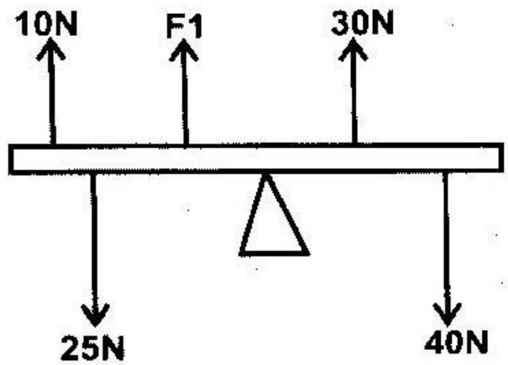
18. A see – saw of length 5 m is pivoted at the centre. A student of mass 50kg sits at one end and is balanced by another student of mass ‘m’ sitting at a distance of 1m from the other end. Calculate the value of ‘m’

19. An astronaut is on the moon. He drops a hammer from a height of 3.2m and it takes 2.0s to hit the lunar landscape. What is the acceleration due to gravity of the moon?

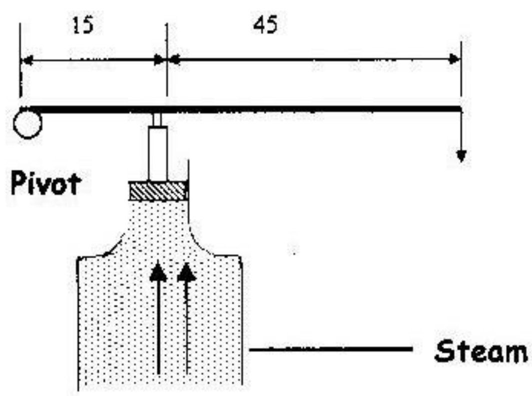
20. An unloaded spring has a length of 15cm and when under a load of 24N it has a length of 12cm. What will be the load on the spring when length is 10cm?

21. Two copper spheres M and N are joined by a light rod such that their center of mass are 30cm apart: if the radius of M is 2 times the radius of N, find the position of the COG from mass M.

22. In the diagram below the system is in equilibrium. Determine the value of F_1 in N.



23. Fig 3 shows a device for closing a steam outlet. The area of the piston is $4.0 \times 10^{-4} m^2$ and the pressure of the steam in the boiler is $2.0 \times 10^5 Nm^2$. Determine the weight W that will just hold the bar in the horizontal position shown.



24. The total weight of a car with passengers is 25,000N. The area of contact of each of the four tyres with the ground is $0.025m^2$. Determine the minimum car tyre pressure.

25. A drum which is 2m high contains water to a depth of 0.5 m and oil of density $0.5g/cm^3$ extends to the top. Find the pressure exerted at the bottom of drum by the two liquids.

26. Figure 2 shows a non- uniform rod, lying in a horizontal position. Vertical force of 5N and 4 N can just lift the rod when applied at the end A and B respectively.

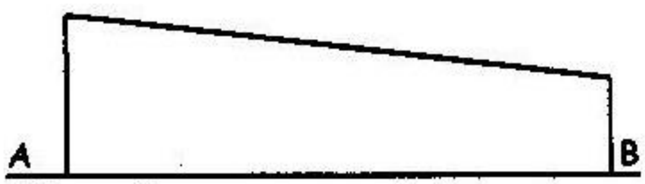


Figure 2

If the rod is 1.8m long find

(i) The position of the centre of gravity

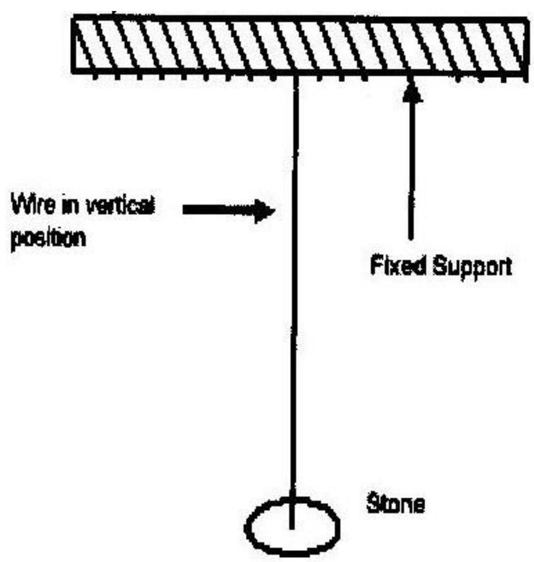
(ii) The weight of the rod

TOPIC 3

PRESSURE

<u>PAST KCSE QUESTIONS ON THE TOPIC</u>

1. Give a reason why a concrete beam reinforced with steel does not crack when subjected to changes in temperature.
2. The figure below shows part of a set up used by a student to demonstrate the expansion of a wire.



(i) What three other items, not shown in the fig would be needed in order to perform the experiment

(ii) What purpose does the stone serve?

3. 2001: State the reason why it may not be possible to suck liquid into your mouth using a drinking straw on the surface of the moon.

Figure 3 shows the levels of two liquids A and B after some air has been sucked out of the tubes through the tap. Use this information and the figure to answer questions 4 and 5.

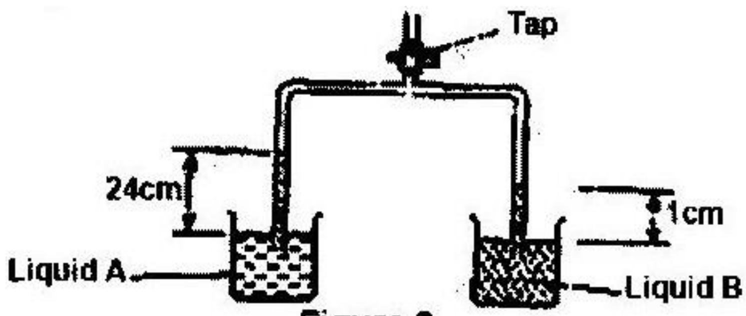


Figure 3

4. The total weight of a car with passengers is 25000N. The area of contact

   of each of the FOUR tyres with the ground is $0.025m^2$.

   Determine the minimum car tyre pressure.

   (a) Write an expression for pressure on a liquid in hydraulic jack

   (b) While using a jack, a mechanic applied a force of 100N on the effort piston while raising the rear part of a car.

   - Determine the maximum load that can be raised
   - Give a reason why gas is not suitable for use in place of the liquid in a jack.

5. State the mode by which heat travels from the cube to the balloons.

(1 mark)

6. The face of the cube towards A is bright and shiny and the face

towards B is dull- black. State with reason the adjustments that should be made on the distances X_1 and X_2 so that the rate of change of temperature in both balloons is the same. (1 mark)

7. Explain why the pressure of a gas increases when the mass of the gas in the container is increased.
8. The lift pump is effective for pumping water as long as the well is less than 10m deep. Explain.
9. The reading on a mercury barometer at Mombasa is 760mm. Calculate the pressure at Mombasa (density of mercury = 1.36×10^4 Kgm^{-3})
10. State one property of a barometer liquid and explain its effects.

TOPIC 4

THE PARTICULATE NATURE OF MATTER.

PAST KCSE QUESTIONS ON THE QUESTIONS

1. State the reason for the rise in the levels of the liquids when air is sucked from the tubes (1 mark)

2. Given that the density of liquid B is 1200 kgm^3, determine the density of liquid A. (3 marks)

3. Brownian motion of smoke particles can be studied by using the apparatus shown in figure 9. To observe the motion, some smoke is enclosed in the smoke cell and then observed through the microscope.

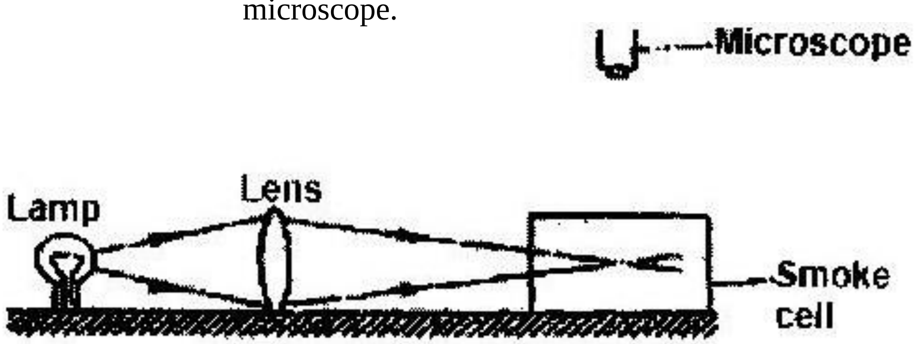


Figure 9

(a) Explain the role of the smoke particles, lens and microscope in the experiment. (6 marks)

(b) State and explain the nature of the observed motion of the smoke particles. (3 marks)

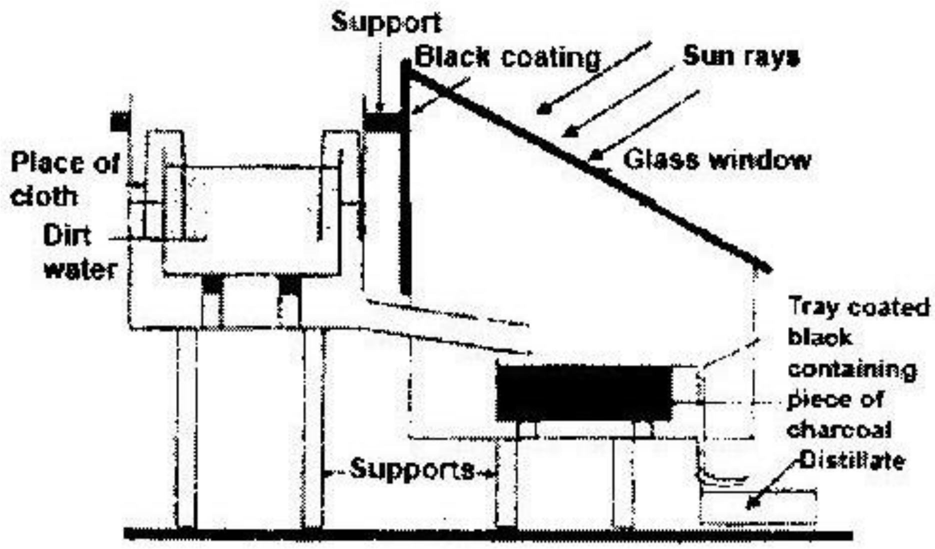
(c) State what will be observed about the motion of the smoke particles if the temperature surrounding the smoke cell is raised slightly. (1 mark)

TOPIC 5

THERMAL EXPANSION

PAST KCSE QUESTIONS ON THE TOPIC

1. 1990: The figure below shows an arrangement for a solar water purifier for dirty.



(i) Describe how the solar water purifier works

(ii) Explain the role of:

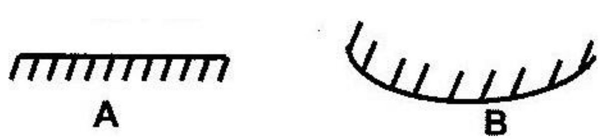
(a) Black coating

(b) The pieces of charcoal in the tray

(iii) State why the solar water purifier continues to work when sunrays are cut off.

(iv) Explain the green house effect process in the purifier above.

2. 2003: The figures (a) and (b) show a convex mirror and a plane mirror of equal aperture.



By sketching a pair of incident and reflected rays for each (a) and (b) show how the convex mirror provides to the eye, a wider field of view than the plane mirror.

3. 2004: Figure 12 shows a parabolic surface with a source of light placed at its focal point F.

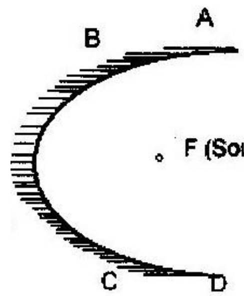
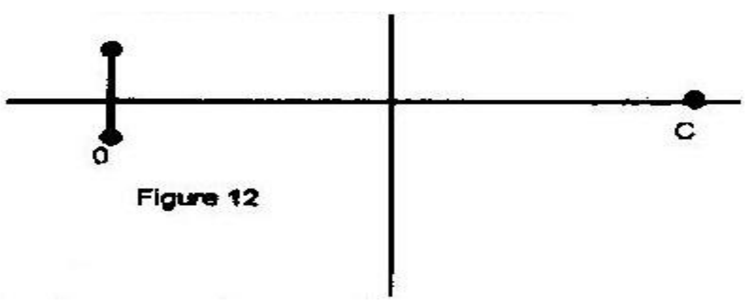


Figure 12

Draw rays to show reflection from the surface when rays from the source strike the surface at points ABC and D.

4. 2005: Fig 12 shows a vertical object O, placed in front of a convex mirror.



On the same diagram draw the appropriate rays and locate the image formed. (3 marks)

5. Figure 1 represents a pinhole camera. Sketch rays to show the formation of an enlarged image in the camera. Label both the objects and the image.

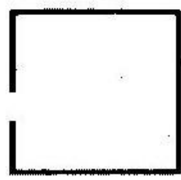


Figure 1

6. Figure 3 shows an object, O in front of a concave mirror and its

   image, 1 formed after reflection.

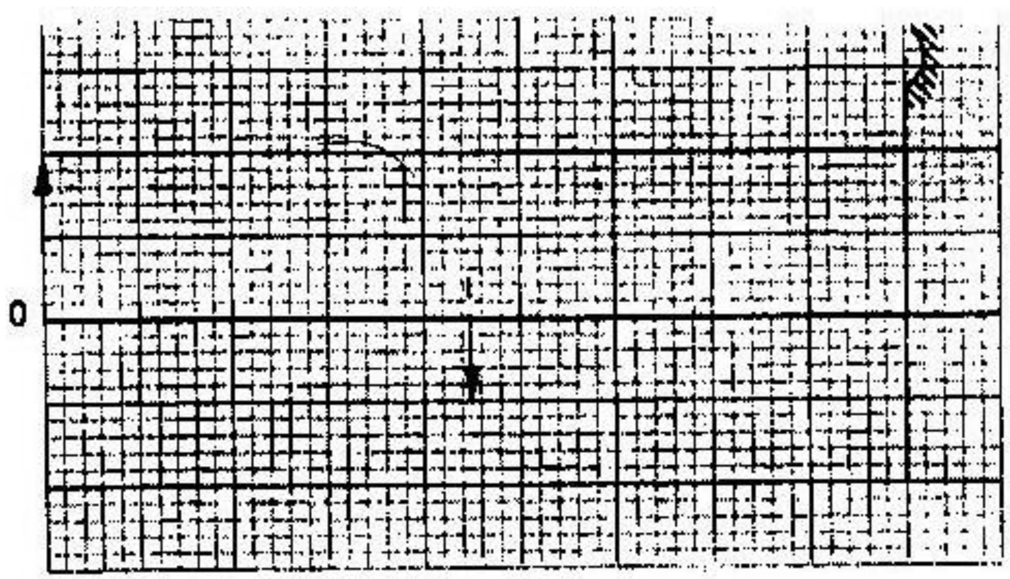


Figure 3

(a) On the same diagram appropriate ray(s) to locate the principal focus

‘F’ of the mirror (2 marks)

(b) Determine the focal length of the mirror (scale 1:5) (1 mark)

7. Liquids expand more than solids. Explain why

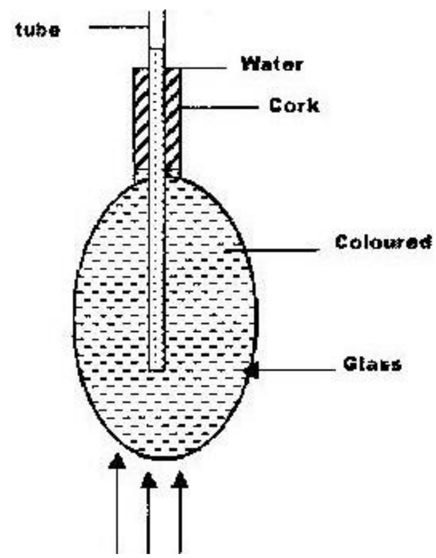
TOPIC 6

HEAT TRANSFER

<u>PAST KCSE QUESTIONS ON THE TOPIC</u>

1. An electric heater is placed at equal distances from two similar cans A and B filled with water at room temperature. The outer surface of can A is shiny while that of can B is dull black. State with reasons, which of the cans will be at higher temperature after the heater is switched on for some time.

2. In the set up shown in figure 4, it is observed that the level of the water initially drops before starting to rise.

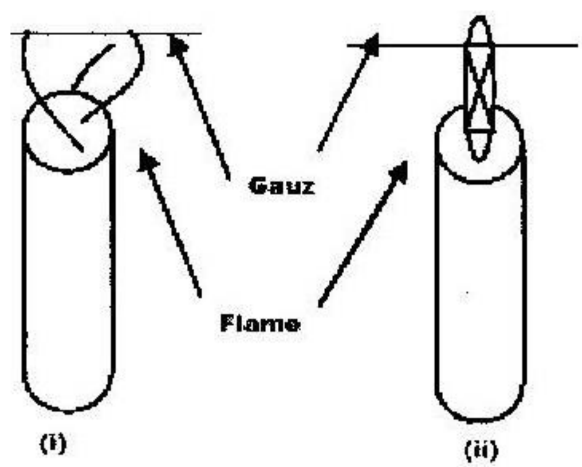


Explain this observation.

3. When a Bunsen Burner is lit below a wire gauze, it is noted that the flame

   initially burns below the gauze as shown in figure (i), after sometime, the

   flame burns below as well as above the gauze as shown in figure (ii)



Explain this observation

4. In a vacuum flask the walls enclosing the vacuum are silvered on the

   inside. State the reason for this (1 mark)

Figure 4 shows two identical balloons A and B. The balloons were filled with equal amounts of the same type of gas. The balloons are suspended at distances X_1 and X_2 from a metal cube filled with boiling water and placed on an insulating material. Use this information to answers questions 5 and 6.

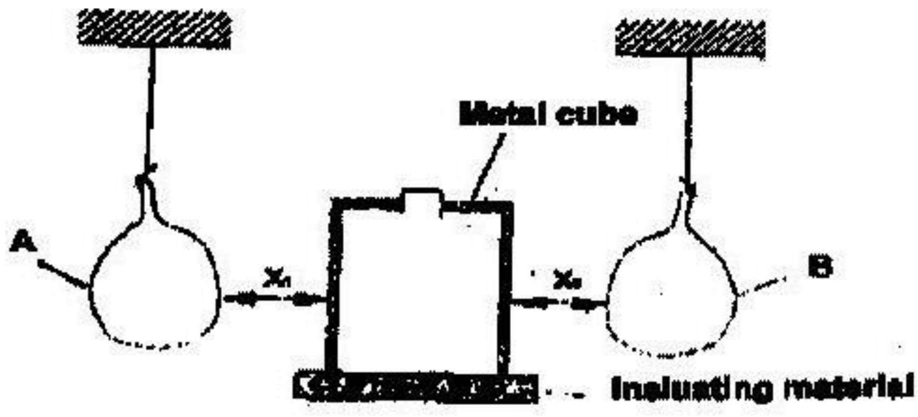


Figure 4

5. State the mode by which heat travels from the cube to the balloons

(1 mark)

6. The face of the cube towards A is bright and shiny and the face towards B is dull black. State with reason the adjustments that should be made on the distances X_1 and X_2 so that the rate of change of temperature in both balloons is the same. (1 mark)

7. Temperature scale in clinical thermometer ranges from 35^0c to 43^0c. Explain.
8. State one application of expansion in gases
9. Why is it that boiling is not used for sterilization of clinical thermometer?

10. Describe ONE advantage and ONE Disadvantage of anomalous behavior of water.

11. (a) Draw a well labeled diagram of a vacuum flask

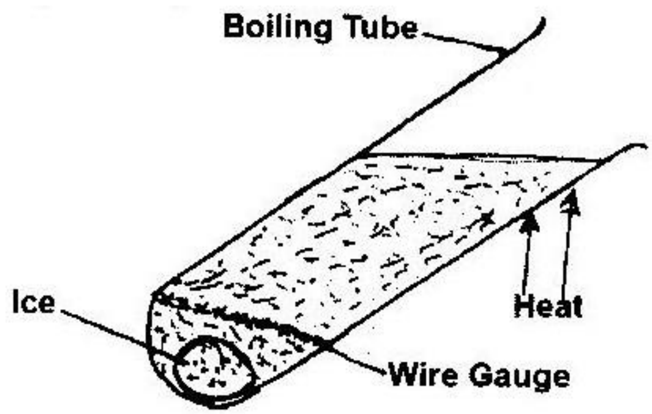
    (b) Stating the specific parts in the flask explain how heat loss is reduced through:

    (i) Conduction

    (ii) Convection

    (iii) Radiation

12. In the diagram below the ice remains in solid state for several minutes as heating continues. Explain the phenomenon.

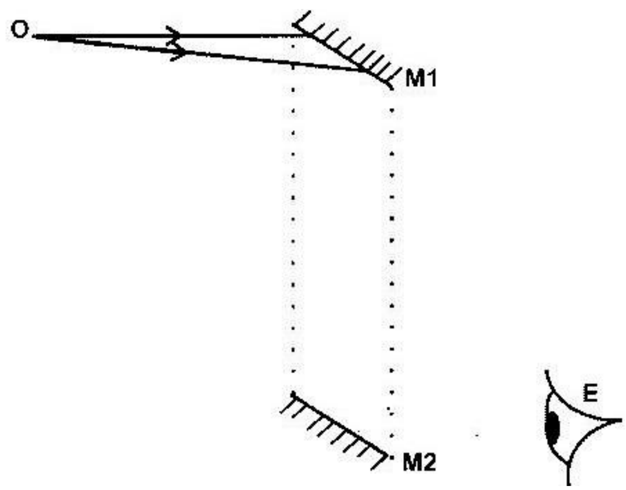


TOPIC 7

RECTILINEAR PROPAGATION OF LIGHT AND REFLECTION AT PLANE SURFACES

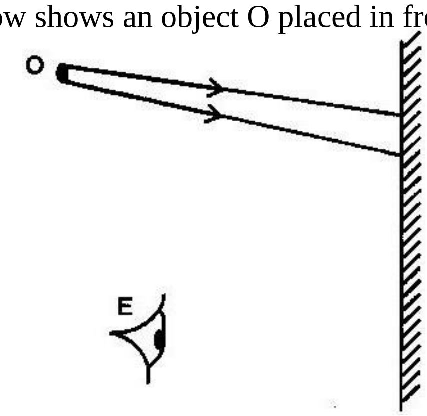
PAST KCSE QUESTIONS ON THE TOPIC

1. What is meant by a virtual image?
2. The figure below shows an object O being viewed using two inclined mirrors M1 and M2.



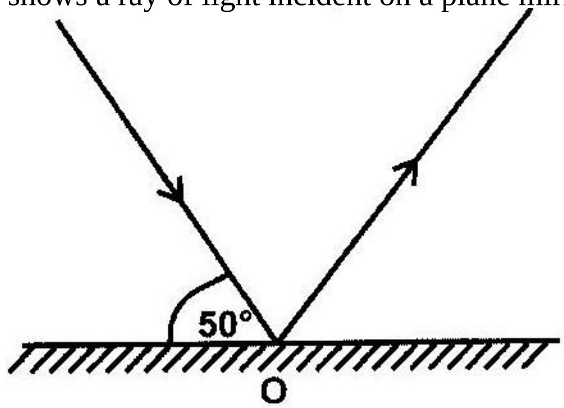
Complete the diagram by sketching rays to show the position of the image as seen by the eye E

3. The figure below shows an object O placed in front of a plane mirror



On the same diagram, draw rays to locate the position of the image 1 as seen from the eye E.

4. The diagram shows a ray of light incident on a plane mirror at point O.

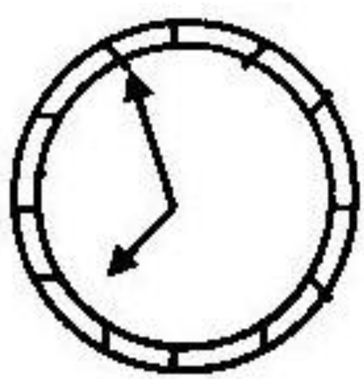


The mirror is rotated clockwise through an angle of 30^0 about an axis perpendicular to the paper. Determine the angle through which the reflected ray rotated.

5. A luminous point object took 3 s to move from P to Q in front of a pinhole camera as shown below.

What is speed in cm/s of the image on the screen?

6. The diagram shows the image of a watch face in a plane mirror



What is the time shown on the watch face?

7. (a) Give two main reasons why concave mirrors are unsuitable as driving mirrors

   (b) State one disadvantage of a convex mirror as a driving mirror

8. Explain why a concave mirror is suitable for use as a make up mirror.

9. In the space provided below, sketch a labeled diagram to show how a pinhole camera forms an image of a vertical object placed in front of the pinhole

(3 marks)

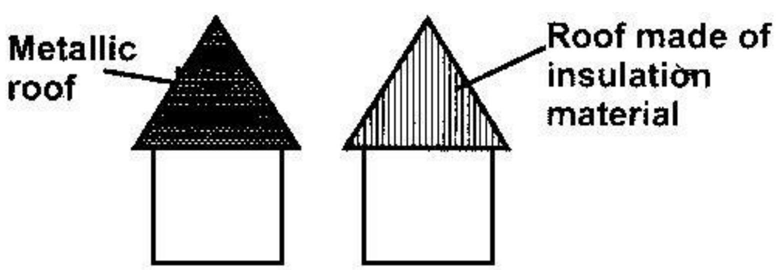
10. A building standing 100m from a pinhole camera produces on the screen of the camera an image 5 cm high 10 cm behind the pinhole. Determine the actual height of the building. (3 marks)

TOPIC 8

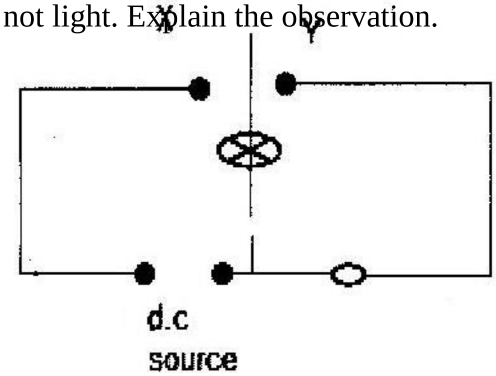
ELECTROSTATICS 1

PAST KCSE QUESTIONS ON THE TOPIC

1. Two isolated and insulated spheres A and B carry the same positive charge. Sketch the electric lines of force of their field when placed close to each other but not touching some.
2. State the observation on the leaves of a positively charged electroscope when a negative charge is brought near it.
3. The fig shows sketches of two types of houses built in a lighting prone area. State with reason which house is safer to stay in during lighting and thunderstorms?



4. The diagram below shows a circuit with a capacitor C and a lamp L. When the sketch is closed at Y, the lamp L lights. When the switch is closed at X, L does not light. Explain the observation.

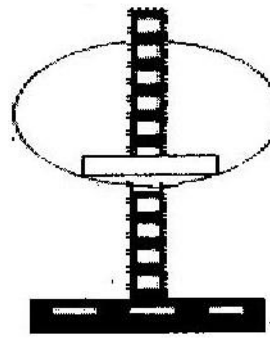


5. In the clothing and textile industries the machines experiences electrostatics forces at certain points. Suggests one method of reducing these forces.
6. State two other factors to be considered in constructing a capacitor other than the surface area of the plates.
7. State the precaution that is taken when charging a metal object.
8. (a) (i) State coulombs law of electrostatic force

   (ii) Define capacitance

   (b) Describe how the type of charge on a charged metal rod can be determined

(c) The fig. Shows hollow negatively charged sphere with a metal disk attached to an insulator placed inside. State what would happen to the leaf of an uncharged electroscope if the metal disk were brought near the cap of the electroscope. Give a reason for your answer.

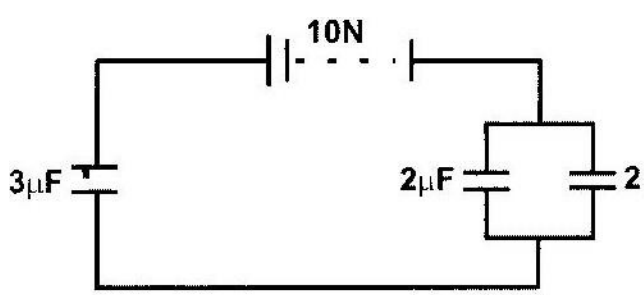


(d) State two ways of charging the magnitude of the deflection of the leaf of an electroscope.

(e) The fig- shows an arrangement of capacitors connected to a 10V d.c supply. Determine:

(i) The charge stored in the 2μ F capacitor.

(ii) The total capacitance of the arrangement.



9. Explain why the leaf of an uncharged object is brought near the cap.

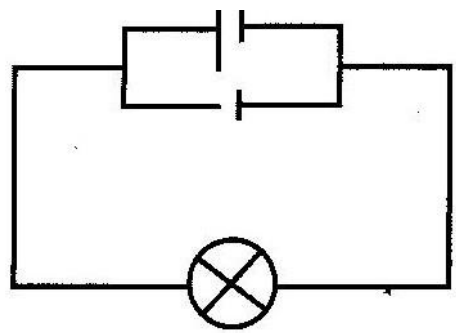
10. A glass rod can be charged positively by rubbing it with silk. Explain what happens when the glass rod is being charged.

TOPIC 9

CELLS AND SIMPLE CIRCUITS

<u>PAST KCSE QUESTIONS ON THE TOPIC</u>

1. A student learnt that a battery of eight dry cells each 1.5V has a total e.m.f of 12V the same as a car battery. He connected in series eight new dry batteries to his car but found that they could not start the engine. Give a reason for this observation
2. Distinguish between a primary cell and a secondary cell.
3. What current will a 500Ω resistor connected to a source of 240V draw?
4. A current of 0.08A passes in a circuit for 2.5 minutes. How much charge passes through a point in the circuit?
5. In large circuits, large resistors in parallel are preferred to low resistors in series. Explain.
6. State two advantages of an alkaline battery over a lead acid battery.
7. A current of 0.5A flows in a circuit. Determine the quantity of charge that crosses a point in 4 minutes.
8. Explain why the bulb in figure 10 (b) will be brighter than each of the bulbs in figure 10 (a). (2 marks)
9. Give the reason why the cells in figure 10 (b) Can be used for a longer period than the cells in Fig 10 (a)
10. State the purpose of manganese dioxide in a dry cell. (1 mark)



11. A student wishes to investigate the relationship between current and voltage for a certain device X. In the space provided, draw a circuit diagram including two cells, rheostat, ammeter, voltmeter and the device X that would be suitable in obtaining the desired results. (1 mark)

12. State one advantage of an alkaline cell over a lead acid cell

(1 mark)

13. In the circuit diagram shown in figure 7, the ammeter has negligible resistance. When the switch S is closed, the ammeter reads 0.13A. (3 marks)

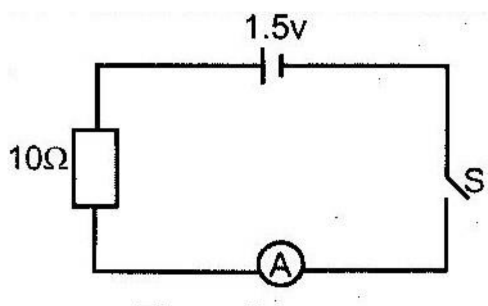


Figure 7

(a) State Ohm's law

(b) The graph in figure 9 shows the current voltage characteristics of a device, X

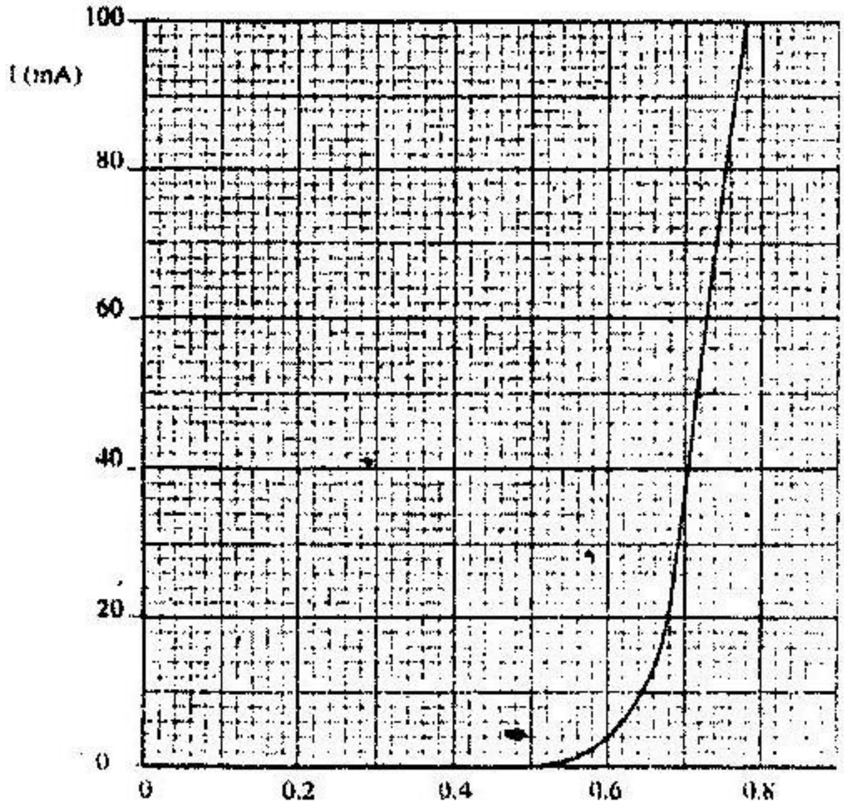
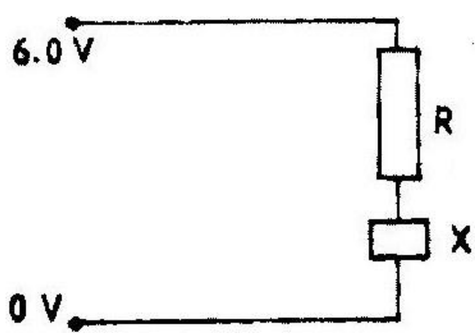


Figure 9

(i) State with a reason whether the device obeys Ohm's laws (2 marks)

(ii) Determine the resistance of the device X when the current through it is 60mA.

(iii) When the device X is connected in the circuit below, the voltage across it is 0.70V.



Calculate the value of the resistance R.

(c) The cell in figure 10 has an emf of 2.1V and negligible internal resistance.

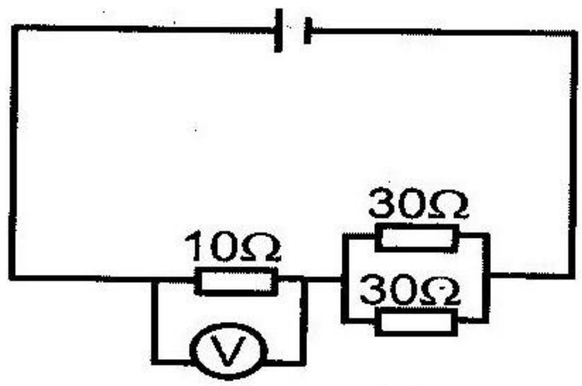


Figure 10

Determine the

(i) Total resistance in the circuit (2 marks)

(ii) Current in the circuit (1 mark)

(iii) Reading on the voltmeter (2 marks)

14. Explain clearly the precautionary measures you would take to maintain the efficiency of an accumulator?

15. State the advantage of Nickel-cadmium battery over the lead -acid type

16. Draw a well labeled diagram of a dry cell

17. When ammeter is connected between the two plates of a simple cell, the pointer deflects along the scale. Explain

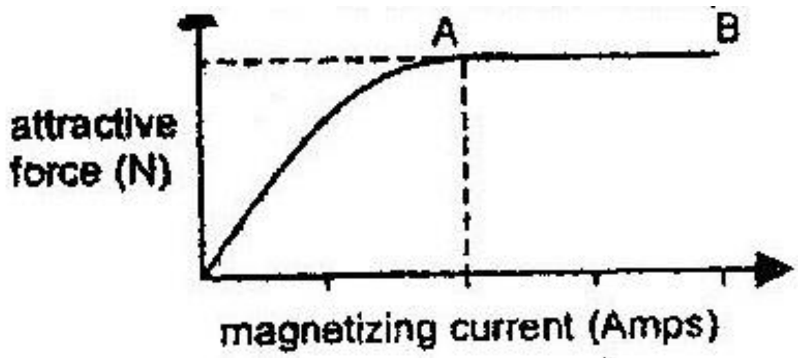
FORM 2 WORK

TOPIC 1

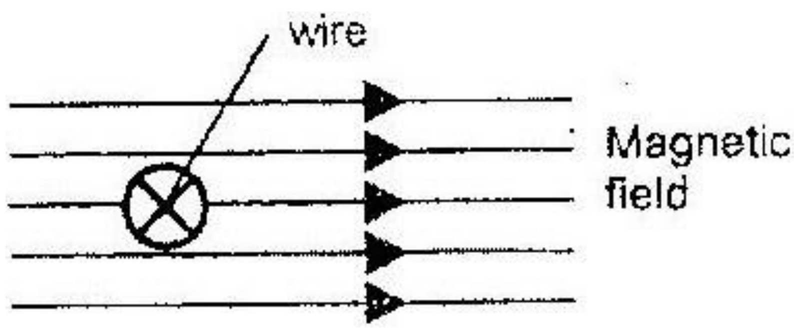
MAGNETISM AND ELECTROMAGNETISM

PAST KCSE QUESTIONS ON THE TOPIC

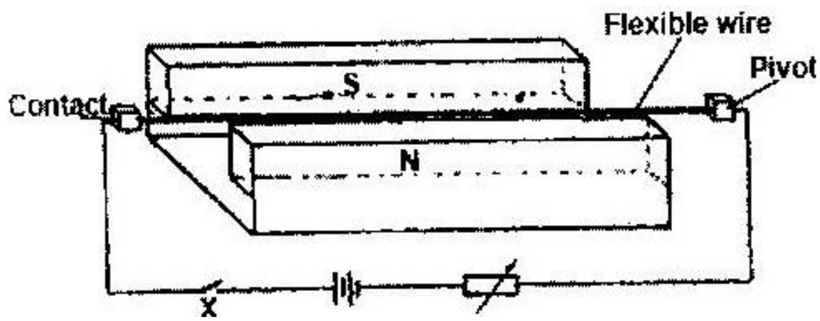
1. The graph in the figure shows the relationship between the attractive forces of an electromagnetic and the magnetizing current. Give reasons for the shape of the curve in terms of the domain theory.



2. The figure shows a wire in a magnetic field. A current is switched on to flow through the wire in the direction shown. State the direction of motion of the wire.



3. The diagram in the figure below shows a flexible wire in a magnetic field.



(i) Explain the behaviour of the wire when the switch K is turned on

(ii) What is the behaviour of the wire if R is reduced?

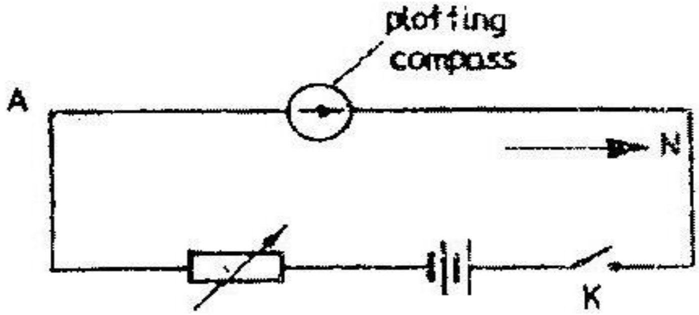
4. You are provided with two iron bars, X and Y, one is magnetized and the other is not. Explain how you would identify the magnetized bar without using a magnet.

5. One way of demagnetizing bar is to place it in a solenoid in which an alternating current (ac) flows. How is the demagnetization achieved?

6. Give two reasons why soft irons is used as a core of the coil of an electric bell.

7. Give two differences between uniform and non-uniform magnetic fields

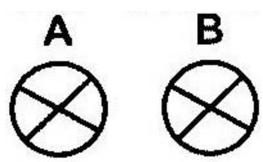
8. Figure 5 represents a long horizontal insulated wire AB connected to an electric circuit. A plotting compass is placed on the wire as shown. When the switch K is closed, the plotting compass shows a deflection. State two changes which can be made in the circuit to increase the deflection.



9. State three factors which determine the magnitude of the force on a current carrying conductor which is in a magnetic field.

10. Give a reason why attraction in magnetism is not regarded as a reliable method of testing

11. The figure below shows two parallel current- carrying conductors A and B placed close to each other. The direction of the current is into the plane of the paper. Copy the diagram and on the same figure;



(i) Sketch the magnetic field pattern

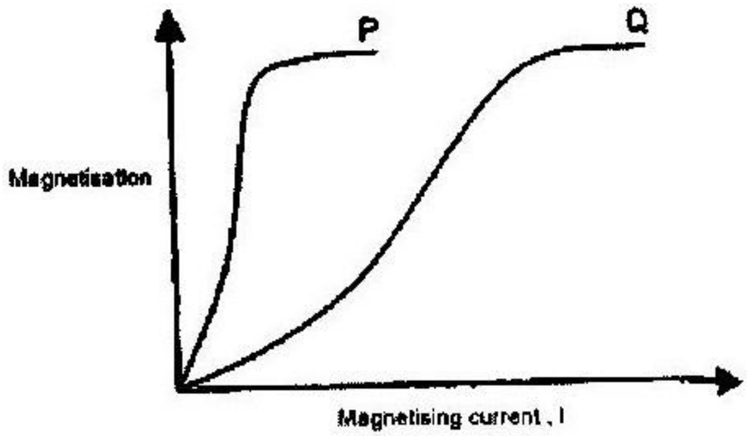
(ii) indicate the force F due to the current on each conductor

12. (a) Given a bar magnet, an iron bar and a string.

(i) Describe a simple experience to distinguish between the magnet and the iron bar

(ii) State with reasons the observations that would be made in the experiment.

(b) In an experiment to magnetize two substances P and Q using electric currents, two curves (graphs) were obtained as shown. Using the information in figure 7 explain the differences between the substance P and Q with reference to the domain theory.

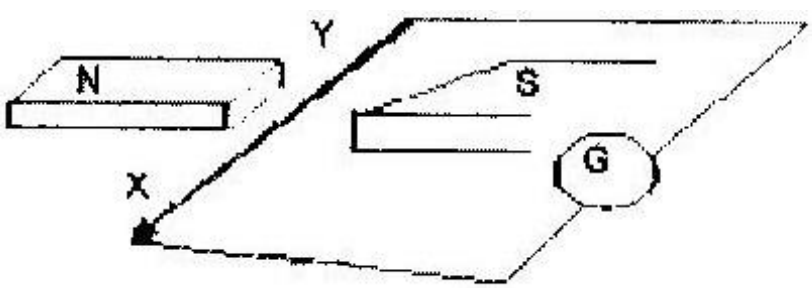


13. Distinguish between soft and hard magnetic material

14. Explain how hammering demagnetizes a magnet.

15. How can it be shown that the strength of a magnet is concentrated at the poles

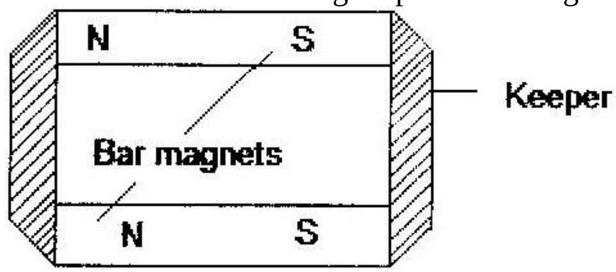
16. Figure 11 shows a wire XY at right angles to a magnetic field. XY is part of a circuit containing a galvanometer. When XY is moved, the current flows in the direction shown. State the direction in which XY is moved.



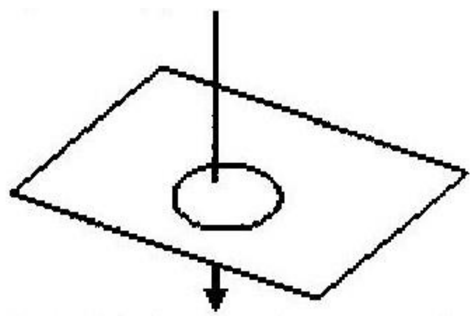
17. Fig 12 shows how magnets are stored in pairs with keepers at the end.

Explain how this method of storing helps in retaining magnetism longer.

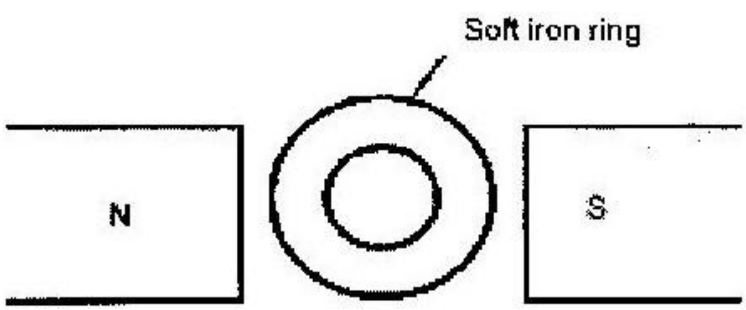
(2 marks)



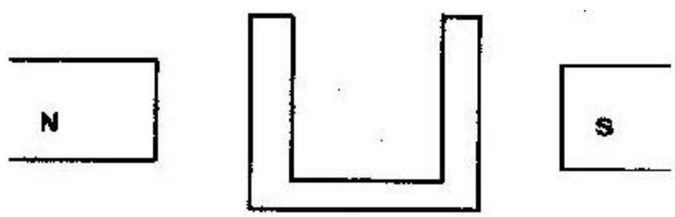
18. In figure 13 the arrow indicates the direction of the current in the conductor. Sketch on the diagram the magnetic field pattern (1)



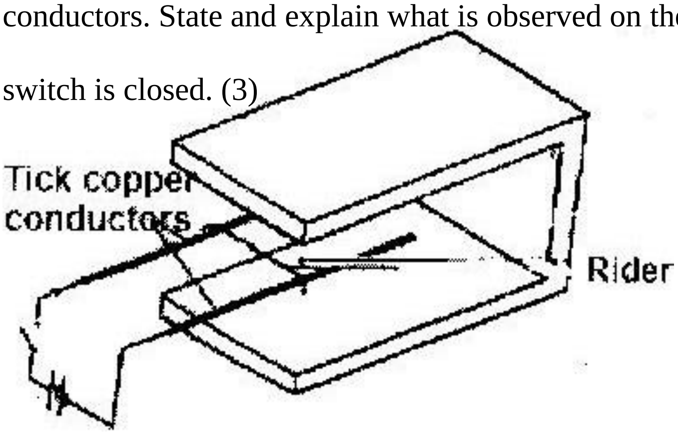
19. Fig 14 shows a soft iron ring placed between the poles of magnet. Copy the diagram and sketch the magnetic field pattern. (1)



20. Fig 16 shows a soft iron core placed between poles of two magnets. Copy the diagram and sketch the magnetic field pattern. (1)



21. The figure below shows two parallel thick copper conductors connected to a d.c power supply. A rider made from a thin copper wire is placed on the conductors. State and explain what is observed on the rider when the switch is closed. (3)



22. Figure 7 shows the poles of two magnets close together.

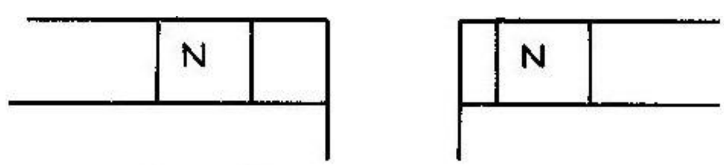


Figure 7

Sketch the magnetic field pattern in the space between the poles.

(2 marks)

23. Figure 2 shows a horse- Shoe magnet whose poles are labeled and two other magnets near it. Iron nails are attracted to the lower ends of the magnets as shown.

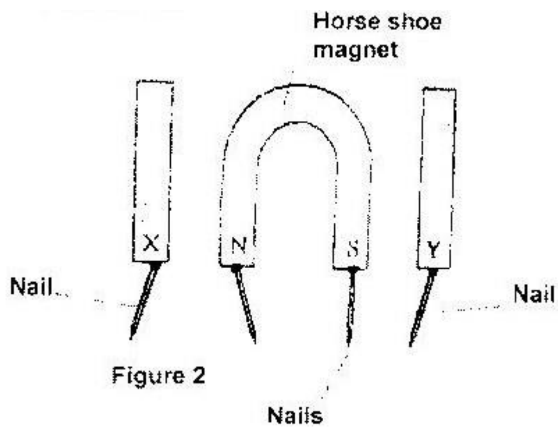
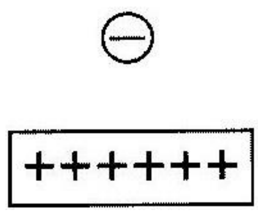


Figure 2

Identify the poles marked X and Y. (2 marks)

24. Sketch the electrostatic field pattern due to the arrangement of the charges shown in fig 6 (1 mark)



25. Fig 7 shows the features of a dry cell (Leclanche) use the information in the figure to answer question 2A and 2B.

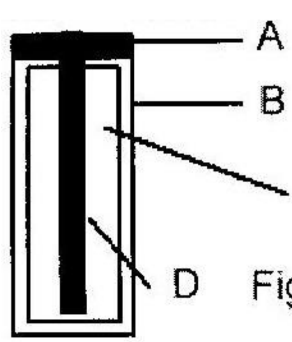
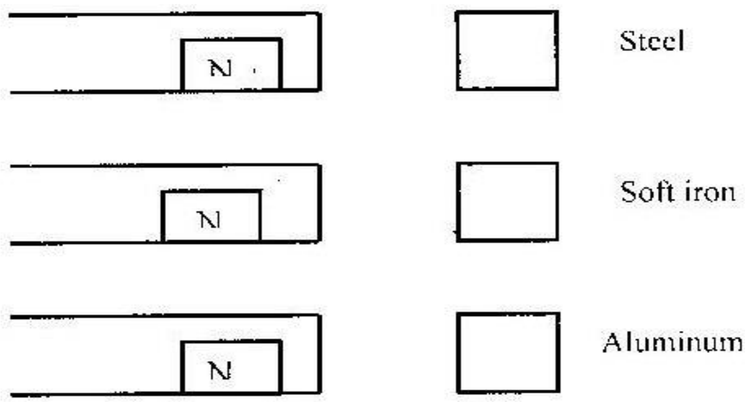


Figure 7

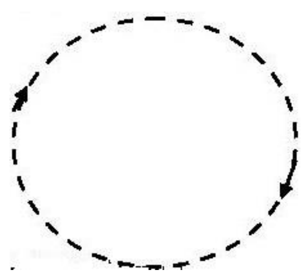
(a) Name parts A, B, C, D

(b) Explain the purpose of B

26. Three magnets were brought near 3 pieces of material steel, soft from iron and aluminum as shown in figure 7. Indicate the magnetic field in each diagram.



27. The figure shows the circular path followed by an electric beam in a magnetic field.

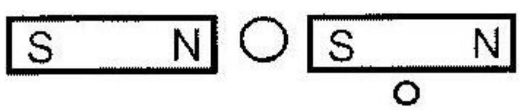


(a) A force acts on the electrons as they follow this circular path. Show on the diagram the direction of that force.

(b) Draw on the diagram the direction of the magnetic field responsible for the deflection of the electrons.

28. Draw the magnetic field pattern in the diagram below and indicate the direction of the forces acting on the conductors.

29. The force of a conductor carrying a current in a magnetic field can be varied by changing among others, the magnitude of the current and the magnetic field strength. Name two other factors that can be changed to vary the force.
30. The figure below shows a soft iron ring placed between poles of two magnets.



Sketch the magnetic field pattern

31. Four bars of metal A, B, C and D are tested for magnetism. B attracts both A and C but not D. D does not attract A, B or C

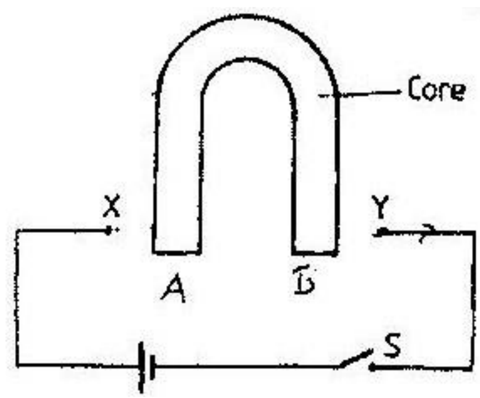
A and C sometime attract one another and sometimes repel one another. What conclusion can you draw about?

(a) Bar A

(b) Bar B

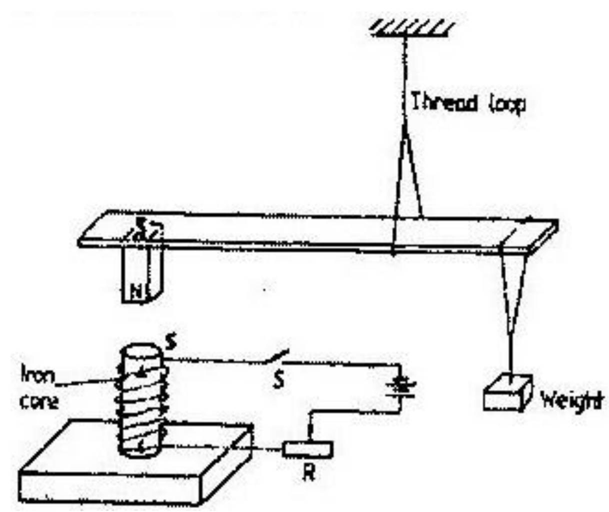
(c) Bar D

32. Figure 8 beside shows an incomplete circuit of an electromagnet. Complete the circuit between X and Y by drawing the windings on the two arms of the core such that A and B are both North poles when the switch S is closed. Indicate the direction of the current on the windings drawn.



33. (a) State TWO factors that affect the strength of an electromagnet.

(b) In the set up in figure 9, the suspended meter rule is in equilibrium balanced by the magnet and the weight shown. The iron core is fixed to the bench.



(i) State and explain the effect on the meter rule when the switch S is closed

(ii) What would be the effect of reversing the battery terminals

(iii) Suggest how the set up can be adapted to measure the current flowing in the circuit.

34. (a) In an experiment to determine the strength of an electromagnet, the weight of pins that can be supported by the electromagnet, was recorded against the number of turns. The current was kept constant throughout the experiment. The table shows the data obtained.

Number of turn, n	0	4	8	12	16	20	24	28	32	36
Weight, W, of pins x 10^{-3} (N)	0	4	14	30	58	108	198	264	296	300

(i) Plot a graph of weight, W, y- axis against the number of turns, n

(ii) Use the domain theory to explain the nature of the curve.

(iii) Sketch on the same axes, the curve that would be obtained using a higher current.

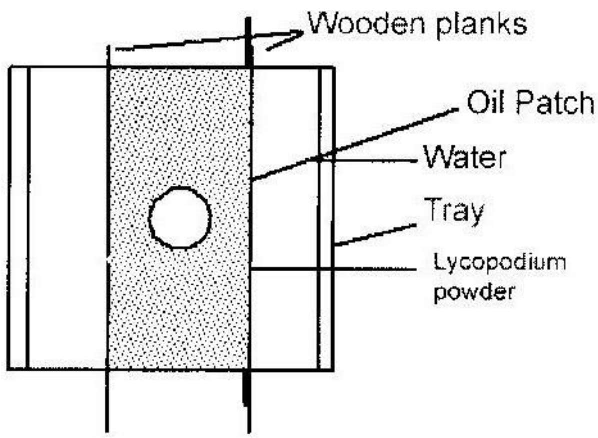
(b) Using a labeled diagram, explain the working of a simple relay.

TOPIC 2

MEASUREMENTS II

<u>PAST KCSE QUESTIONS ON THE TOPIC</u>

1. describe one method of determining the diameter of the oil drop? (3 mks)
2. Explain the cause of random motion of smoke particles as observed in Brownian motion experiment using smoke cell.
3. Fig. 3 shows part of an experimental set up of estimating the diameter of an oil molecule.



(i) Describe how the oil patch is formed. (2 marks)

(ii) In an experiment, the diameter, a, of the patch was measured to be 200mm for an oil drop of radius 0.25mm. Determine the diameter of the molecule of the oil. (4 marks)

(iii) State why this is an estimate (1 mark)

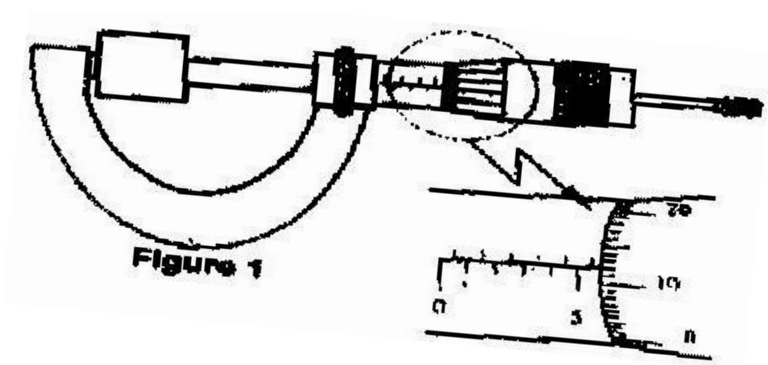
4. An oil drop of average diameter 0.7mm spreading out into a roughly circular patch of diameter 75mm on the surface of water in a trough.

(i) Calculate the average diameter of a molecule of oil.

(ii) State two assumptions to be made in (i) above when calculating the diameter.

5. The Screw of micrometer screw gauge has a pitch of 0.5mm. The thimble is divided into 50 equal divisions. What is the smallest unit it can measure?

Figure 1 shows a metal cube of mass 1.75g placed between the jaws of a micrometer screw gauge. The magnified portion of the scale is also shown. The reading on the gauge when the jaws were fully closed without the cube was 0.012cm. Use this information and the figure to answer questions 6 and 7.

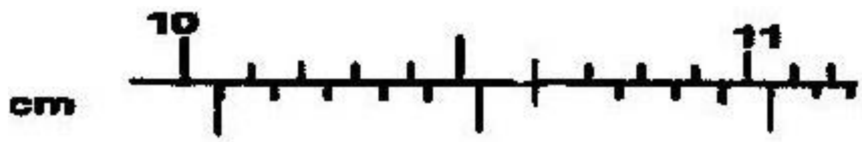


6. What is the length of the cube?

7. Determine the density of the metal cube giving your answer correct to three significant figures.

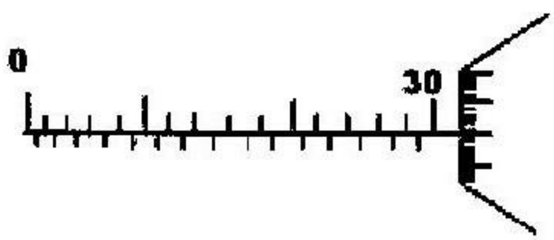
8. In an oil drop experiment the diameter of the oil was found to be 0.4mm and the drop was placed on a clean water surface. It spread into a circular parch of diameter 180mm. Estimate the size of the oil molecule.

9. Name an instrument that would use for measuring the depth if a blind hole nearly 900mm deep.
10. Suggest a suitable instrument that can be used for measuring the width of an object stated as 2.6×10^{-1}cm.
11. What is the reading indicated by the scale of the vernier caliper below?



12. Name the instrument that would be most suitable for measuring the thickness of one sheet of paper.
13. The micrometer screw gauge shown has a thimble scale of 50 divisions

    What is the reading shown?



14. In an experiment to estimate the radius of oil molecule 200 identical drops of oil of density 800kg/m^3 are run from a burette. The reading on the burette changes from 0.0cm^3 to 0.5cm^3.

    One of these drops is placed on a large water surface dusted lightly using chalk dust. It spreads forming a uniform patch of area 0.2m^2.

    What is the purpose of the chalk dust?

What is the mass of one drop of oil in kg?

What is the volume of one oil drop in m^3?

What is the thickness of the oil film?

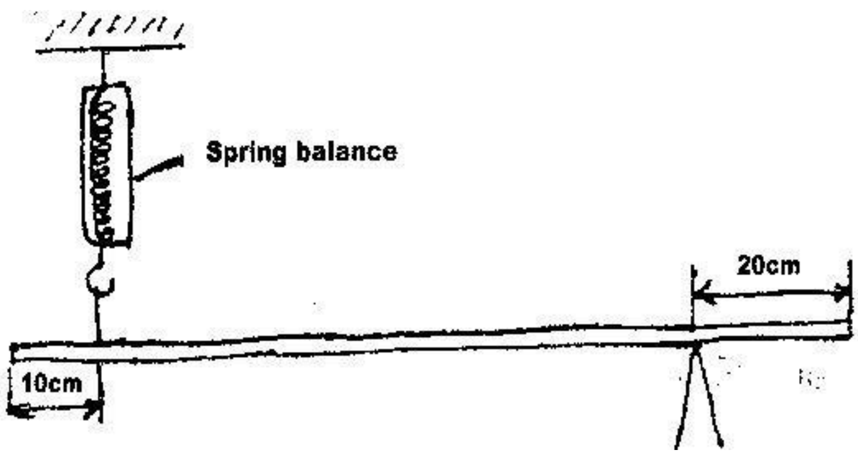
Estimate the assumption (s) made in this experiment

TOPIC 3

TURNING EFFECT OF A FORCE

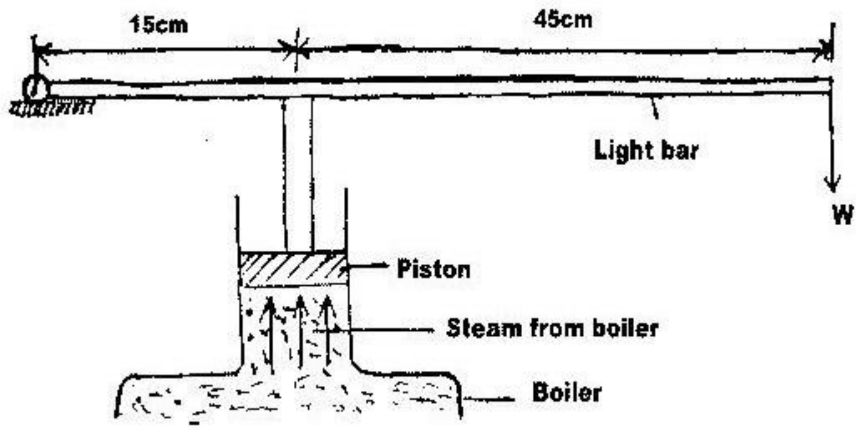
PAST KCSE QUESTIONS FROM THE TOPIC

1. The figure below shows a uniform bar of length 1 m pivoted near one end. The bar is kept in equilibrium by a spring balance as shown.



Given that the reading of the spring balance is 0.6N. Determine the weight of the bar.

2. The figure shows a device for closing a steam outlet.



The area of the piston is 4.0×10^{-4} m^2 and the pressure of the steam in the boiler is $2.0 \times 10^5 Nm^{-2}$. Determine the weight W that just holds the bar in the horizontal position shown.

3. The figure below shows force F1 and F2 acting on a metre rule such that it is in equilibrium.

Mark on the figure a third force F3 acting on the rule such that the equilibrium is maintained.

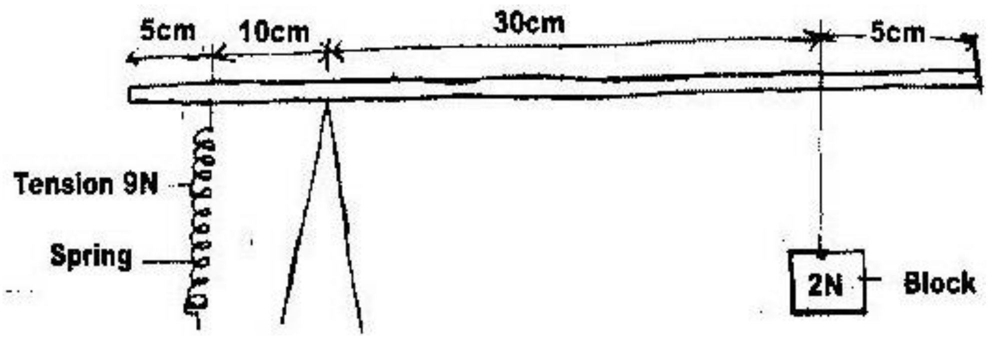
4. (a) State the principle of moments.

   (b) Two men P and Q carried a uniform ladder 3.6 m long weighing 1200N. P held the ladder from one end while Q supported the ladder at a point 0.4m from the other end.

      (i) Sketch a diagram showing the forces acting on the ladder.

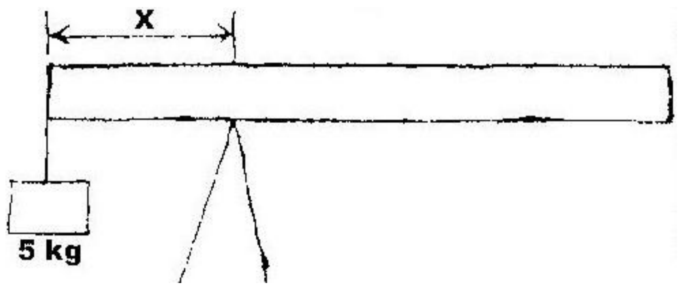
      (ii) Calculate the load supported by each man.

5. The figure shows a uniform half metre rod that is balanced over a pivot using a block of weight 2N and a spring.



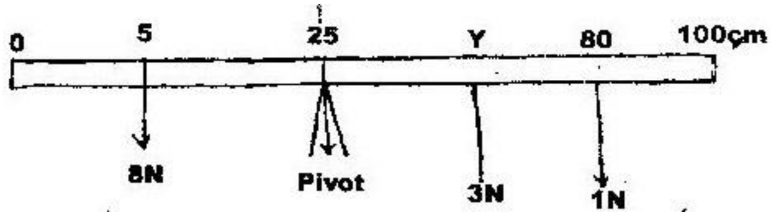
Given that the tension in the spring is 9N, determine the weight of the rod.

6. The diagram below shows a uniform bar of lengths 6m. If the weight of the bar is 15N, determine x.



7. State the principle of moments
8. Name four activities which produce a turning effect
9. Why is it very difficult to open a door from a point too close to hinges
10. Why are people who are maimed or have lost one leg provided with crutches?
11. A uniform half- metre rod is balanced by a weight of 38N at one end. If the pivot is placed 10cm from the same end, calculate the weight of the rod.
12. Two forces of 10N and 20N when applied at ends A and B respectively are just able to lift a non- uniform rod of lengths 2m.

    (a) What is the weight of the rod?
    (b) Determine the position of the centre of gravity of the rod
13. Determine the value of Y in the diagram below

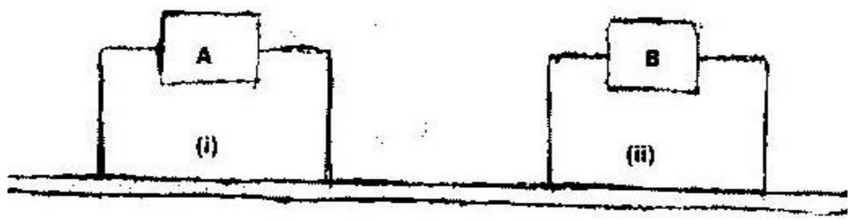

0
5
25
Y
80
100cm
8N
Pivot
3N
1N

TOPIC 4

EQUILIBRIUM AND CENTRE OF GRAVITY

PAST KCSE QUESTIONS ON THE TOPIC

1. The figure shows two identical trolleys with loads A and B. The loads are identical in shape and size.



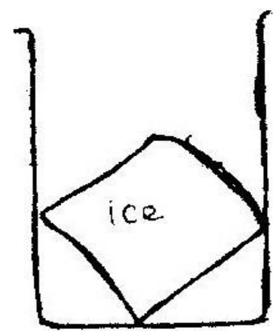
Given that the density of A is greater than that of B, explain why the trolley in (ii) is more stable.

2. Figure 2 shows a solid cylinder standing on a horizontal surface. The cylinder is in stable equilibrium.

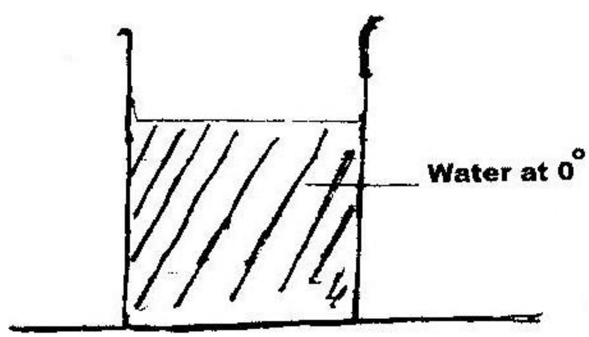
In the horizontal space provided, sketch the cylinders in neutral equilibrium

3. State two factors that determine the stability of a vehicle
4. State the necessary conditions for equilibrium of body which is acted upon by a number of forces
5. State the modification introduced in the modern buses so as to enhance stability

6. The figure below show a beaker placed on a bench. A block of ice is placed in the beaker as shown. State and explain the changes in the stability of the beaker when the ice melts.



7. The figure below shows beaker containing water at 0^0. The beaker is placed on a bench.



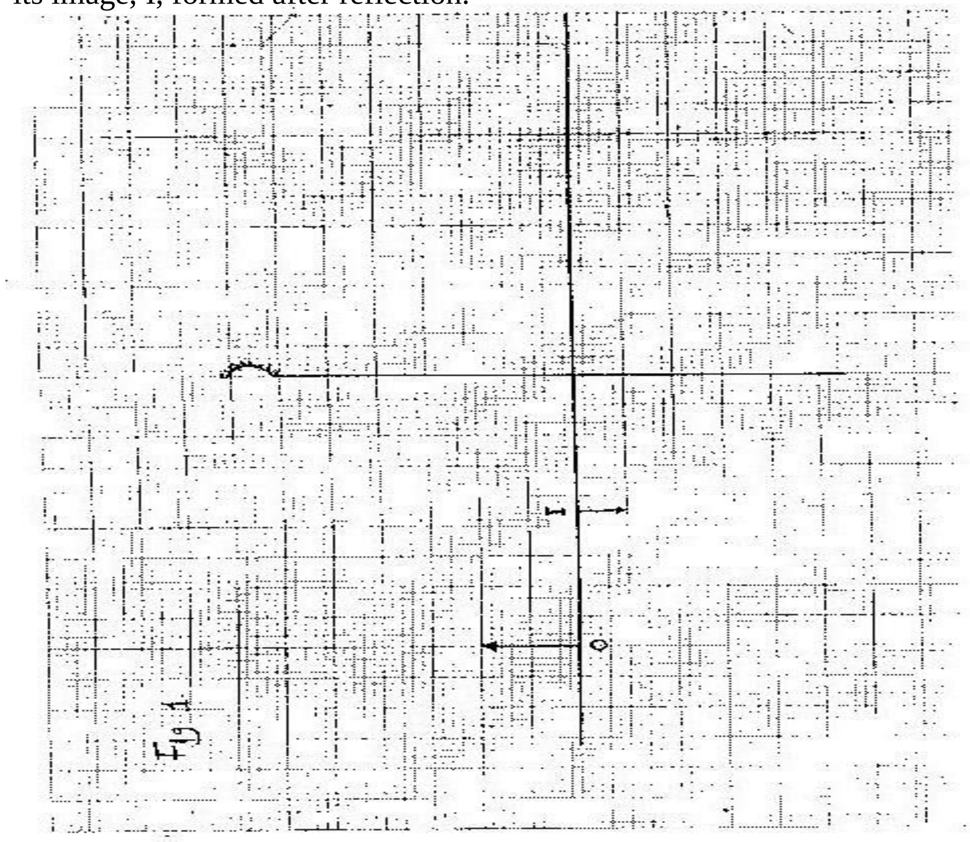
State and explain the changes in stability of beaker when water freezes

TOPIC 5

REFLECTION AT CURVED SURFACES

PAST KCSE QUESTIONS ON THE TOPIC

1. The figure (fig 1) on the grid shows an object O in front of a concave mirror and its image, I, formed after reflection.

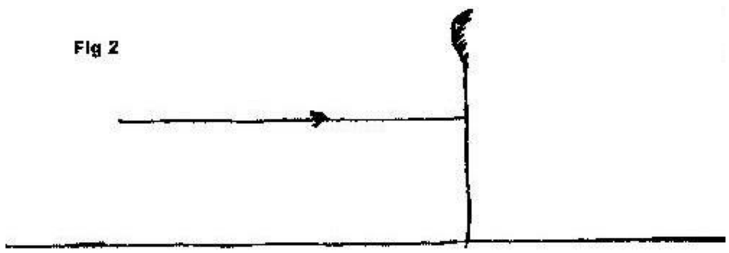


(a) On the same diagram draw appropriate ray(s) to locate the principal focus, F, of the mirror.

(b) Determine the focal length, f of the mirror, (scale 1.5)

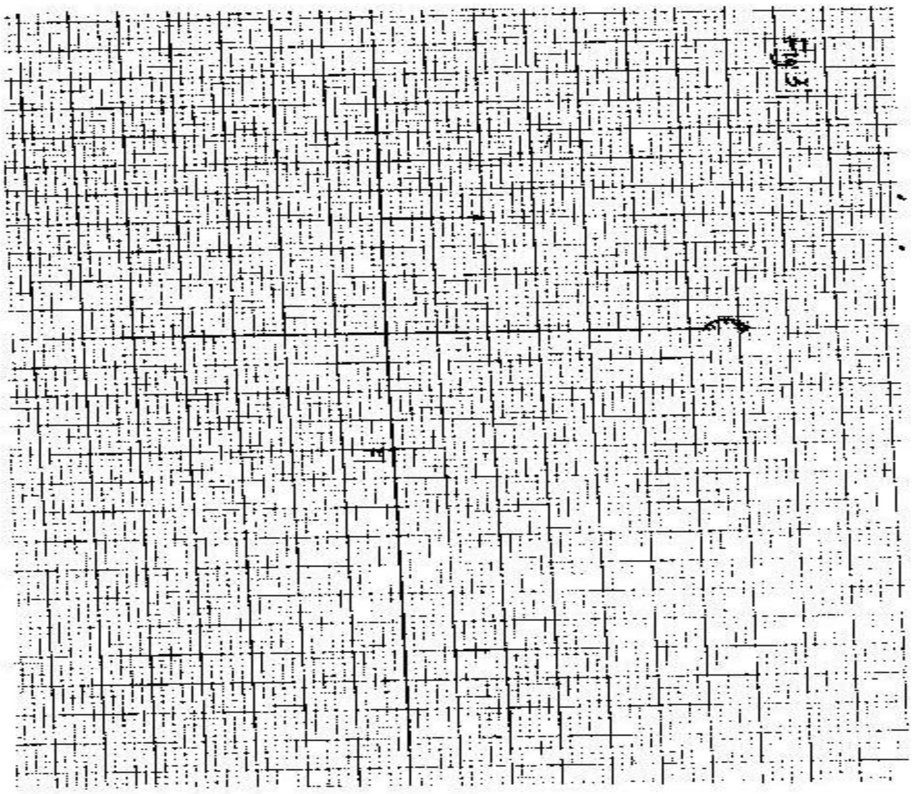
2. Fig 2 shows a ray of light incident on a convex mirror

Fig 2



Use a suitable construction on the same diagram: determine the radius of curative of the mirror.

3. Fig 3 shows a vertical object O, placed in front of a convex mirror.

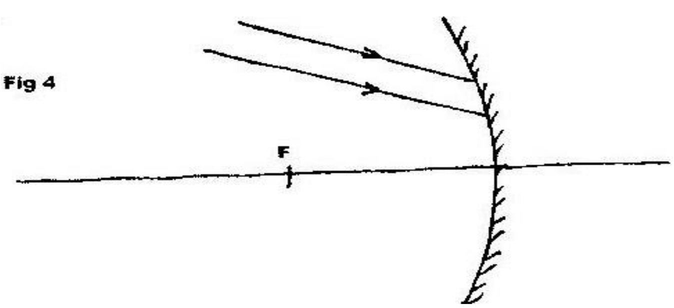


On the same diagram draw the appropriate rays and locate the image formed.

4. What is meant by a virtual image?

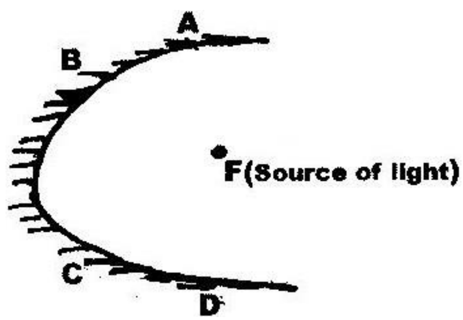
5. Fig 4 shows two parallel rays incident on a concave mirror. F is the focal point of the mirror.

Fig 4



On the same diagram sketch the path of the rays after striking the mirror

6. Fig 5 shows a parabolic surface with a source of light placed at its focal point F.



Draw rays to show reflection from the surface when rays from the source strike the surface at points ABC and D.

7. Fig 6 (a) and (b) shows a convex mirror and a plane mirror of equal aperture.

By sketching a pair of incident and reflected rays for each (a) and (b) shows how the convex mirror provides to the eye, a wide field of new than the plane mirror.

8. Distinguish between a real and a virtual image.
9. State ONE application of each of the following
    (i) Convex mirrors
    (ii) Parabolic mirrors

(iii) Concave mirrors

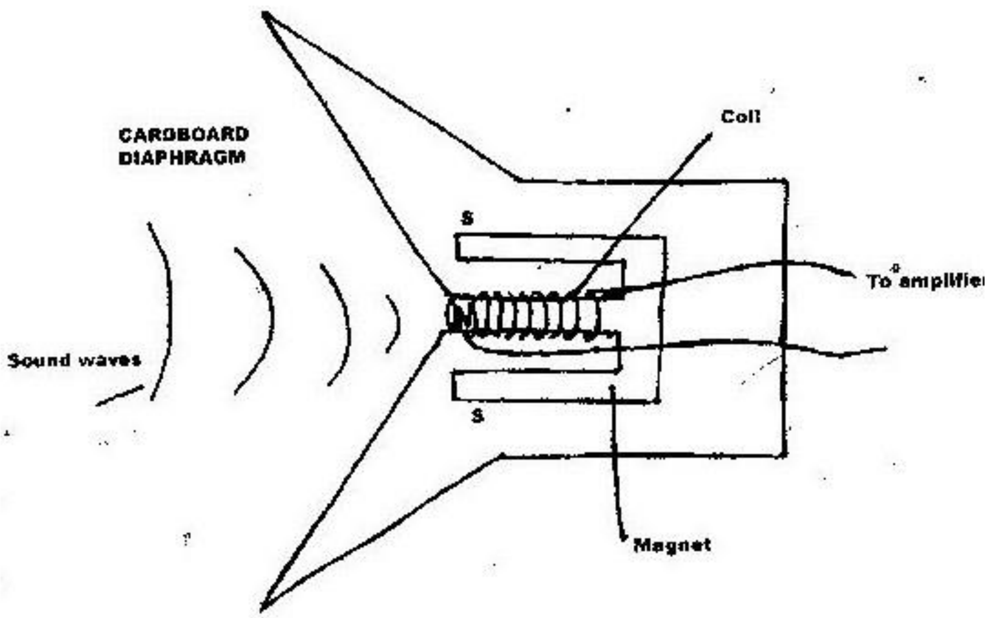
10. State the advantages a diverging mirror has over a plane mirror when used as a rear- view in vehicles.
11. State characteristics of an image observed in a concave mirror when the object is between the focal point and the mirror.
12. If a concave mirror has a focal length of 10cm. Find the two positions where an object can be placed to give in each case, an image twice the height of the object.

TOPIC 6

MAGNETIC EFFECT OF AN ELECTRIC CURRENT

PAST KCSE QUESTIONS ON THE TOPIC

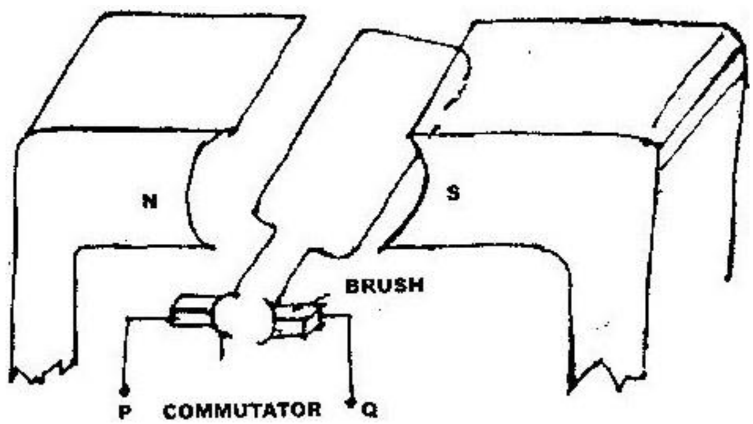
1. Fig 4 shows a simple microphone in which sound waves from the person talking causes the cardboard diaphragm to vibrate.



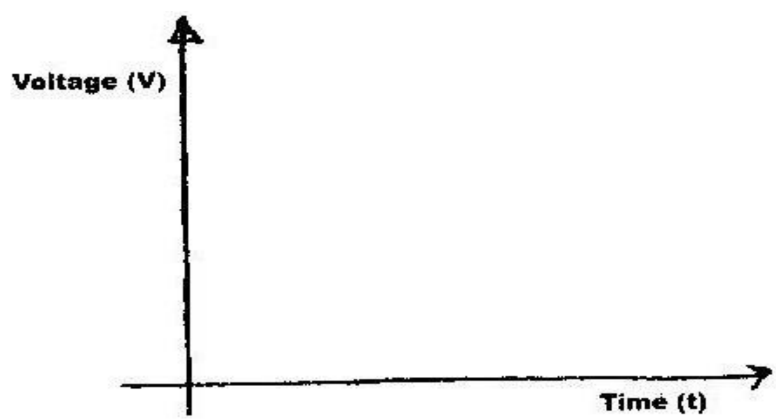
(a) Explain how a varying current is induced in the coil when the diaphragm vibrates

(b) State two ways in which the induced current in (a) above can be increased

2. Fig 5 shows an electric generator. The points P and Q are connected to a Cathode Ray Oscilloscope (CRO).



Sketch on the axes provided the graph of the voltage output as seen on the CRO, given that when t= 0, the coil is at the position shown in the figure.



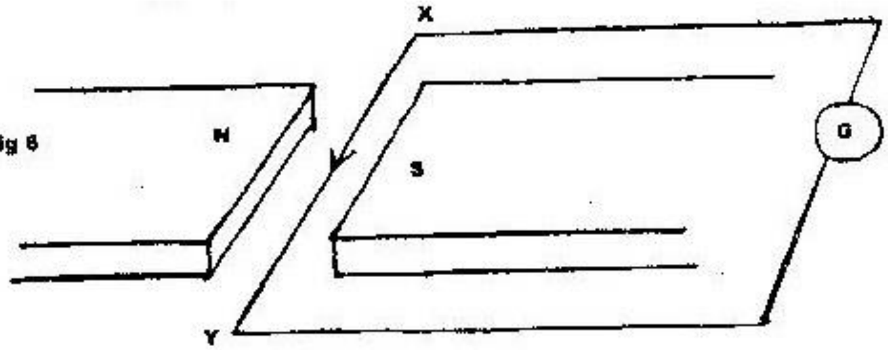
3. An armature composed of turns of insulated copper wire wound on a laminated soft- iron core is rotated in a magnetic field to generate an e.m.f. Use this information to answer the following questions.

   (a) State two factors other than the speed of rotation that affect the magnitude of the e.m.f generated.

   (b) State the reason why soft- iron is laminated.

4. Fig 6 shows a wire XY at right angle to a magnetic field. XY is part of a circuit containing a galvanometer.

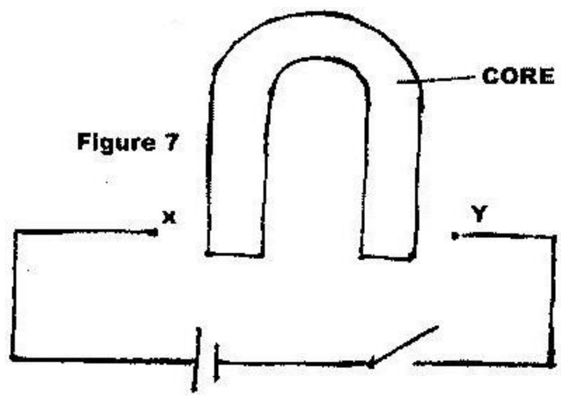
Fig 6



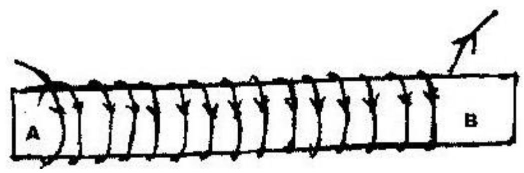
When XY is moved, the current flows in the direction shown. State the direction in which XY is moved.

5. Fig 7 shows an incomplete circuit of an electromagnet. Complete the circuit between X and Y by drawing the windings on the two arms of the core such that A and B are both North poles when switch S is closed. Indicate the direction of the current on the windings drawn.

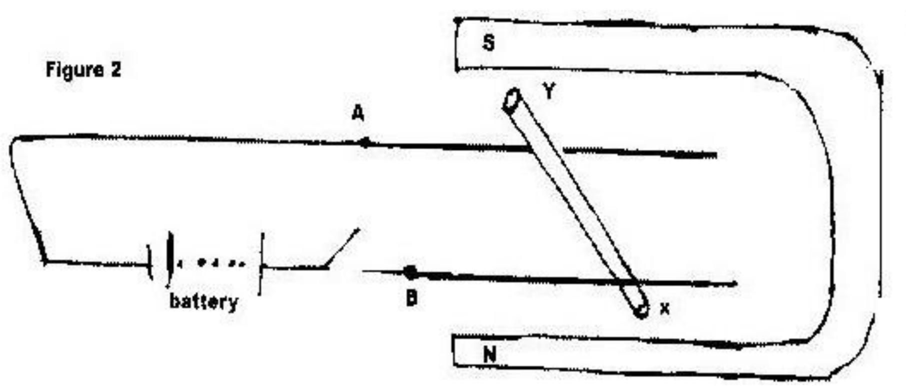
Figure 7



6. State, with reasons, the material which you would consider most suitable for an electromagnet.
7. Explain two ways of demagnetizing a magnet.
8. State two ways of increasing the strength of an electromagnet.
9. An iron rod XY is placed inside a coil of wire. What type of magnetic pole is induced at the end x when the current flows through the coil?



10. An un insulated copper wire XY lies over the fixed wire A and B connected to a battery when the key in the circuit is closed, the wire XY experiences a force.



(i) In which direction does the wire XY- experience the force?

(ii) How do you determine the direction in (i) above

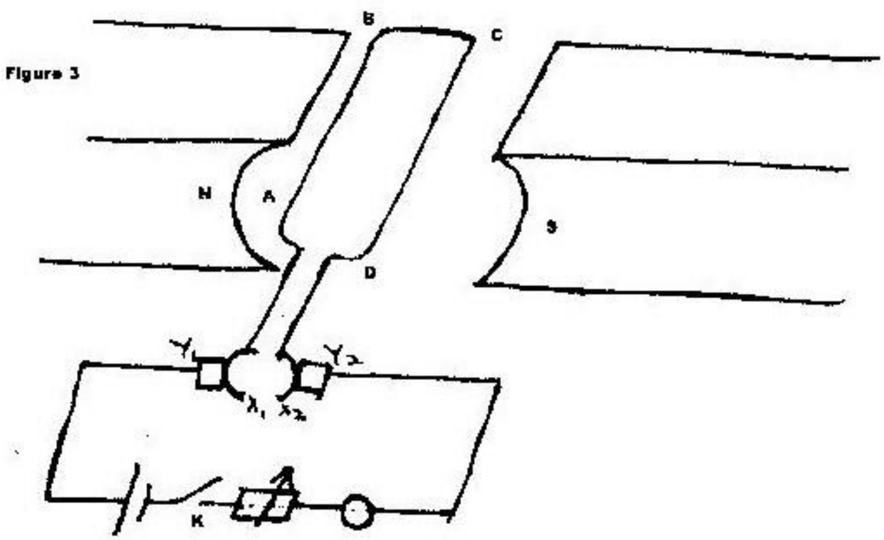
(iii) When is the force on the wire XY greatest?

(iv) What is the effect of reversing both the magnetic field and direction of flow of current?

(v) State TWO factors by which the force on XY can be decreased

(vi) Name an instrument which uses this effect

11. Fig 3 shows a D.C electric motor.



(a) Name the parts labeled X_1 and X_2 and state their functions.

(b) What is the purpose of parts labeled Y_1 and Y_2?

(c) When the switch k is closed state the forces acting on the sides of the coil and the direction of movement of the coil

(d) What can be done to increase the speed of rotation of the motor?

12. State FOUR reasons why the efficiency of an electric motor is always less than 100%

13. Give TWO practical applications of an electromagnet

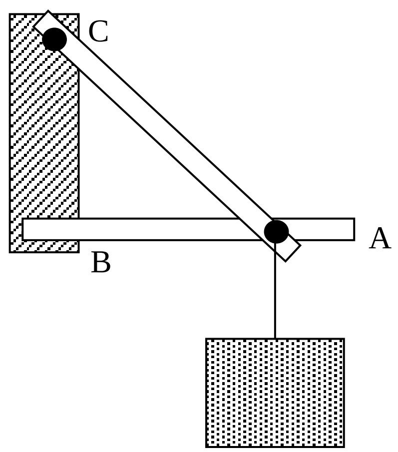
TOPIC 7

HOOKES LAW

PAST KCSE QUESTIONS ON THE TOPIC

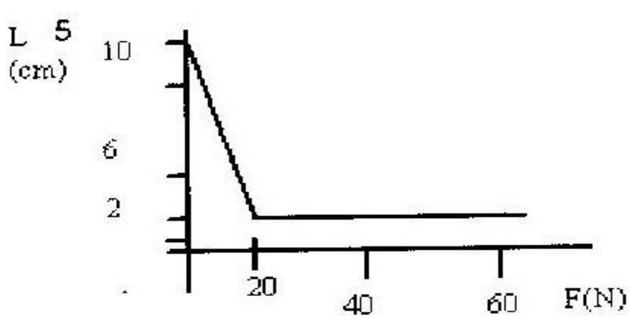
1. 1990: Distinguish between ductile end and brittle material

2. 1990: Identify the girders in the structure that can be replaced by a string



3. It is easier to bend an iron rod than a glass rod of the same dimensions at room temperature. Give a reason for this

4. (a) An experiment was performed to find out how the length L of a spiral spring varies with the compression force, F The figure shows the variation.

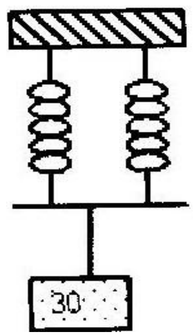


(i) Draw a diagram of a possible set up of the apparatus

(ii) Over which range of the force does the spring obey Hooker's law?

(iii) Suggest a reason for the shape of the graph between 40N and 60N

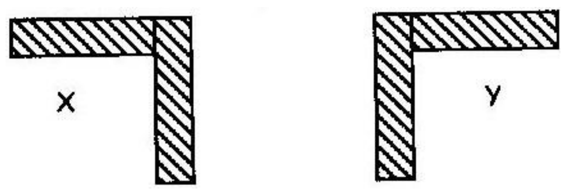
(b) Two identical springs of spring constant 3N/cm are used to support a load of 30N as shown. Determine the extension of each spring.



(c) State two factors that govern the strengths of a spiral of given material

5. 1994: (a) State Hooke's Law)

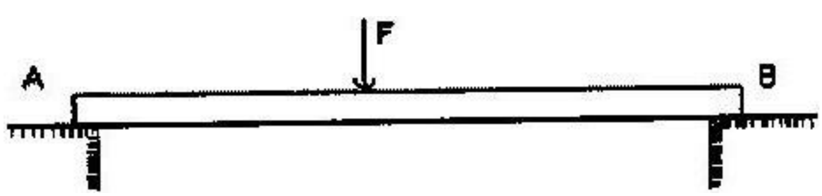
(b) Long uniform beams are to be supported near their ends by two supports X and Y, Which are fixed to the ground and at the same level. When beam A is placed on the supports, it sags in the middle but when it is turned through an angle of 90^0 the sag is the same.



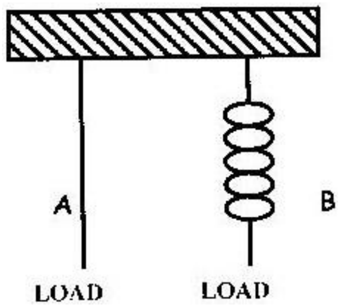
(i) Suggest the possible shapes of the beams A and B.

(ii) Beam C is of the same shape as beam B but has a notch in the middle. How should it be placed on the supports so that the notch does not extend? Give a reason for your answer.

6. The fig shows a beam AB supported at points A and B. A large force is applied on the beam as shown. Mark on the diagram the position X where the notch is likely to appear.



7. The figure shows a wire A and a spring B made of the same material. The thickness of the wire is the same in both cases. Masses are added on each of the same intervals and the extension noted each time.



Sketch the graph of extension against load for each. (Hooks Law is obeyed.)

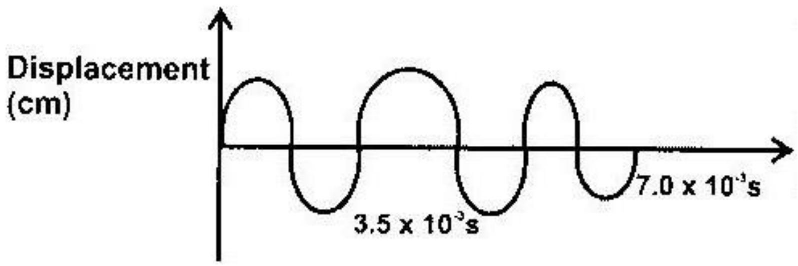
8. State Hooke's Law
9. A spiral spring stretches by 0.6 cm when a mass of 300g is suspended on it. What is the spring constant?

TOPIC 8

WAVES 1

<u>PAST KCSE QUESTIONS ON THE TOPIC</u>

1. Fig 1 shows the displacement – time graph for a certain wave



   Determine the frequency of the wave?

2. State one effect that would be observed when water waves pass from deep to shallow water.

3. A source generates 40 waves in a second. If the wavelength is 8.5 cm. Calculate the time taken to reach a wall 102m from the source.

4. Name a property of light that shows it is a transverse wave.

5. State ONE difference between mechanical and electromagnet waves.

6. Explain the following terms and state their S.I units

   (i) Wavelength

   (ii) Amplitude

   (iii) Periodic time

   (iv) Frequency

7. State THREE differences between light waves and sound waves.

8. (a) Name two types of progressive wave motion

(b) Distinguish between the waves stated in 3 (a) above

9. (a) Fig 1 shows a displacement – time graph of a wave. The velocity of the wave is 50cm/s.

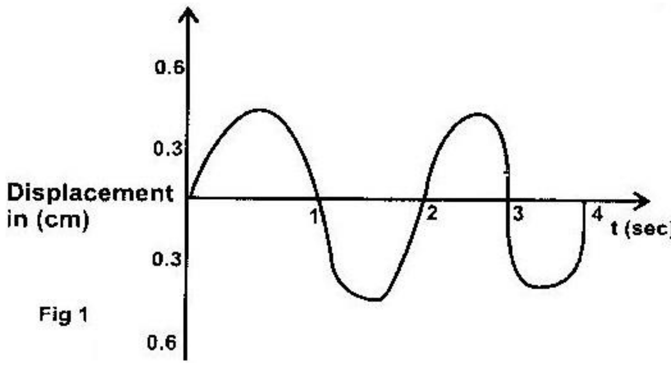


Fig 1

Determine the

(i) Amplitude

(ii) Period

(iii) Wavelength

(iv) Frequency

(b) State ONE factor that does not change as water moves from shallow to deep part.

10. Give an example which show that speed of a wave depends on the medium in which it travels.

11. Give an example to demonstrate that waves carry energy

12. Best FM station broadcasts on a frequency of 250 KHz and the wavelength of its signals is 1200m.

(i) The speed of radio waves in m/s

(ii) The wavelength of the signal of another station that broadcasts on a frequency of 200KHZ.

TOPIC 9

SOUND

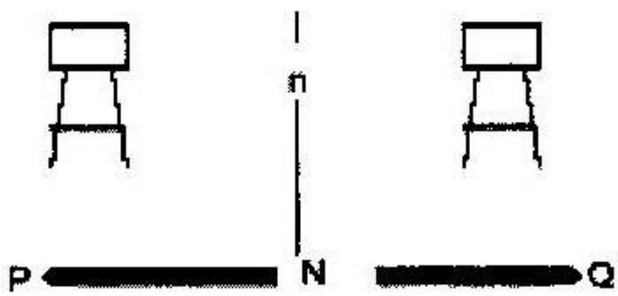
PAST KCSE QUESTIONS ON THE TOPIC

1. State the type of wave produced when a stretched string plucked

2. When a sound wave travels from a dense to a less dense gas, its velocity changes. What wave property does this observation show?

3. Standing waves are set up in a rope resulting in a series of nodes and antinodes. In what state of motion is the rope at the nodes?

4. Two identical sources of sound S_1 and S_2 are emitting the same frequency. Explain with reasons, the observations that will be made by an observe listening to the sound emitted who was moving slowly along the lines, PQ and MN



5. The table shows the frequency – squared f of the fundamental note produced by a stretched string for various tensions, T

T(N)	8	18	32	50	72	98
F2 (Hz2)	14,500	32,500	57,500	90,000	129,500	176,500

(i) Plot a graph of f2 against the tension T.

(ii) Determine the gradient of the graph and hence obtain an equation relating the frequency f and the tension T.

6. A gun is fired and an echo heard at the same place 0.5s later. How far is the barrier, which reflected the sound from the gun? (Speed of sound 330m/s).
7. State two ways by which frequency of a note produced by a given guitar wire may be increased.
8. An observer watching a fireworks displays sees the light from an explosion and hears the sound 2 seconds later. How far was the explosion from the observer? (Speed of sound is air 340m/s)
9. (a)
   (i) What is the differences between longitudinal and transverse waves?
   (ii) A mineworker stands between two vertical cliffs 400m from the nearest cliff. The cliffs are distance apart. Every time he strikes the rock once, he hears two echoes the first one comes after 2.5s while the second follows 2s later. From this information calculate:
      a. The speed of sound in air
      b. The value d
10. A girl standing 600m away from a cliff bangs two pieces of wood together and hears an echo 3.5 seconds later. Determine the speed of sound in air at that place.

11. What is an echo?

12. Describe an experiment to show that sound cannot travel in a vacuum.

13. Fig 1 shows air molecules in front of a hollow wooden box P set vibrating by a turning fork T of frequency 800Hz.

(a) What is the purpose of fixing the tuning fork on the box which is open on one end?

(b) Name the section labeled X and Y

(c) State and explain the nature of the waves shown

(d) Given that the speed of sound in air is $330ms^{-1}$. Calculate the wavelength of the waves.

14. Sound is very faint in high altitudes than at sea level. Why?

15. Distinguish between the following terms

(i) Intensity and loudness

(ii) Frequency and pitch

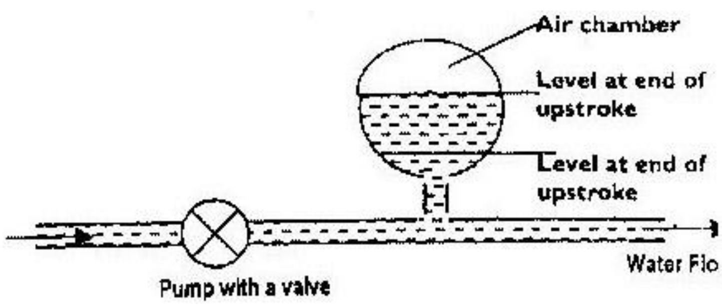
16. State two factors that affect the frequency of the note produced by a vibrating string

TOPIC 10

FLUID FLOW

PAST KCSE QUESTIONS ON THE TOPIC

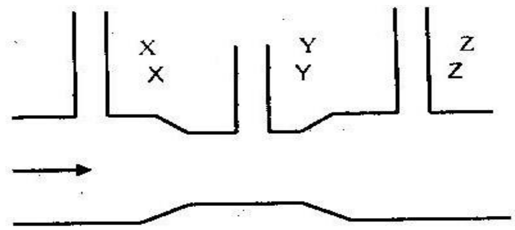
1. When spraying a field of water using a hose pipe, it is common to reduce the pipes opening in order to spray water furthest. Other than pressure, what other quality is varied in the process?
2. The figure below shows water forces through a hydraulic system by a pump. An air chamber is used to maintain a continuous flow of water during both the up stroke and down stroke of the piston pump.



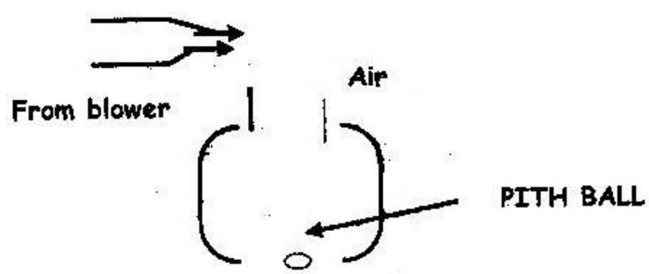
Explain how the continuous flow of water is maintained.

3. A pupil blows a current of air over the surface of a sheet of paper held close to its mouth. State and explain what happens to the paper.
4. Two table Tennis balls are in the same level while suspended from threads a short distance apart. A stream of air is blown between the balls in a horizontal direction. Explain what happens to the balls
5. The figure represents a tube through which liquid is flowing in the

direction shown by the arrow. Copy the diagram and show on it the relative positions of the level of the liquid in sections marked, X, Y and Z.



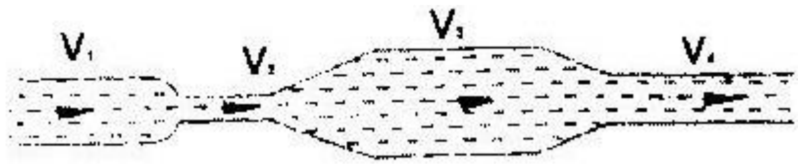
6. State how the pressure in a moving fluid varies with speed of the water is steadily increased from low to high value.
7. Water flows in a horizontal smooth pipe. State the changes that would be observed in the nature of the flow if the speed of the water is steadily increased from low to high value?
8. The figure below shows a pith ball in a flask. When a jet of air is blown over the mouth of the flask as shown, the pith ball is observed to rise from the bottom.



Explain the observation

9. State Bernoulli's principle. (1 mark)

Figure 2 shows a tube of varying cross sectional area. $V_1V_2V_3$ and V_4 represents the speeds of water as it flows steadily though the sections of the tube.



Arrange the speeds V_1, V_2, V_3 and V_4 in decreasing order starting with the highest.

10. Water flows along a horizontal pipe of cross sectional area $30cm^2$. The speed of the water is 4m/s but it reaches 7.5m/s in a constriction in the pipe. Calculate the area of the constriction.
11. A heart pumps blood at a rate of 1.8×10^3 cm^3/ min though its aorta is of cross sectional area 0.6 cm^3. The blood spreads into a capillary network that is equivalent to about 4×10^6 fine tubes each of diameter 6×10^{-3cm}.

    Calculate:

    (a) The average velocity of blood in the aorta

    (b) The average blood velocity in the capillary tubes.

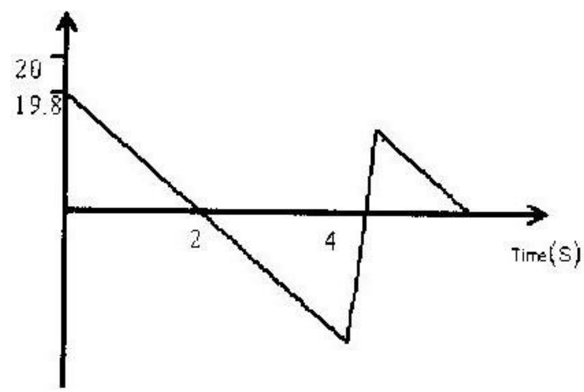
FORM THREE WORK

TOPIC 1

LINEAR MOTION

<u>PAST K.C.S.E QUESTIONS ON THE TOPIC</u>

1. a) The diagram below shows part of the motion of a tennis ball, which is projected vertically upwards from the ground and allowed to bounce on the ground. Use this information to answer questions that follow.



i) Describe the motion of the ball relating it to different positions of the ball along the following AB, BC, CDE.

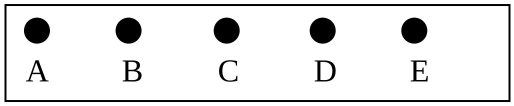
ii) From the graph, calculate the acceleration due to gravity.

iii) How high does the ball rise initially?

iv) Explain why E is not at the same level as A.

2. Sketch a velocity- time graph showing the motion of a ball vertically upwards with an initial velocity of u.

3. Calculate the acceleration shown by the tickers-tape that was made using a ticker timer vibrating at 50HZ.



4. What is the difference between speed and velocity?

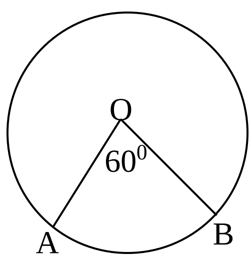
5.An object is projected vertically upwards at a speed of 15m/s. How long will it take to return to the same level of projection?

6.A block slides off a horizontal table 4 meters high with a velocity of 12-m/s. Find:

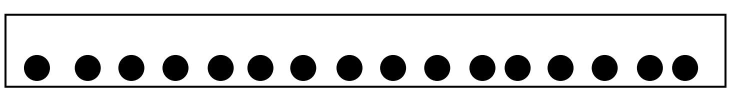
a) The horizontal distance from the table at which the block hits the floor.

b) The horizontal and vertical components of the velocity when it reaches the floor.

7.A particle initially at A moves along an arc AB of a horizontal circle of radius 4m and centre O.A is south of O and angle AOB is 60^0. Determine the displacement AB.



8.The figure represents dots made by a ticker-timer. The dots were made at a frequency of 50 dots per second. (Diagram not drawn to scale)



a) What is time interval between two consecutive dots?

b) The arrow on the tape indicates the dots made at time t = 0. Copy the diagram and indicate in a similar way the dots made at t= 0.1s, 0.2s, 0.3s.

c) Determine the average velocities of the tape over time intervals -0.02s to 0.02s, 0.08s to 0.12s, 0.18s to 0.22s and 0.28s to 0.32s

d) Draw a suitable graph and from it determine the acceleration of the tape.

9.A mass is projected horizontally from height of 5m above the ground with a velocity of 30m/s. Calculate:

a) The time taken to reach the ground

b) The horizontal distance traveled before hitting the ground

c) The vertical velocity with which the mass hits the ground

10. The data in the table below represents the motion over a period of 7 seconds

Time s	0	1	2	3	4	5	6	7
D is m	0	20	40	60	80	95	105	110

a) Plot on graph paper a graph of displacement (y-axis) against time.

b) Describe the motion of the vehicle for the first 4 seconds.

c) Determine the velocities at 4.5s and 6.5 s. Hence or otherwise determine the average acceleration of the vehicle over this time interval.

11. a) A body accelerates uniformly from initial velocity, U to the final velocity V, in time t, the distance traveled during this time interval is S. If the acceleration is shown by the letter a, show that;

i) $V = U + at$ ii) $s = ut + \frac{1}{2} at^2$ iii) $V^2 = U^2 + 2as$

b) A body initially moving at 50m/s decelerates uniformly at 2m/s until it come to rest. What distance does it cover from the time it started to decelerate?

12. An object dropped from a height h attains a velocity of 6m/s just before hitting the ground, find the value of h.

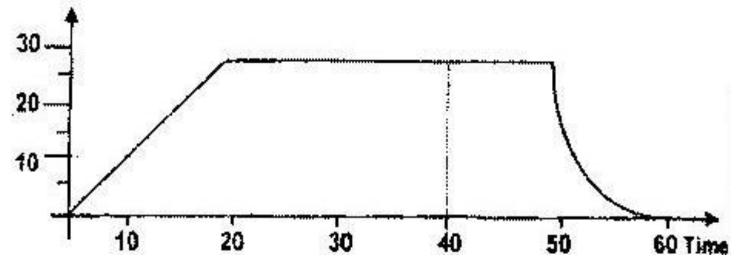
13.: a) A stone is thrown vertically upwards from the edge of a platform eventually the stone lands without bouncing on the ground below the platform. Taking the upward velocity to be positive, sketch the velocity-time graph of the motion of the stone.

b) A car can be brought to rest from a speed of 200m/s in a time of 2s.

i) Calculate the average deceleration

ii) If the driver reaction time is 0.2s, Determine the shortest stopping distance.

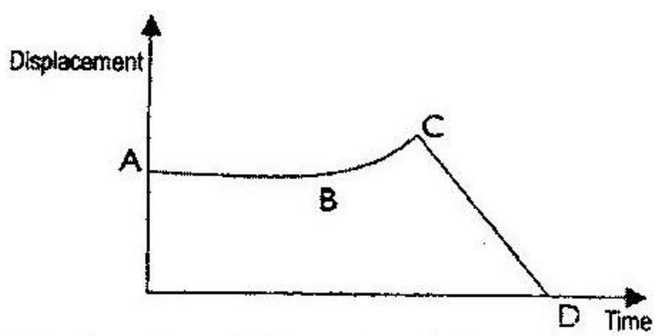
14.: The figure shows a speed-time graph for part of the journey of a motorcar.



Determine the distance the car travels in the first 40 seconds

15. Draw axes and sketch a graph of velocity (v versus time (t) for uniformly accelerated motion given that when t = 0, v is greater than zero.

16. a) The figure below shows the displacement time graph of the motion of a particle.



State the nature of the motion of the particle between:

i) A and B

ii) B and C

iii) C and D

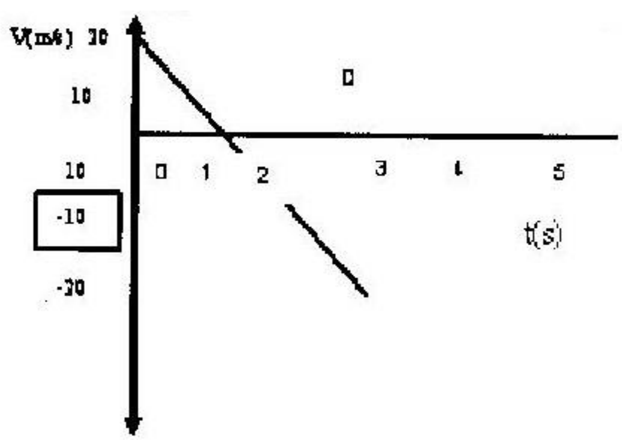
b) A ball is thrown horizontally from the top of a vertical tower and strikes the ground at a point 50m from the bottom of the tower. Given that the height of the tower is 45m, determine the;-

i) Time taken by the ball to hit the ground

ii) Initial horizontal velocity of the ball.

iii) Vertical velocity of the ball, just before striking the ground. (Take acceleration due to gravity g as $10ms^{-2}$)

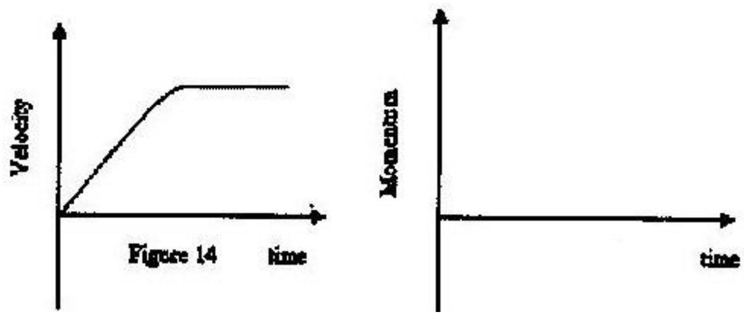
16. The graph bellows shows how the velocity varies with time for a body thrown vertically upwards.



Determine the total distance moved by the body. (3mks)

17. A bullet is fired horizontally from a platform 15m high. If the initial speed is 300ms-1, determine the maximum horizontal distance covered by the bullet. (3mks)

18. Fig 14 shows the velocity-time graph for a small metal sphere falling through a viscous fluid.



On the axes provided sketch the graph of momentum against time for the same mass (1mk)

Given that the reading of the spring balance is 0.6N, determine the weight of the bar. (3mks)

The graph in figure 6 shows the velocity of a car in the first 8 seconds as it accelerates from rest along a straight line. Use the graph to answer question 19 and 20.

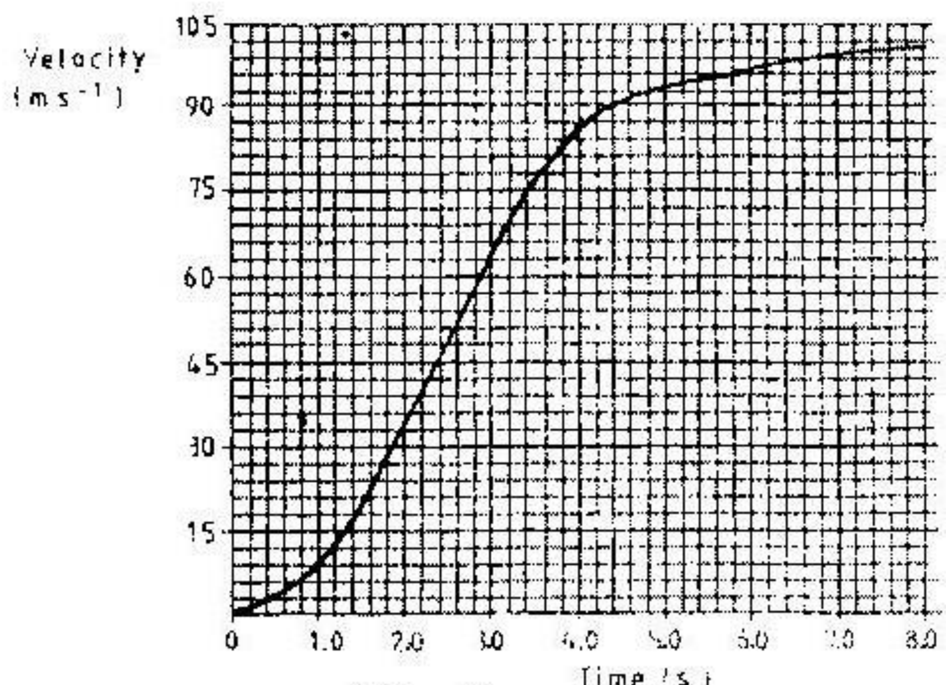


Figure 6

Determine the distance traveled 3.0 seconds after the start. (3mks)

Determine the acceleration of the car at 4.0 seconds. (2mks)

21. A bomber flying horizontally at 100m/s releases a bomb from a height of 300m.

    Calculate:

    a) Time taken for the bomb to hit the ground.

       The horizontal distance traveled when hitting the ground.

    c) The magnitude and direction of the velocity when hitting the ground?

22 An airplane is flying horizontally over a camp at 250m/s and drops a pack. How far from the camp will the pack land if the plane was flying 300m above the ground?

23. An object is projected horizontally at a velocity of 40m/s from a cliff 20m high.

    Calculate:

    a) The time taken to hit the ground

    b) The distance from the foot of the cliff when the object hits the ground.

24. A ball-bearing X is dropped vertically downwards, from the edge of a table and it takes 0.5s to hit the floor below. Another bearing Y leaves the edge of the table horizontally with a velocity of 5m/s. find:

    a) The time taken for bearing Y to reach the floor.

    b) The horizontal distance traveled by Y before hitting the floor.

    c) The height of the table-top above the floor level.

25. A helicopter, which was ascending vertically at a steady velocity of 20m/s, released a parcel that took 20 second to reach the ground.

    i) State the direction in which the parcel moved immediately it was released.

ii) Calculate the time taken by the parcel to reach the ground from the maximum height.

iii) Calculate the velocity of the parcel when it strikes the ground.

iv) Calculate the maximum height above the ground the parcel reached.

v) What was the height of the helicopter at the instant the parcel was dropped.

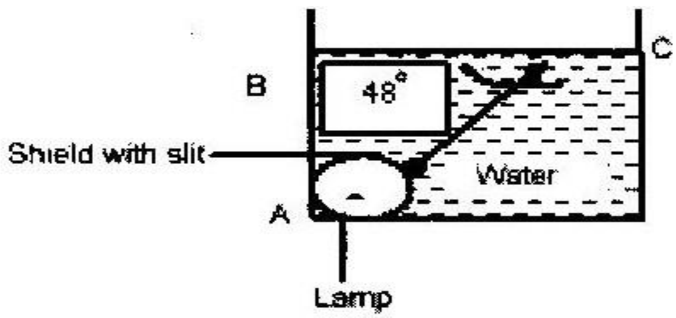
26. A stone is thrown horizontally from a building that is 50 m high above a horizontal ground. The stone hits the ground at a point, which is 65m from the foot of the building. Calculate the initial of the stone.

TOPIC 2

REFRACTION OF LIGHT

PAST KCSE QUESTIONS ON THE TOPIC

1. The diagram below shows a transparent water tank containing water. An electric light is fixed at corner A of the tank. A light ray from the slit shines on the water surface BC at an angle of 48^0 as shown



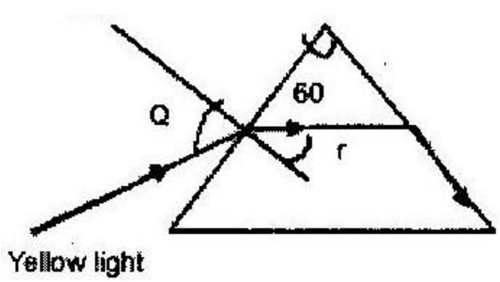
a) i) Determine the angle of refraction for the ray shown in the diagram.

ii) Complete the diagram to show the refracted ray.

b) Determine the angle of incidence for which the angle of refraction is 90^0

c) Calculate the speed of light in water (nw = $^4/_3$, C= 3 x 10^8ms)

2. The figure shows the path of a yellow light through a glass prism. The speed of yellow light in the prism is 1.88 x 10^8 m/s.



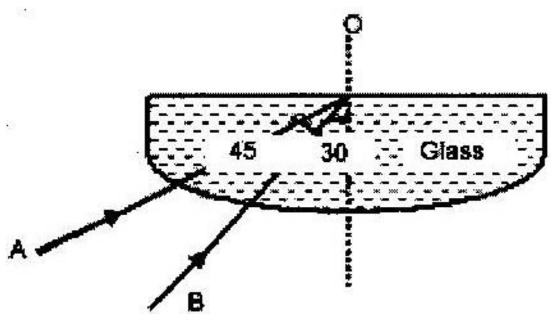
a) Determine the refractive index of the prism material for the light. (Speed of light in vacuum = $3.0 \times 10^8\ ms^{-1}$)

b) Show on the figure the critical angle C and determine the value.

c) Given that $r = 21.2^0$, determine angle Q.

d) On the same figure, sketch the path of the light after striking the prism if the prism was replaced by another of similar shape but lower refractive index. (Use dotted line for your answer).

3. 2002: The figure below shows two rays A and B entering a semi circular glass block which has critical angle of 42^0. The rays are incident at an air glass boundary at point O



Complete the path of the two rays from point O. Label A^1 and B^1 the corresponding rays.

4. A ray of light is directed at an angle of 50^0 on to a liquid-air boundary.

The refractive index of the liquid is 1.4.

Show on a diagram the patch taken by the ray on striking the liquid-air boundary. Show how you arrive at your answer.

5. Figure 13 shows a coin placed in a large empty container. An observer

looking into the container from the position shown is unable to see the coin.

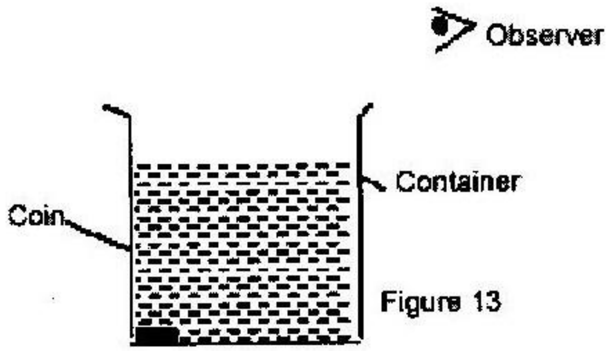


Figure 13

Sketch two rays from a point on the coin to show how the observer is able to see the image of the coin after the container is filled with water.

6.

Figure 6 show a ray of light incident on the face of a water prism.

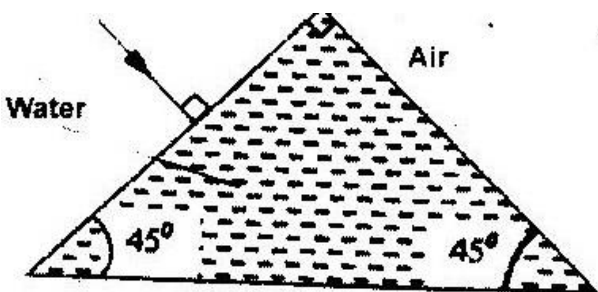


Figure 6

Sketch the path of the rays as it passes through the prism. Critical angle for water is 49^0 (1mk)

7. Calculate the refractive index of glass given that the velocity of light in air is $3x\ 10^8$ ms^{-1} and velocity of light in glass is $2.4 \times 10^8 ms^{-1}$.

8. The real thickness of crown glass block of refractive index 1.58 is 10cm is 10cm. Calculate the apparent thickness of the glass.

9. You are provided with the following;

   -A 50cm beaker full of water.

   -Stand and clangs

   -A half metre rule

   -2 optical pins

   -Cork

   a) Explain briefly how you would determine the refraction index of water using the materials provided.

   b) The data below shows the results obtained when such an experiment was performed by form three students using various values of real depths, Y of a liquid.

Real depth cm	30	50	70	90	110	130
Apparent depth cm	22	37	52	66	81	96

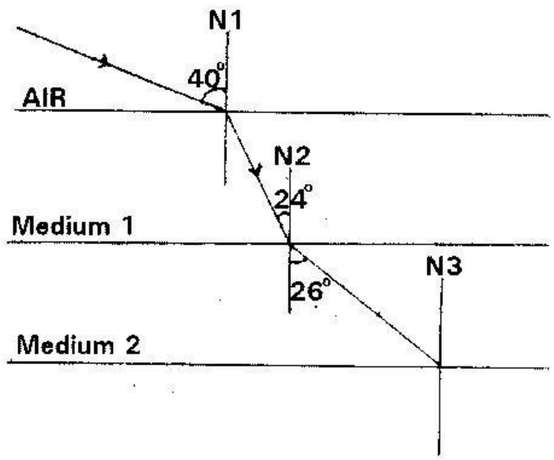
   i) Plot a graph of the real depth (y-axis) against apparent depth.

   ii) From the graph, determine the refractive index of the liquid.

10. Paraffin has a greater refractive index than that of water. Comment about the relative velocity of light in paraffin and in water.

11. a) State SNELL'S LAW

    b) A ray of light travels from air into medium 1 and 2 as shown.



Calculate;

i) The refractive index of medium 1.

ii) Critical angle of medium 1

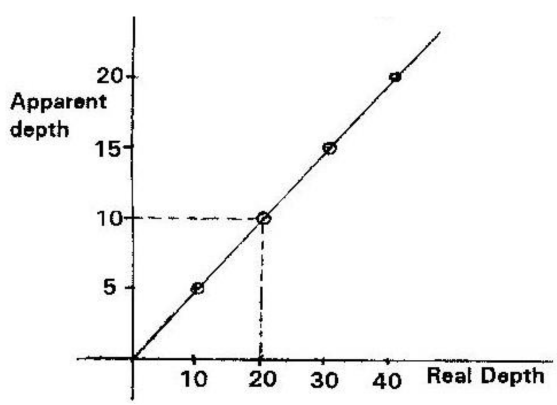
iii) The refractive index of medium 2 relative to medium ($_1n_2$)

12. Explain with the aid of a diagram, how a suitable glass prism may be used to turn a ray of light 180^0

13. What measurable quantity is associated with colour of light?

14. State TWO uses of total internal reflection.

15. The graph shown below shows, the apparent depth (y-axis) against real depth. Use it to calculate the refractive index of glass.



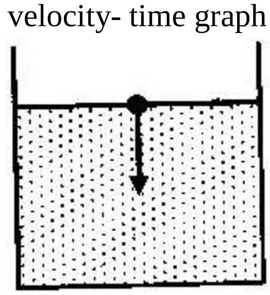
16. The refractive index for air-water boundary is $^4/_3$. Calculate the critical cycle for water–air interface.

TOPIC 3

NEWTON'S LAW OF MOTION

PAST K.C.S.E QUESTIONS ON THE TOPIC

1. Two masses of 3kg and 7kg are connected by a light string. The 3 kg mass rests on a smooth incline plane 30^0 to the horizontal. The 7 kg mass hangs freely from the frictionless pulley attached to the top of plane.
   i) Draw a diagram showing the bodies and identify the forces acting on the 3 kg mass.
   ii) Calculate the acceleration of the masses.
2. A rocket propelled upward with a constant thrust. Assuming friction due to air is negligible and the burning of the fuel is steady. Explain its motion.
3. A 2 kg body slides down a smooth slope from a height of 5m. As it reaches the horizontal, it strikes another body of mass 3 kg which is at rest. Both bodies stick together. Calculate the velocity of the bodies after collision.
4. A girl of mass 40 kg stands on a scale balance in a lift. The lift is accelerating upwards. At one instant the acceleration of the lift is 2m/s. Calculate the reading on the scale at that instant.
5. The diagram shows a tall measuring cylinder containing a viscous liquid. A very small steel ball is released from rest at the surface of the liquid as shown. Sketch the velocity- time graph for the motion of the ball from the



time it is released to the time just before it reaches the bottom of the cylinder.

6. A body of mass 5 kg is ejected vertically from the ground when a force of 600N acts on it for 0.1s. Calculate the velocity with which the body leaves the ground.

7. a) i) A body is initially in motion. If no external force acts on the body, describe the subsequent motion.

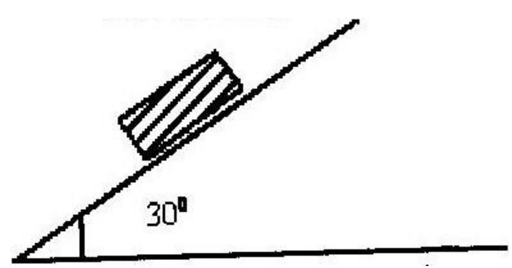
ii) A car of mass 800 kg is initially moving at 25 m/s. Calculate the force needed to bring the car to the rest over a distance of 20 m.

b) Two trolleys of masses 2 kg and 1.5 kg are traveling towards each other at 0.25m/s and 0.40 m/s respectively. Two trolleys combine on collision.

i) Calculate the velocity of the combined trolleys.

ii) In what direction do the trolleys move after collision?

8. a) The diagram shows a block of mass 5 kg sliding down from rest on a plane incline at an angle of 30^0 to the horizontal. A frictional force of 6N acts between the block and the plane.



i) Copy the diagram and show the forces acting on the block.

ii) Calculate the resultant force on the block.

iii) Calculate the time taken by the block to cover the distance of 25cm.

b) The table shows the value of the resultant force, F, and the time t for a bullet traveling inside the gun barrel after the trigger is pulled.

Force, F (N)	360	340	300	240	170	110
Time, (t) (milliseconds)	3	4	8	12	17	22

(i) Plot a graph of Force, f against time t.

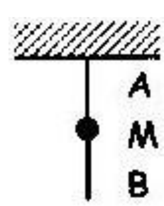
ii) Determine from the graph.

i) The time required for the bullet to travel the length of the barrel assuming that the force becomes zero just at the end of the barrel.

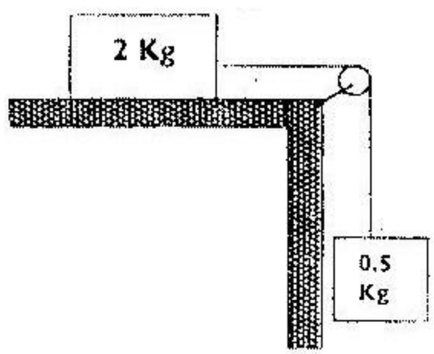
ii) The impulse of the force.

iii) Given that the bullet emerges from the muzzle of the gun with a velocity of 200 m/s, calculate the mass of the bullet.

9. 1993: The diagram shows two identical strings A and B attached to a large mass M. String A is attached to the ceiling. State the reason why string B cuts when its free and is suddenly pulled downward.



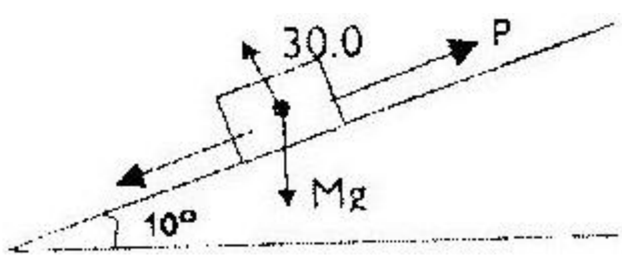
10. 1994: The fig. shows a 2 kg block attached to 0.5 kg mass by a light inextensible string which passes over a pulley. The force of friction between the horizontal bench and block is 3N. The block is released from rest so that both masses move through a distance of 0.6m. Calculate the velocity of the string.



11. A trolley is moving at constant speed in a friction compensated track.

Some plasticine is dropped on the trolley and sticks to it. State with a reason what is observed about the motion of the trolley.

12. Fig. 4 shows a block of mass 30.0 kg being pulled up a slope by force P at a constant speed. The frictional force on the block is 20.0N



a) i) On the same figure name and indicate other forces acting on the block.

ii) Determine the component of the weight acting on the trolley down the slope

iii) Determine the value of P.

b) On reaching the top of the slope, the block is left to run freely down the slope.

i) Which one of the forces previously acting on the block would then act in the opposite direction?

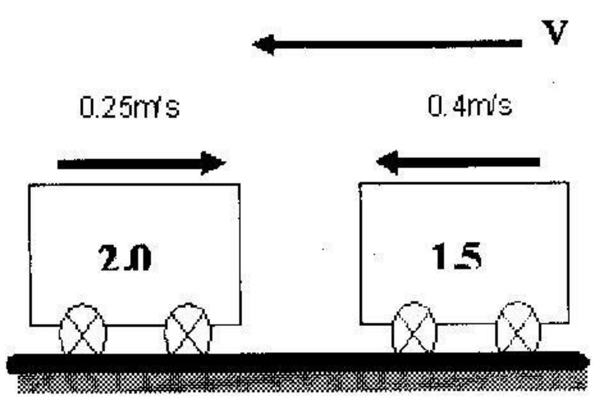
ii) Determine the acceleration of the block down slope.

iii) What is the effect of increasing the angle of slope on your answer in (ii) above?

13. 2002: A high jumper usually lands on a thick soft mattress. Explain how the mattress helps in reducing the force of impact.

14. 2003: A resultant force F acts on a body of mass m causing an acceleration a_1 on the body. When the same force acts on a body of mass 2m, it causes an acceleration a_2. Express a_2 in terms of a_1.

15.



The figure above shows two trolleys of mass 2.0 kg and 1.5 kg traveling towards each other at 0.25m/s and 0.4m/s respectively. The trolleys combine on collision. Calculate the velocity of the combined trolley and show the direction in which they move after collision.

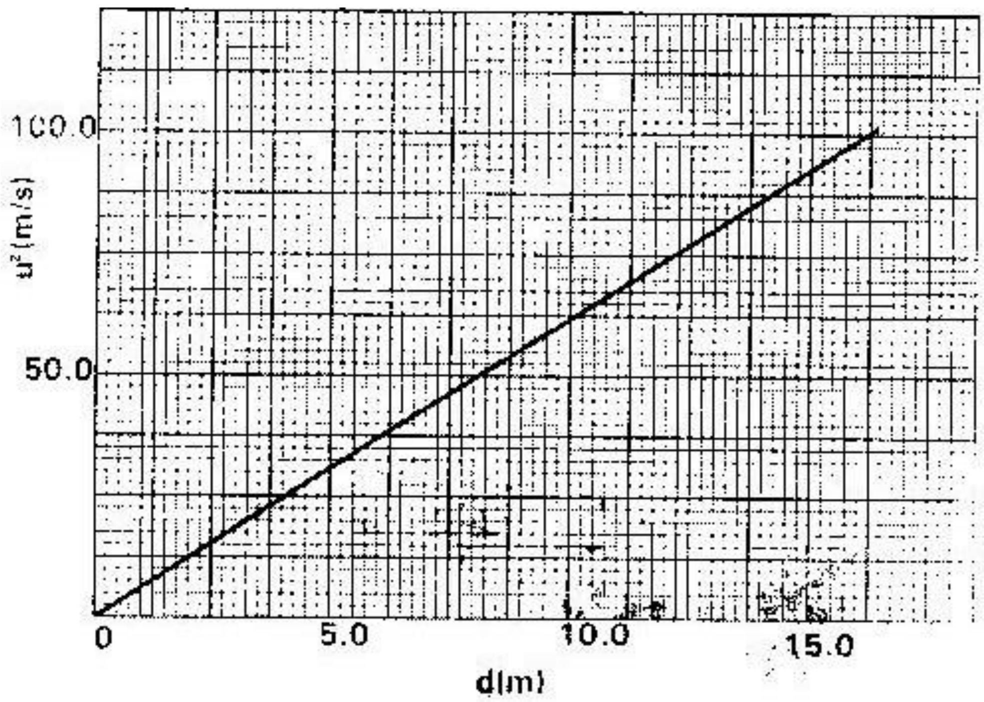
16. Two identical stones A and B are released from the same height above the ground. B falls through air while A falls through water. Sketch the graphs of kinetic energy (KE) against time (t) for each stone. Label the graph appropriately.

17. A trolley is moving at uniform speed along a track. A piece of plasticine is dropped on the trolley and sticks on it. Explain why the trolley slows down. (2 mks)

18.

a) State the Newtons law of motion. (1 mk)

b) A wooden block resting on a horizontal bench is given an initial velocity, u, so that it slides on the bench surface for a distance, d, before coming to a stop. The values of d were measured and recorded for various values of initial velocity. Figure 10 shows the graph of u against d.



i) Determine the slope, s, of the graph

ii) Given that $u^2 = 20kd$, where k is a constant for the bench surface, determine the value of k from the graph.

iii) State how the value of k would be affected by change in the roughness of the bench surface.

(c) A car of mass 800kg starts from the rest and accelerates at $1.2ms^{-2}$. determine its momentum after it has moved 400m from the starting

19. A force of 6N acts on a 2kg trolley and accelerates at 2 m/s^2. Calculate the retarding force acting on the trolley.
20. A boulder is sliding down a slope, with a uniform acceleration of 3 ms^{-2}; calculate its velocity after it has slid 10m down the slope.

21. A man whose mass is 70 kg stands on a spring weighing machine. When the lift starts to ascend its acceleration is 2.45m/s. What is the reading on the scale?
22. A bullet of mass 22 g traveling at a velocity of 18/ms penetrates a sand bag and is brought to rest in 0.6 seconds. Find:

    The depth of penetration in metres

    The average retarding force of the sand
23. A bullet of mass 10g traveling horizontally with a velocity of 300m/s strikes a block of wood of mass 290g which rests on rough horizontal floor. After impact they move together and come to rest after traveling a distance of 15m.

    Calculate the common velocity of the bullet and the block.

    Calculate the acceleration of the bullet and the block.

    Calculate the coefficient of sliding friction between the block and the floor.

    a) A body of mass m initially at rest is acted on by a force F for a time t, as a result its velocity changes to a final value V. Use this information to show that the gain is kinetic energy E= ½ MV^2

    b) Calculate the kinetic energy of a car of mass 1000 kg traveling at 36 km/h
24. Under a driving force of 400N a car of mass 1250 kg has an acceleration of 2.5 m/s. Find the frictional force acting on the car.
25. An apple of mass 100g falls a distance of 2.5m to the ground from a branch of a tree.

    a) Calculate the speed at which it hits the ground and the time taken for it to fall. (Ignore air resistance).

    b) Assuming the apple takes 100 milliseconds to come to rest. Calculate the average force experienced by the apple.

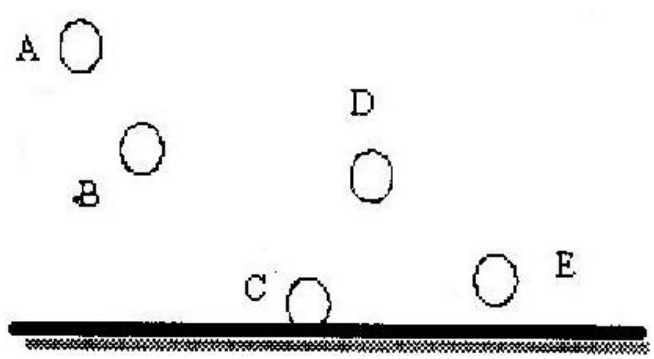
26. A helicopter of mass 3000 kg rises vertically at a constant speed of 25 ms^{-1} if the acceleration due to gravity is 10 ms^{-2}; determine the resultant force working on the helicopter.

TOPIC 4

WORK, ENERGY, POWER AND MACHINES

PAST K.C.S.E QUESTIONS ON THE TOPIC

1. 1990: The figure shows positions of a ball bouncing on a floor. State the energy changes at C.



2.

a) Explain why a burn from the steam of boiling water more severe that of water itself?

b) An energy saving stove when burning steadily has an efficiency of 69%. The stove melts 0.03 kg lf ice 0^0C in 180 seconds.

Calculate: -

i) The power rating of the stove.

ii) The heat energy wasted by the stove.

c) A pump uses 1g of a mixture of petrol and alcohol in the ratio 4:1 by mass to raise 1000 kg of water from a well 200m deep.

i) How much energy is given by 1g of mixture?

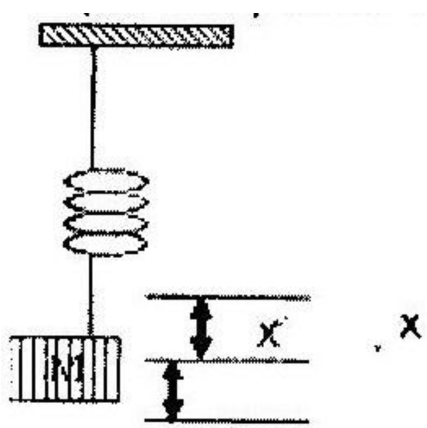
ii) If the pump is 40% efficient, what mass of this mixture is needed to raise the water? (1g of alcohol = 7000J, of petrol= 48000J)

d) Suggest two energy changes that accompany the changing of a liquid in a vapour phase.

3. A bullet of mass 0.80 g traveling at 400 m/s is stopped by a concrete wall.

4. A small mass m is suspended freely at the lower end of a spring as shown.

The mass is displaced by a small distance and then released and allowed to oscillate. What form of energy does the mass have at a point midway between A and B?



. What makes the amplitude of osculation of a simple pendulum to decrease with time?

6. A screw advances 1mm when the screw is turned through two revolutions.

What is the pitch of the screw?

7. A ball rolls on a table in a straight line. A part from the transitional kinetic energy, state the other form of kinetic energy possessed by the ball.

8. A car of mass 800 kg is initially moving at 25 m/s. Calculate the force needed to bring the car to rest over a distance of 20 m.

9. A workshop has the following simple machines for lifting heavy loads, a

wheel and axle, and a movable pulley. The wheel has a diameter of 30cm while the axle has diameter of 3.0cm.

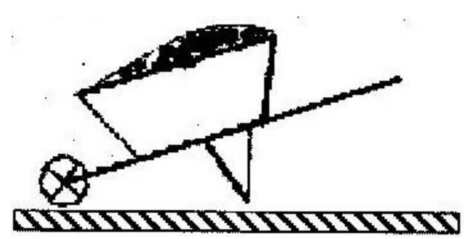
i) Sketch force diagrams to show how each machine works.

ii) Assuming that the machines are perfect. Calculate the mechanical advantage for each of the machines and show which machine is more advantageous in lifting loads.

10. A body has 16 Joules of kinetic energy. What would be its kinetic energy if its velocity was double?

11. Define the efficiency of a machine and give a reason why it can never be 100%

12. a) The fig shows a loaded wheelbarrow. Indicate and label on the diagram three forces acting on the wheelbarrow when a worker is just about to lift the handle.

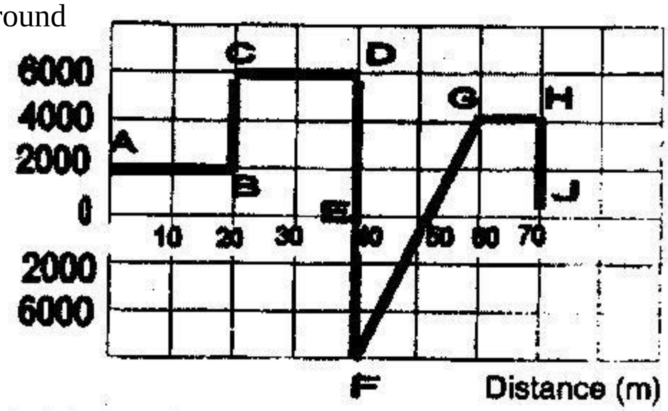


b) Suppose the handlebars of the wheelbarrow were extended, which force(s) would change and how?

13. Sketch a labeled diagram to show how an arrangement of a single pulley may be used to provide a mechanical advantage of 2.

14. The fig. below shows a force distance graph for a car being on a horizontal

ground

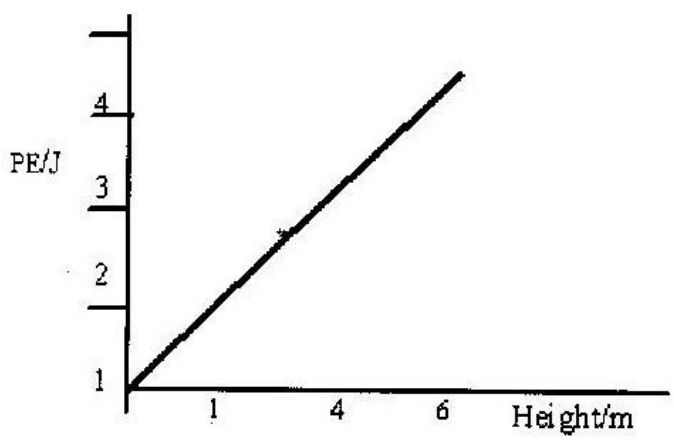


a) Calculate the total work done

b) If the velocity just before reaching point D is 6m/s, calculate the power developed by the agent providing the force at this point.

c) An electric pump can raise water from a lower-level reservoir to the high level reservoir to the high level reservoir at the rate of 3.0 x 10^5 kg per hour. The vertical height of the water is raised 360m. If the rate of energy loss in form of heat is 200 kW, determine the efficiency of the pump.

15. The figure below shows how the potential Energy (P.E) of a ball thrown vertically upwards.



On the same axes, plot a graph of kinetic energy of the ball.

16. Using a pulley system, a girl lifts a load of 1800N using an effort of 400N. If the system is 65% efficient, determine the velocity ratio of the system.

17. a) A crane lifts a load of 200 kg through a vertical distance of 3.0m in 6 seconds. Determine the;

i) Work done

ii) Power developed by the crane

iii) Efficiency of the crane given that it is operated by an electric motor rated 12.5 kw.

18. A certain machine uses an effort of 400N to raise a load of 600N. If the efficiency of the machine is 75%, determine its velocity ration. (3mks)

19. Figure 5 shows a uniform bar of length 1.0 pivoted near one end. The bar is kept in equilibrium by a spring balance as shown.

Figure 5

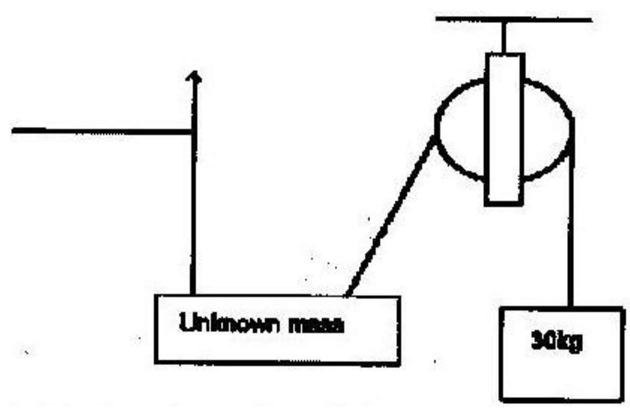
Given that the reading of the spring balance is 0.6N. Determine the weight of the bar.

20. When an electric pump whose efficiency is 70% raises water to a height of 15m, water is delivered at the rate of 350 litres per minute.

What is the power rating of the pump?

What is the energy lost by the pump per second?

21. In the arrangement shown, the mass of 30 kg hanging on the pulley helps to raise the unknown load. The person pulling up the other string finds that he had to do 800 Joules of work in order to raise the load 4m.



a) Calculate the value of the unknown mass.

b) State the assumptions you make in calculating the value (a) above

22. A load of 100N is raised 20m in 50s. Calculate;

The gain in potential energy

The power developed

23. Gitonga has a mass of 60kg and climbs up a slop of 200m long and inclined at an angle of 10^0 to the horizontal. Calculate the minimum work done by Gitonga.

24. A force of 8N stretches a spring by 10cm. How much work is done in stretching this spring by 13cm?

25. A simple pendulum is released from rest and it swings towards its lowest position. If the speed at the lowest position is 1.0m/s, calculate the vertical height of the bob when it is released.

TOPIC 5

CURRENT ELECTRICITY II

PAST K.C.S.E QUESTIONS ON THE TOPIC

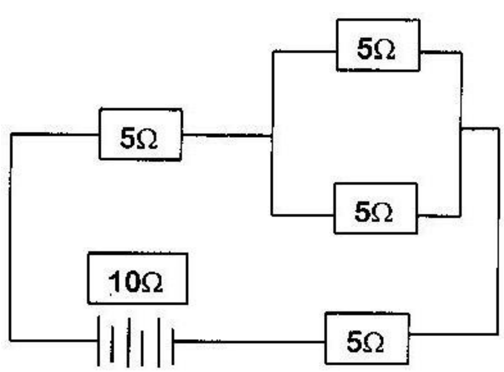
1. A student learnt that a battery of eight dry cells each 1.5v has a total e.m.f of 12V the same as a car battery. He connected in series eight new dry batteries to his car but found that they could not start the engine. Give a reason for this observation
2. a) You are required to determine the resistance per unit length of a nichrome wire x, you are provided with A.D.C. power supply an ammeter and voltmeter.
   i) Draw a circuit diagram to show how you would connect the circuit.
   ii) Describe how you would use the circuit in (a) (i) above to determine the resistance per unit length of x.

   b) i) State Ohm's Law.

   ii) A filament lamp and a thermostat are ohmic devices to a certain extent. Explain.

   c) i) Explain why moving coil meters are unstable for the use of alternating voltages.

   d) Four 5Ω resistors are connected to a 10V d. c. supply as shown in the diagram below.

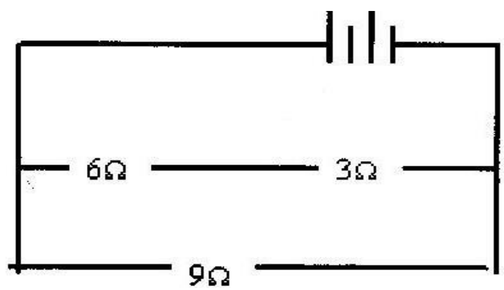


Calculate;-

i) The effective resistance in the circuit.

ii) The current I following in the circuit.

3. Study the circuit diagram. Determine the potential drop across the 3 resistor.



4. State two conditions that are necessary for a conductor to obey Ohm's law.

5. a) State Ohm's law.

   b) Describe with aid of a diagram and experiment to verify Ohm's law

   c) Two resistors R_1 and R_2 are connected in series to a 10V battery. The current flowing then is 0.5A. When R_1 only is connected to the battery the current flowing is 0.8A.

   Calculate the

   i) Value of R_2

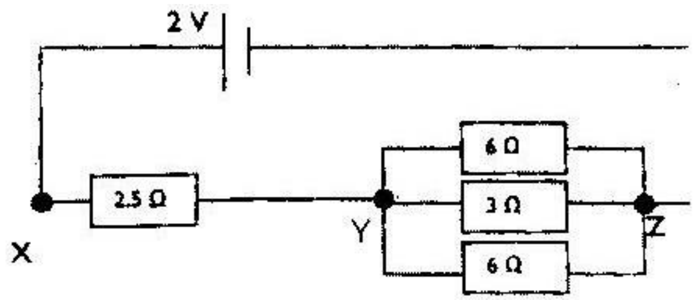
   ii) Current flowing when R_1 and R_2 are connected in parallel with the same batter.

   d) Recharging is one of the practices of maintenance of accumulators. State two measurements, which need to be taken to help you decide when an accumulator is due for charging.

6. A current of 0.08A passes in circuit for 2.5 minutes. How much charge passes through a point in the circuit?

7. An ammeter, a voltmeter and a bulb are connected in a circuit so as to measure the current flowing and the potential difference across both. Sketch a suitable circuit diagram for the arrangement.

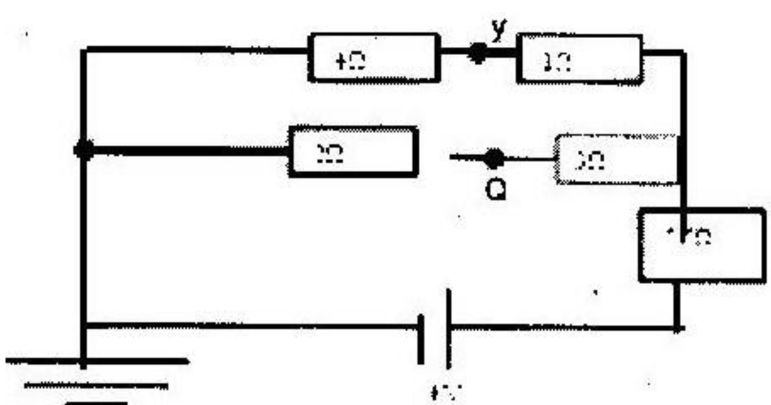
8. a) In the circuit diagram shown, calculate the effective resistance between Y and Z.



   b) Determine the current through the 3Ω resistor.

   c) One of the 6Ω resistors has a length of 1m and cross-sectional area of $5.0 \times 10^{-5} m^2$. Calculate the resistivity of the material.

9. In the circuit diagram five resistors are connected to a battery of e.m.f. 4V, and negligible internal resistance. Determine:



i) The total resistance of the circuit.

ii) The current flowing through the 5.5μ resistor.

iii) The potentials at points Y and O.

iv) The potential difference between Y and O

10. An electric bulb with a filament of resistance 480Ω is connected to a 240V mains supply. Determine the energy dissipated in 2 minutes.

11. A student wishes to investigate the relationship between current and voltage for a certain device X. In the space provide, draw a circuit diagram including two cells, rheostat, ammeter, voltmeter and the device X that would be suitable in obtaining the desired results.

12. In the circuit diagram shown in figure 7, the ammeter has negligible resistance. When the switch S is closed, the ammeter reads 0.13A.

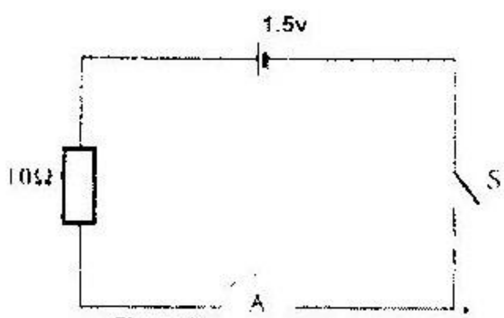


Figure 7

Determine the internal resistance of the cell.

13 a) State Ohm's law.

b) The graph in figure 9 shows the current voltage characteristics of a device, X.

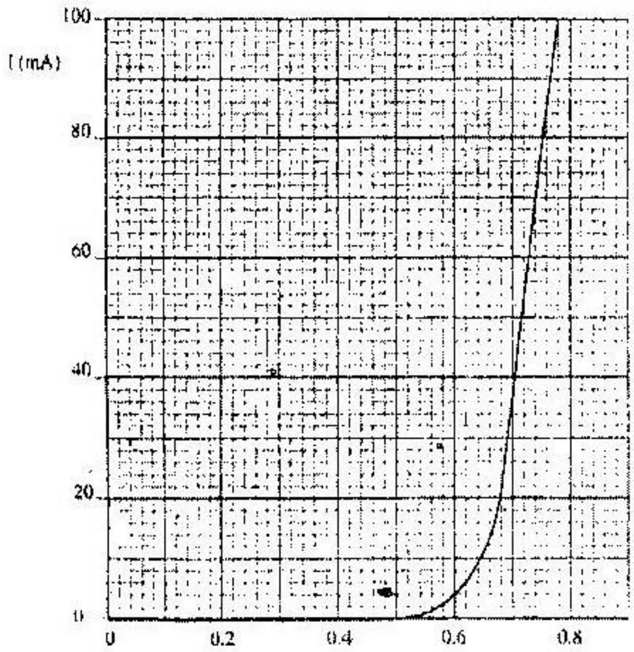
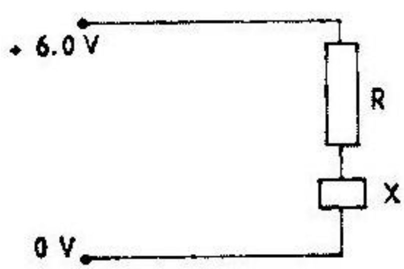


Figure 9 V (Volts)

i) State with a reason whether the device obeys Ohm's laws.

ii) Determine the resistance of the device, X, when the current through it is 60m A.

iii) When the device, X, is connected in the circuit below, the voltage across it is 0.70V.



Calculate the value of the resistance R.

c) The cell in figure 10 has an emf of 2.1V and negligible internal resistance.

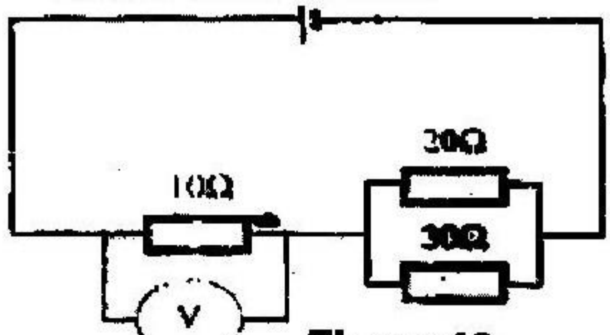


Figure 10

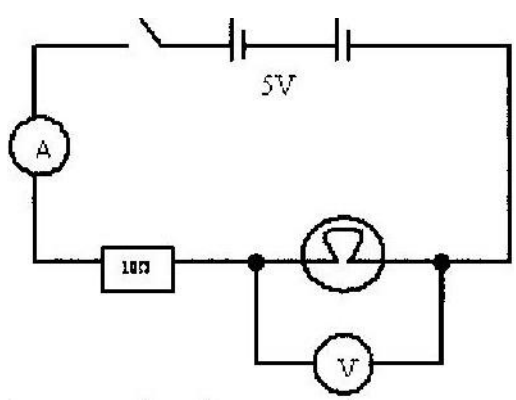
Determine the

i) Total resistance in the circuit.

ii) Current in the circuit

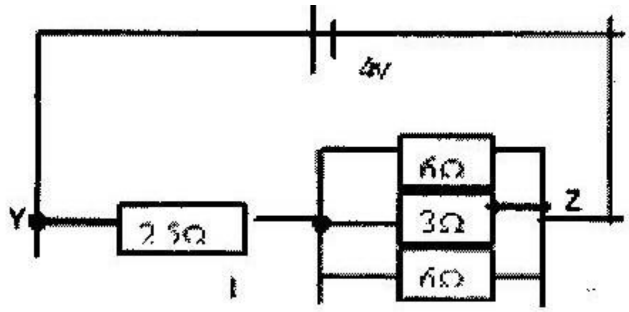
iii) Reading on the voltmeter

14. The diagram below shows an electrc circuit. When the switch is close the ammeter reading is 0.3A



Determine the voltmeter reading.

15. a) In the circuit diagram shown, calculate the effective resistance between Y and Z



b) Determine the current through the 3Ω resistor.

16. A battery of e.m.f. 3v drives a current through a 20Ω resistor. The p.d across the resistor is 2.8v as measured by a voltmeter. Calculate the internal resistance of the battery.

17. A torch uses two identical dry cells connected in series. When a bulb of resistance 2.0 ohm's is connected across the cells the pd across the bulb is 2.0 v. When a bulb of resistance 1.5 ohms is used, the p.d is 1.8v, calculate the e.mf and internal resistance of each cell.

18. Suppose a high–resistance voltmeter reads 1.5v connected across a dry battery on open circuit and 1.2v. when the same battery is in a closed circuit when it is supplying a current of 0.3A through a lamp of resistance R.

    Draw a circuit diagram to show the above experiment when in;

    i) Open circuit

    ii) Closed circuit.

    What is

    - i) The emf of the battery.
    - ii) The internal resistance of the battery
    - iii) The value of R?

19. When a resistor is connected across the terminals of a battery a current of 0.20A flows.

    What is the time taken for 2.0 coulombs of charge to pass a given point in the circuit?

    If e.m.f of the battery is 4.0v and its internal resistance is 0.20hm determine the rate at which heat is produced in the resistor.

20. a) State Ohm's law.

    b) In an experiment to determine the resistance of a resistor x, it is connected in parallel with a 100 Ω resistor. The current through the combination and the p.d across the combination is tabulated as shown below.

Potential difference (v)	1.5	3.0	4.5	6.0	7.5
Current (A)	0.075	0.015	0.225	0.30	0.375

Draw a diagram of the circuit that could have been used

c) i) plot a graph of current against potential difference.

   ii) Calculate the gradient of the slope

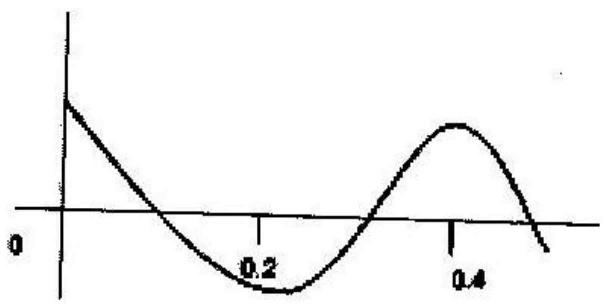
   iii) Calculate the resistance of resistor x.

TOPIC 6

WAVES II

PAST K.C.S.E QUESTIONS ON THE TOPIC

1. Explain how you would make a diffraction grating on a piece of glass slide.
2. One range of frequencies used in broadcasting varies from 0.5×10^0 Hz to 2.0×10^7 Hz. What is the longest wavelength of this range? Velocity of light air $=3x10^8$ / s
3. State one effect that would be observed when water waves pass from deep to shallow water.
4. The fig. shows a wave profile. Determine the frequency of the wave.



5. What happens to the wavelength of a water wave when it moves from the deep part to the shallow part of a ripple tank?
6. A source generates 40 waves in a second. If the wavelength is 8.5m. Calculate the time taken to reach a wall 102m from the source.
7. What condition is necessary for a wave incident on a slit to be diffracted?
8. a) Sketch a displacement-time graph of a wave of amplitude 0.5 cm and frequency 4Hz over a time interval of 1.25s

b) i) State one condition not involving a phase difference for interference pattern to be observed.

ii) Two points sources s_1 s_2 oscillate in phase producing waves of wavelength = 1cm. The separation of the sources is 3cm

a) Draw to scale a series of 10 semicircular lines to represent the wave fronts produced at intervals of one periodic time (T) for each of the two sources.

b) Draw on the same diagram, lines which represent positions of constructive interference.

c) Mark a point P on one of the lines drawn in II. Determine the magnitude of ($S_2P - S_1P$) in terms of wavelength.

9. Light travels through glass of refractive index 1.5 with a speed v.

Calculate the value of v. (Speed of light in air =3.0×10^8 m/s).

10. Name a property of light that shows it is a transverse wave.

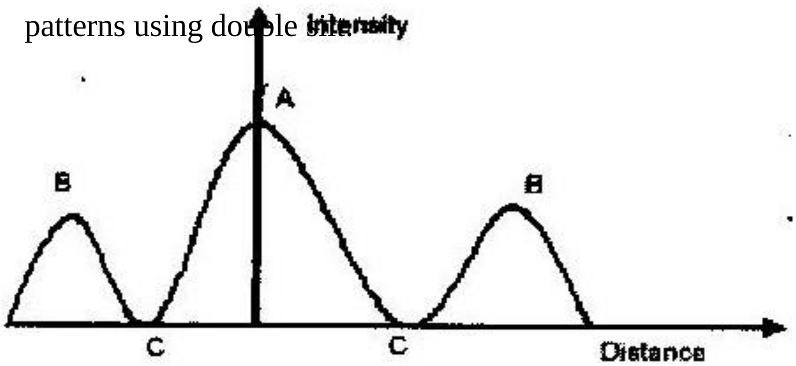
11. In an experiment using a ripple tank the frequency, f of the electric pulse generator was reduced to one third of its original value. How does the new wave length compare with the initial wavelength? Explain your answer.

12. a) Distinguish between stationary and progressive waves.

i) Describe how a young's double slit may be made in a laboratory.

ii) State the condition for a minimum to occur in an interference pattern.

The sketch graph shows the results of an experiment to study diffraction patterns using double slit.



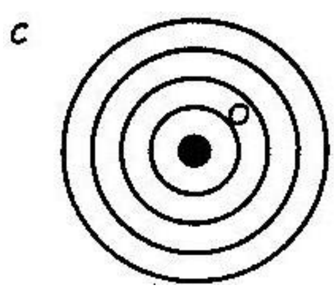
i) Sketch an experimental set up that may be used to obtain such a pattern.

ii) Name an instrument for measuring intensity

iii) Explain how the peaks labelled A and B and troughs labeled C are formed.

13. What measurable quantity is associated with colours of light?

14. Circular water waves generated by a point source at the centre O of the pond are observed to have the pattern shown in the Fig. Explain the pattern.



15. Explain how a piece of Polaroid reduces the sun's glare.

16. In an experiment to observe interference of light waves, a double slit is place close to the source.

i) State the function of the double silt.

ii) Describe what is observed on the screen.

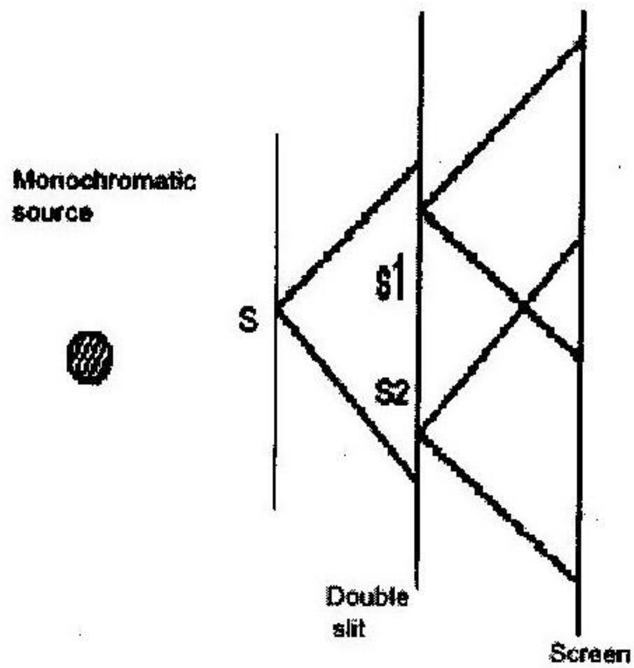
iii) State what is observed on the screen when

a) The slit separation S_1S_2 is reduced.

b) White light is used instead of monochromatic source.

17. The Fig. shows an experimental arrangement. S_1 and S_2 are narrow slits.

State what is observed on the screen when the source is:-

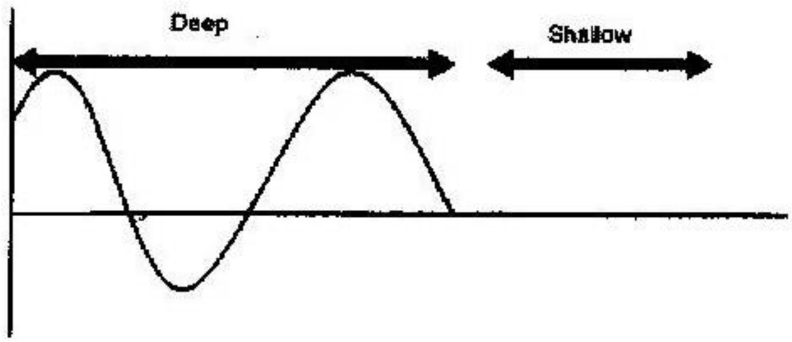


i) Monochromatic (ii) White light

18. (a) (i) Distinguish between transverse and longitudinal waves.

(ii) Give one example of a transverse wave and one example of a longitudinal wave.

(b) The fig shows the displacement of a practice in progressive wave incident on a boundary between deep and shallow regions.



(i) Complete the diagram to show what is observed after boundary. (Assume no loss of energy).

(ii) Explain the observation in (i) above.

19. State one difference between mechanical and electromagnetic waves.

20. Figure 4 shows the displacement-time graph for a certain wave.

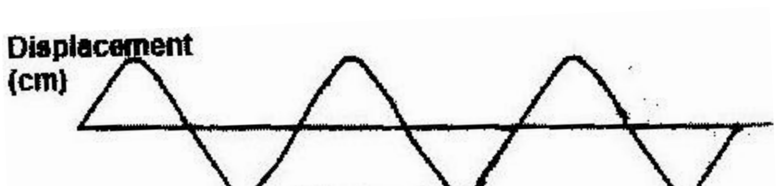


Figure 4

Determine the frequency of the wave. (3mks)

21. Figures 5 (a) and (b). Show wave fronts incident on barriers blocking part of the path.

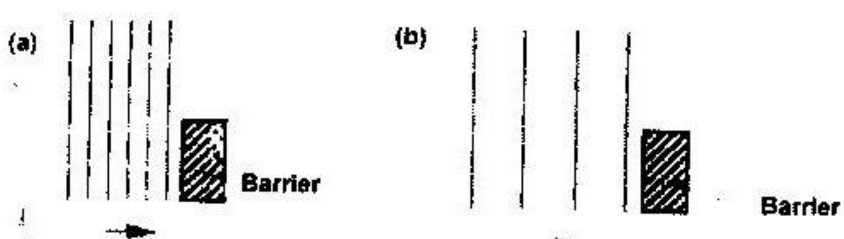


Figure 5

On the same figures sketch the wave fronts to show the behaviour of the waves as they pass each barrier and after passing the barrier. (1mk)

22. A source generates 40 waves per second. If the wavelength is 8.5cm. Calculate the time waves takes to reach a wall 120 meters from the source.
23. A gun is fired and an echo heard at the same place 0.5 s later. How far is the barrier which reflected the sound from the gun? (Velocity of sound = 340 m/s)
24. A man standing between two parallel walls fires a gun. He hears an echo after 1.5 seconds and another one after 2.5 seconds and yet another one after 4 seconds. Determine the separation of the walls. (Take velocity of sound 340 m/s)

TOPIC 7

ELECTROSTATICS II

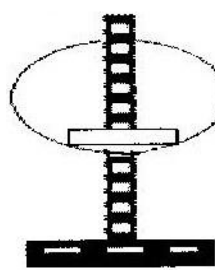
<u>PAST K.C.S.E QUESTIONS ON THE TOPIC</u>

1. a) i) State coulombs law of electrostatics force.

   ii) Define capacitance.

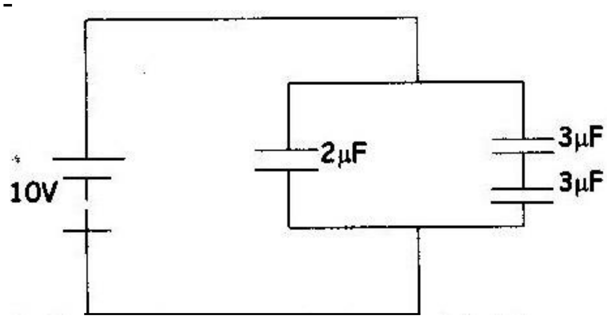
   b) Describe how the type of charge on a charged metal rod can be determined.

   c) The fig. shows a hollow negatively charged sphere with metal disk attached to an insulator placed inside. State what would happen to the leaf of an uncharged electroscope if the metal disk were brought near the cap of electroscope. Give a reason for your answer.



   d) State two ways of charging the magnitude of the deflection of the leaf of an electroscope.

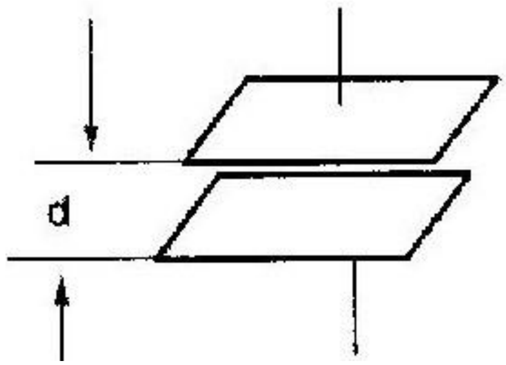
   e) The fig. shows an arrangement of capacitors connected to a 10v. D.C supply determine:-



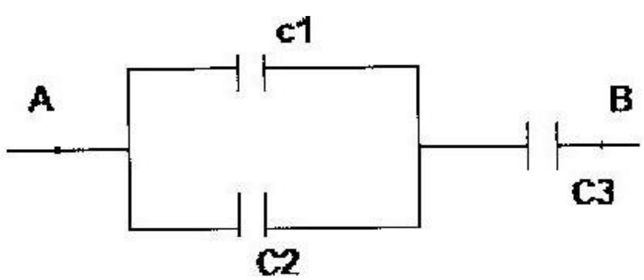
i) The charge stored in the 2μF capacitor

ii) The total capacitance of the arrangement

2. The figure below represents two parallel plates of a capacitor separated by a distance d. Each plate has an area of A square units. Suggest two adjustments that can be made so as to reduce the effective capacitance.

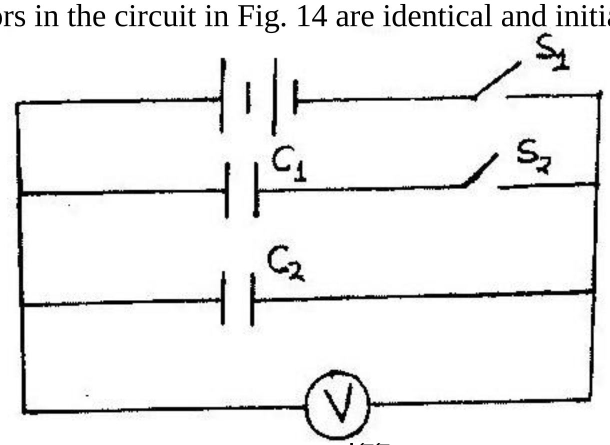


3. The Fig. Shows part of a circuit containing three capacitors. Write an expression for C_T. The effective capacitance between A and B.



4. State the law of electrostatic charge.

5. The capacitors in the circuit in Fig. 14 are identical and initially uncharged.



Switch S_1 is opened and switch S_2 closed. Determine the final reading of the voltmeter, V.

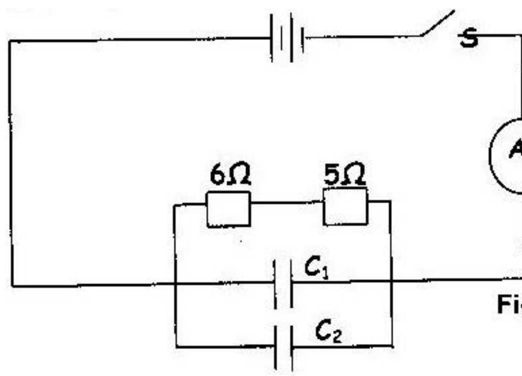


Figure 4

b) In the circuit diagram shown in Fig. 4 each cell has an e.m..f of 1.5 and internal resistance of 0.5Ω. The capacitance of each capacitor is 1.4μF.

When the switch s is closed determine the:

(i) Ammeter reading

(ii) Charge on each capacitor

6 A 2μF capacitor is charged to a potential of 200V, the supply is disconnected. The capacitor is then connected to another uncharged capacitor. The p.d. across the parallel arrangement is 80V. Find the capacitance of the second capacitor.

7 A 5μF capacitor is charged to a p.d of 200v and isolated. It is then connected to another uncharged capacitor of 10μF. Calculate

i) The resultant p.d

ii) The charge in each capacitor.

8 Three capacitors of 1.5μF, 2.0 μF and 3.0 μF are connected in series to p.d. of 12V. Find;-

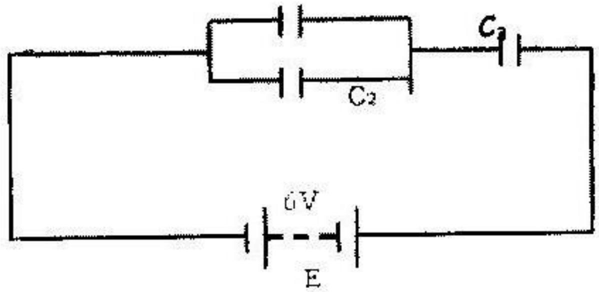
a) The combined capacitance.

b) The total charge stored in the arrangement

c) The charge in each capacitor.

9 In the circuit of the figure 3 C_1=2 μF, C_2 =C_3 = 0.5 μF and E is a 6V battery.

Calculate the total charge and p.d across C_1



10. In an experiment to study the variation of charge stored on capacitor and the potential difference across it, the following results were obtained.

Charge Q (μ)	0.08	0.16	0.24	0.32	0.40	0.56
p.d (v)	2.0	4.0	6.0	8.0	10.0	14.0

Plot a graph of charge Q. against p.d

Use your graph to determine:-

a) Capacitance of the capacitor.

b) Energy stored in the capacitor when the p.d across its plate is 10V.

TOPIC 8

HEATING EFFECT OF AN ELECTIC CURRENT

PAST K.C.S.E QUESTIONS ON THE TOPIC

1. An electric bulb rated 40W is operating on 240V mains. Determine the resistance of its filament
2. When a current of 2A flows in a resistor for 10 minutes, 15KJ of electrical energy is dissipated. Determine the voltage across the resistor.
3. How many 100W electric irons could be safely connected to a 240V moving circuit fitted with a 13A fuse?
4. A heater of resistance R1 is rated P watts, V volts while another of resistance R2 is rated 2P watts, $^{V}/_{2}$ volts. Determine $^{R1}/_{R2}$
5. State THREE factors which affect heating by an electric current.
6. What is power as it relates to electrical energy?
7. An electrical appliance is rated as 240V, 200W. What does this information mean?
8. An electrical heater is labelled 120W, 240V.

   Calculate;

   a) The current through the heating element when the heater is on.

   b) The resistance of the element used in the heater.
9. An electric toy is rated 100W, 240V. Calculate the resistance of the toy when operating normally.

TOPIC 9

QUANTITY OF HEAT

PAST K.C.S.E QUESTIONS FROM THE TOPIC

1. An electric heater rated 6000W is used to heat 1kg of ice initially at -10^{0}c

   until all the mass turns to steam. Given that

   Latent heat of fusion =334kJ^{-1}

   Specific heat capacity of ice= 2,260J kg $^{-1}$ K $^{-1}$

   Specific heat capacity of water = 4, 200J kg^{-1} K^{-1}

   Latent heat of vaporization = 2, 260KJ kg $^{-1}$ K $^{-1}$

   Calculate the minimum time required for this activity.

2 a) Explain why a burn from the steam of boiling water more severe that of water itself?

b) An energy saving stove when burning steadily has an efficiency of 60%. The stove melts 0.03kg of ice at 0^{0}c in 180 seconds.

Calculate; -

i) The power rating of the stove.

ii) The heat energy wasted by the stove.

c) A pump uses a mixture of petrol and alcohol in the ratio 4: 1 by mass to raise 100kg of water from a well 200m deep.

i) How much energy is given by 1g of mixture?

ii) If the pump is 40% efficient, what mass of this mixture is needed to raise the water?

d) i) Suggest two energy changes that accompany the changing of a liquid in a vapour phase.

ii) Explain why the time calculated in (i) above is minimum

3. An immersion heater rated 90W is placed in a liquid of mass 2kg. When the heater is switched on for 15 minutes, the temperature of the liquid rises from 20^0C to 30^0C. Determine the specific heat of the liquid.

4. State two factors that would raise the boiling point of water to above 100^0c

5. a) State what is meant by the term specific latent heat of vaporization

b) In an experiment to determine the specific latent heat of vaporization of water, steam at 100^0c was passed into water contained in a well-lagged copper calorimeter. The following measurements were made:

Mass of calorimeter = 50g

Initial mass of water = 70g

Final mass of calorimeter + water + condensed steam = 123g

Final temperature of mixture = 30^0C

(Specific heat capacity of water = 4200 J kg $^{-1}$K and specific heat capacity for copper = 390 J kg $^{-1}$ K^{-1})

Determine the

i) Mass of condensed steam

ii) Heat gained by the calorimeter and water

iii) Given that L is the specific latent heat of evaporation of steam

I. Write an expression for the heat given out by steam

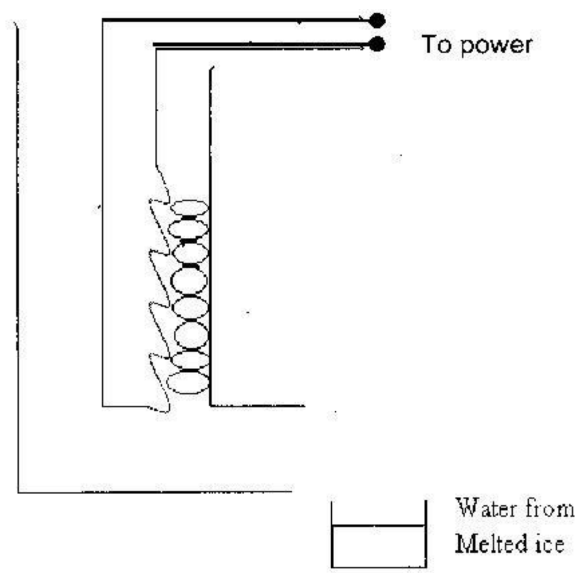
II. Determine the value of L.

6. A heating element rated 2.5 KW is used to raise the temperature of 3.0 kg of water through 50^0C. Calculate the time required to effect this.

(Specific heat capacity of water is 4200 J/kgK)

7. An electric heater is connected to the mains supply. A fault in the mains reduces the supply potential slightly. Explain the effect on the rate of heating of the heater. (3mk)

8. In an experiment to determine the power of an electric heater, melting ice was placed in a container with an outlet and the heater placed in the ice as shown in Fig. 2. The heater was connected to a power supply and switched on for some time. The melted ice was collected.

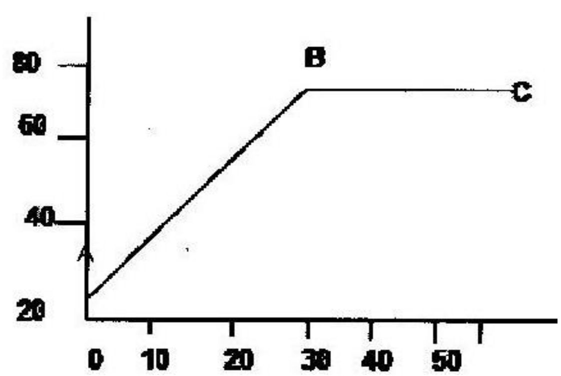


a) Other than the current and voltage, state the measurement that would be taken to determine the quantity of heat absorbed by the melted ice in unit time. (2mks)

b) If the latent heat of fusion of ice is L, show how measurements in (i) above would be used in determining the power P, of the heater, (2mks)

c) It is found that the power determined in this experiment is lower than the manufacturer's value indicated on the heater. Explain. (1mk)

Fig 11 shows the variation of temperature 'θ' with time t, when an immersion heater is used to heat a certain liquid. Study the figure and answer questions 9 and 10.



9. State the reason for the shape of the graph in the section labelled BC.

(1mk)

10. Sketch on the same axes the graph for another liquid of the same mass but higher specific heat capacity when heated from the same temperature.

(1 mk)

11State two factors that affect the melting point of ice. (2mks)

12.

a) Define the term specific latent heat of vaporization of a substance.

(1mk)

b) Figure 11 shows the features of a domestic refrigerators. A volatile liquid circulates the capillary tubes under the action of the compression pump.

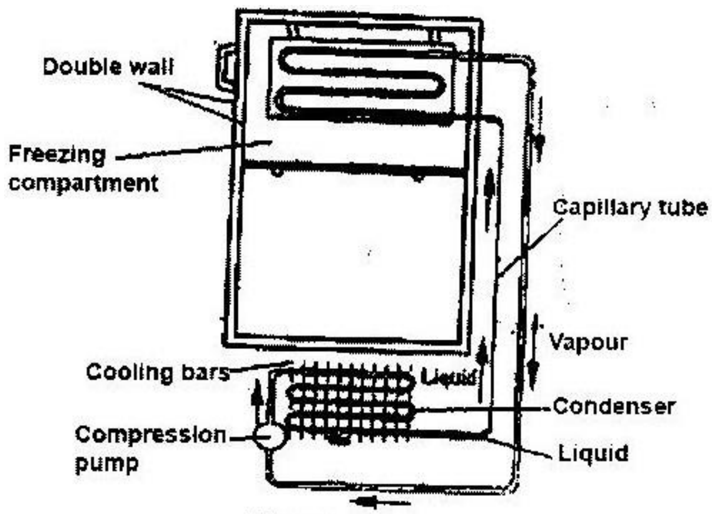


Figure 11

(i) State the reason for using a volatile liquid. (1mk)

(ii) Explain how the volatile liquid is made to vaporize in the cooling compartment and to condense in the cooling fins. (2mks)

(iii) Explain how cooling takes place in the refrigerator. (3mks)

(iv) What is the purpose of the double wall? (1mk)

c) Steam of mass 3.0g at 100^0c is passes into water of mass 400g at 10^0c. The final temperature of the mixture is T. The container absorbs negligible heat. (Specific latent heat of vaporization of steam= 2260 kJ/kg, specific heat capacity of water= 4200Jk^{-1})

i) Derive an expression for the heat lost by the steam as it condenses to water at temperature T. (2mks)

ii) Derive an expression for the heat gained by the water. (2mks)

iii) Determine the value of T. (2mks)

13. A can together with stirrer of total head capacity 60j/k contains 200g of water at 10^0 c. dry steam at 100^0c is passed in while the water is stirred until the whole reaches a temperature of 30^0c Calculate the mass of steam condensed.
14. An immersion heater which takes a current of 3A from 240V mains raised the temperature of 10kg of water 30^0c to 50^0c. How long did it take?
15. 100g of boiling water are poured into a metal vessel weighing 800g at a temperature of 20^0c if the final temperature is 50^0c. What is the specific heat capacity of the metal? (Specific Heat capacity of water 4.2 x 10^3J/kgk)
16. 0.02kg of ice and 0.01kg of water 0^0c are in a container. Steam at 100^0c is passed in until all the ice is just melted. How much water is now in the container?
17. In a domestic oil-fired boiler, 0.5kg of water flows through the boiler every second. The water enters the boiler at a temperature of 30^0c and leaves at a temperature of 70^0c, re-entering the boilers after flowing around the radiators at 30^0c. 3.0x 10^7J of heat is given to the water by each kilogram of oil burnt. The specific heat capacity of water is 4200Jkg $^{-1}$K^{-1}

    Use the information above to calculate the energy absorbed by the water every second as it passes through the boiler

Use the same information above to calculate the mass of oil which would need to be burnt in order to provide this energy.

18. You are provided with two beakers. The first beaker contains hot water at 70^0c. The second beaker contains cold water at 20^0c. The mass of hot water is thrice that of cold water. The contents of both beakers are mixed. What is the temperature of the mixture?

19. Calculate the heat evolved when 100g of copper are cooled from 90^0c to 10^0c. (Specific Heat Capacity of Copper = 390J/Kgk).

19. An-immersion heater rated 150w is placed in a liquid of mass 5 kg. When the heater is switched on for 25 minutes, the temperature of the liquid rises from 20 - 270^0c. Determine the specific heat capacity of the liquid. (Assume no heat losses)

TOPIC 10

THE GAS LAW

<u>PAST QUESTIONS ON THE TOPIC</u>

1. a) The table shows the results, which were obtained in an experiment on the behaviour of a gas.

Temperature	^{0}C	15	30	45	60	76	90
Volume (Cm^3)		42	45	47.5	51	54	57

(i) Plot a graph of volume against temperature,

(ii) Using the graph, determine the constant of proportionally k of the relationship for this range of temperature.

b) The pressure of helium gas of volume 10cm^3 decreases to one third of its original value at a constant temperature. Determine the final volume of the gas.

2. On a certain day when the temperature is 37^{0}c, the pressure in an open gas jar is 640mm of mercury. The jar is then sealed and cooled to the temperature of 17^{0}c.

Calculate the final pressure.

3. a) State Boyle's Law.

b) The table shows the results of Boyle's law experiment.

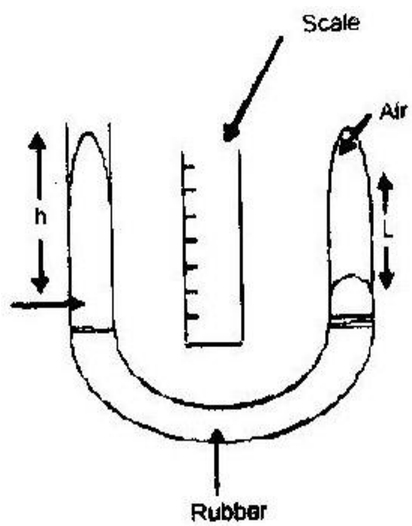
Pressure (Atmospheres)	1	1.3	1.5	1.8	2.3	2.6	3.2	2.7
Length of air column L(MM)	441	31	27.522	22	18	16	12.5	11

i) Copy the table and add values of 1/L (mm^{-1})

ii) With the aid of a labelled diagram describe the apparatus and arrangements used in getting these results.

iii) Plot a graph of pressure against 1/L

4. A student used the set up to investigate the variation of the volume of a trapped mass of air with pressure at constant temperature. By raising the open end of the tube he measured the corresponding values of the length I of the air column and the excess pressure, h.



(a) In determining the volume V of the air he measured the length I of the air column.

(i) What is the relationship between I and V?

(ii) State the assumption made?

(iii) what is the significance of the excess pressure.

(b) The table shows the results obtained using the set up.

Volume of gas (cm^3)	5.1	5.5	6.0	6.8	8.2	9.7
Excess pressure	291	224	123	77	-55	-139

(i) What does the negative excess pressure mean?

(ii) Copy the table and add the values of I/V (cm^3) and plot a graph of I/V against excess pressure.

(iii) From the graph:

a) Write an expression relating pressure and the volume of air.

b) Determine the slope of the graph.

c) Find the value of x of I/V when h = 0 and hence evaluate x/s. Comment on your answer.

5. a) i) Draw and label a diagram of the apparatus you would use to verify Charle's law.

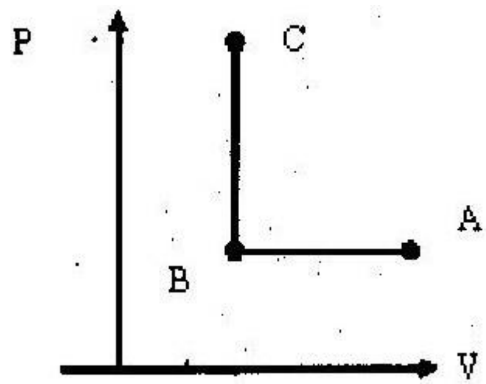
ii) Describe how to use the apparatus to verify the law.

b) A gas has a volume of $20cm^3$ at 27^0C and normal atmospheric pressure. Calculate the new volume of the gas if it is heated to 54^0C at the same pressure.

c) Show that the density of a fixed mass of gas is directly proportional to the pressure at constant temperature.

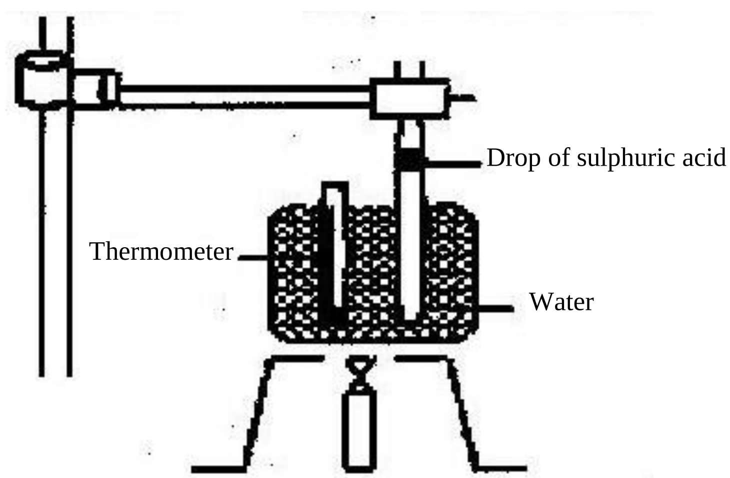
6. The figure shows changes in pressure, P, and volume V for a fixed mass of

a certain gas. Write down a statement of the gas law, which holds true from A to B. (2)



7. a) State the law that relates the volume of a gas to the temperature of the gas.

   b) The fig. below shows an experimental set up that may be used to investigate one of the laws. The glass tube has a uniform bore and it is graduated in millimeters.



i) Describe how the experiment is carried out and explain how the results obtained verify the law.

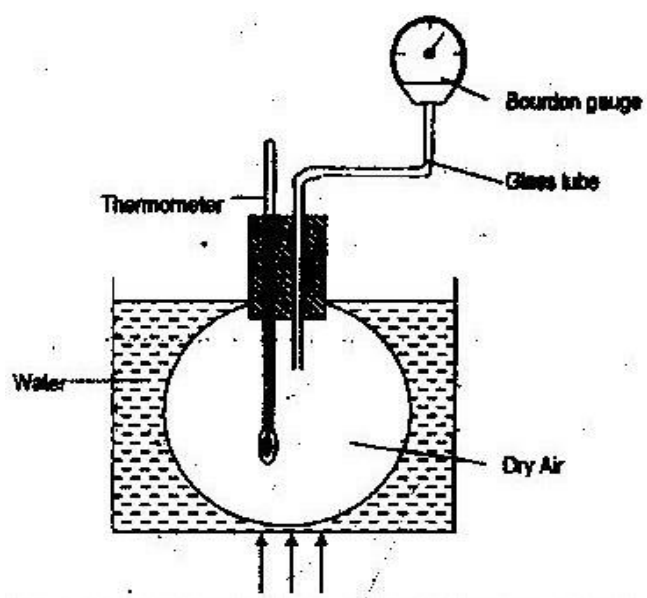
ii) State two limitations of the set up.

8. Draw axes and sketch the P – V graph for a gas obeying Boyle's Law.

9. Two identical containers A and B are placed on a bench. Container A is filled with oxygen gas and B with hydrogen gas masses. If the containers are maintained at the same temperature, state with reason, the container in which pressure is higher.

10. a) The figure below shows a simple set up for pressure law apparatus.

Describe how the apparatus may be used to verify pressure law.



b) The graph in the figure below shows the relationship between the pressure and temperature for a fixed mass of an ideal gas at constant volume.

i) Given that the relationship between pressure, P, and temperature, t in Kelvin is of the form P=kT + C, where k and C are constants, determine from the graph, values of k and C.

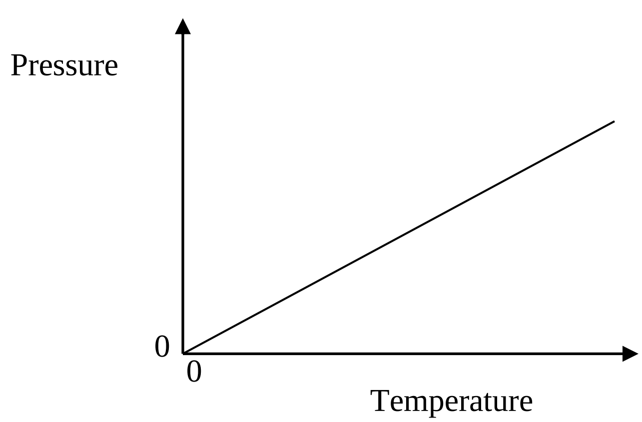
ii) Why would it be impossible for pressure of the gas to be reduced to zero in practice?

c) A gas is put into a container of fixed volume at a pressure of 2.1 x 10^5 Nm^{-2} and temperature 27^0C. The gas is then heated to a temperature of 327^0C. Determine the new pressure.

11. Draw axes and sketch a graph of pressure (p) against reciprocal of volume (1/v) for a fixed mass of an ideal gas at a constant temperature.

12. A balloon is filled with air to a volume of 200ml at a temperature of 293 k. Determine the volume when the temperature rises to 353 k at the same pressure (3mks)

The graph in figure 7 shows the relationship between the pressure and temperature for an ideal gas. Use this information in the figure to answer questions 13 and 14.



13. State the unit of the horizontal axis. (1mk)

14. Write a statement of the gas law represented by the relationship.

(1mk)

15. A balloon filled with organ gas a volume of 200 cm^3 at the earth's surface where the temperature is 20^0C, and the pressure 760mm of mercury. If it is allowed to ascend to a height where the temperature is 0^0C and the pressure 100mm of mercury, calculate the volume of the balloon.

16. A mass of Oxygen occupies a volume of $0.01m^3$ at a pressure of 1×10^5 pa and a temperature 0^0C. If the pressure is increased to 5×10^6 pa and the temperature is increased to 25^0C. What volume will the gas occupy?

17. An empty barometer tube of length 90cm is lowered vertically with its mouth downwards into a tank of water. What will be the depth at the top of the tube when the water has risen 15cm inside the tube, given that the atmospheric pressure is 10m head of water?

18. A hand pump suitable for inflating a football has a cylinder which is 0.24m in length and an internal cross-sectional area of 5.0×10^{-4} m^2. To inflate the football the pump handle is pushed in and air is pumped through a one-way valve. The valve opens to let air in to the ball when the air pressure in the pump has reached 150 000 pa. (Assume the air temperature remains constant}

    a) If the pressure in the pump is initially 100 000 pa, calculate how far the piston must be pushed inwards before the one way valves opens.

(b) When the one-way valve opens the total pressure in the cylinder will be 150 000 pa. What force will be exerted on the piston by the air in the cylinder?

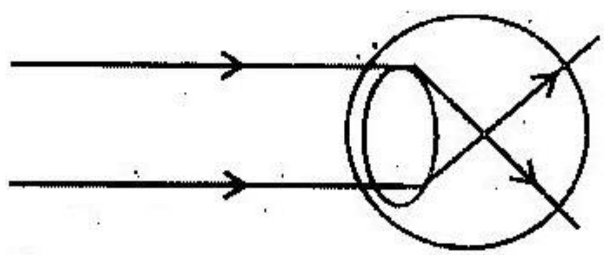
FORM FOUR WORK

TOPIC 1

THIN LENSES

PAST K.C.S.E QUESTIONS ON THE TOPIC

1. The figure below shows how a distant object is focused in a defective eye.



i) State the nature of the defect.

ii) Suggest suitable lens to correct the defect.

2. a) You are provided with a rectangular glass block, two pins and a piece of white paper. Describe how you would use them to determine the refractive index of the glass using real and apparent image method.

b) An object O is placed 15cm from a converging lens of focal length 10cm.

i) At what distance should a screen be placed so that a focused image is formed on it?

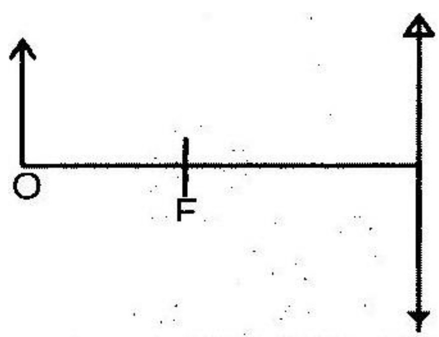
ii) A diverging lens of focal length 37.5 cm is placed half way between the converging lens and the screen. How far should the screen be from the diverging leans in order to receive a focused image?

c) Two lenses L_1 and L_2 placed 12cm from each other. The focal length of L_2 is 4cm. An object 5mm high is placed 4cm from L_1.

i) Construct a scaled ray diagram on a graph paper to obtain the position of the final image as would be observed by a person on the right hand side of L_2

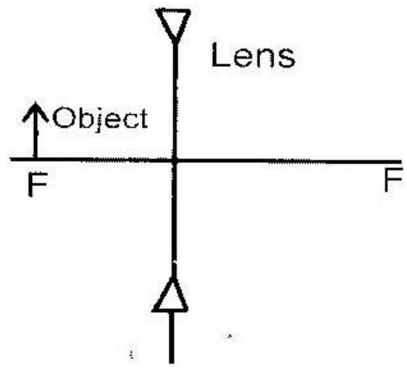
ii) Determine the magnification obtained by the arrangement.

3. The figure below represents and object O placed 10cm in front of a diverging lens. F is the focal point of the lens.



Draw rays to locate the position of the image. Determine the image distance.

4. A vertical object is placed at the focal point F of a diverging lens as shown in figure 16.

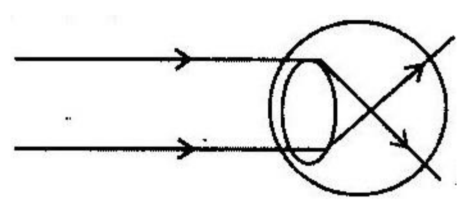


Sketch a ray diagram to show the image of the object. (3mks)

5. a) Describe with the aid of labeled diagram an experiment to determine the focal length of the lens when provided with the following; an illuminated object, a convex lens, a lens holder, a plane mirror and a metre rule. (5mk)

   b) A small vertical object is placed 28cm in front of a convex lens of focal length 12cm. On the grid provided, draw a ray diagram to locate the image. The lens position is shown. (Use a scale: 1 cm represents 4 cm).

   c) Fig. 1 shows a human eye with a certain defect.



i) Name the defect. (1mk)

ii) On the same diagram, sketch the appropriate lens to correct the defect and sketch rays to show the effect of the lens. (2mks)

6. a) Figures 11 (a) and (b) show diagrams of the human eye.

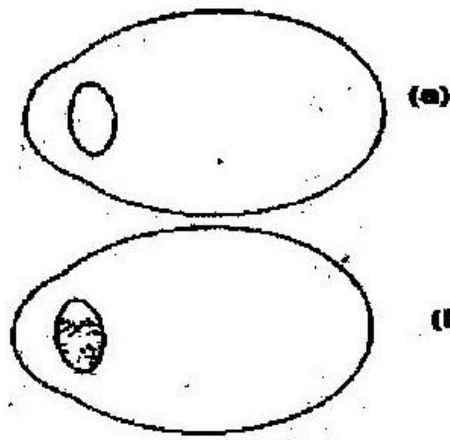


Figure 11

i) Sketch in figure 11(a) a ray diagram to show short sightedness. (1mk)

ii) Sketch in figure 11(b) a ray diagram to show how a lens can be used to correct the shortsightedness. (2mks)

b) Figure 12 shows the features of a simple camera.

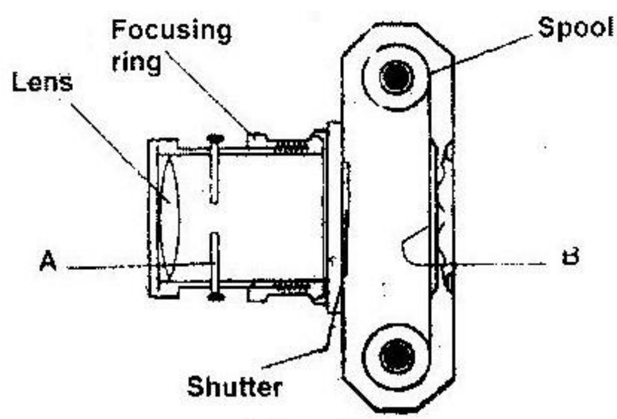


Figure 12

i) Name the parts labelled A and B. (2mks)

ii) A still object is placed at a certain distance from the camera. Explain the adjustments necessary for a clear image of the object to be formed. (2mks)

iii) State the functions of the shutter and the parts labelled A and B (3mks)

c) A lens forms clear image on a screen when the distance between the screen and the object is 80cm. If the image is 3 times the height of the object, determine

i) The distance of the image from the lens. (3mks)

ii) The focal length of the lens. (2mks)

7. An image formed on a screen is three times the size of the object. The object and the screen are 80cm apart when the image is sharply focused. Determine the focal length of the lens.

8. A luminous object and a screen are placed on an optical bench a converging lens is placed between them to throw a sharp image of the object on the screen, the magnification is found to be 2.5. The lens is now moved 30cm nearer to the screen and a sharp image is again formed. Calculate the focal length of the lens.

9. An object is placed 16cm from a converging lens of focal length 12cm. Find.

(i) Position of image.

(ii) Nature and

(iii)Magnification of the image.

10. An object is placed 15cm from a diverging lens and the image is formed 6cm from the lens. What is the focal length of the lens?
11. Calculate the power of a lens whose focal length is given as 10cm.
12. Explain differences between the eye and the camera. State also the similarities.

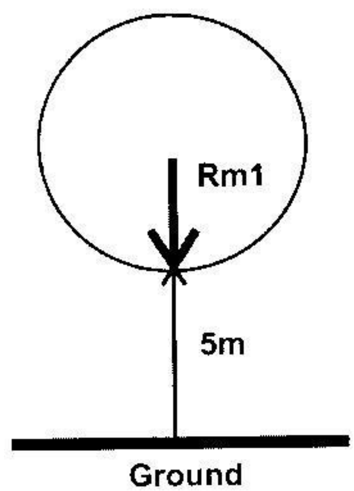
TOPIC 2

UNIFORM CIRCULAR MOTION

PAST K.C.S.E QUESTIONS ON THE TOPIC

1. A light inextensible string of length L is fixed at its upper end and support a mass m at the other end. m is rotated at horizontal plane or radius r as shown. The maximum tension the string can withstand without breaking is 2N. Assuming the string breaks when the radius is maximum, calculate the velocity of the mass when the string breaks, given that L 1.25m, and m= 0.1kg.

2. The diagram below shows a mass m, which is rotated in a vertical circle. The speed of the mass is gradually increased until the string breaks. The string breaks when the mass is at its lowest position A and at a speed of $30ms^{-1}$. Point a is 5m above the ground.



a) Show on the diagram.

i) The initial direction of the mass at the point the string breaks.

ii) The path of the mass from A until it strikes the ground at a point b.

b) Calculate;

i) The time the mass takes to reach the ground after breaking off.

ii) The horizontal distance the mass travels before it strikes the ground.

iii) The vertical velocity with which the mass strikes the ground.

3. State the principle by which a speed governor limits the speed of a vehicle.

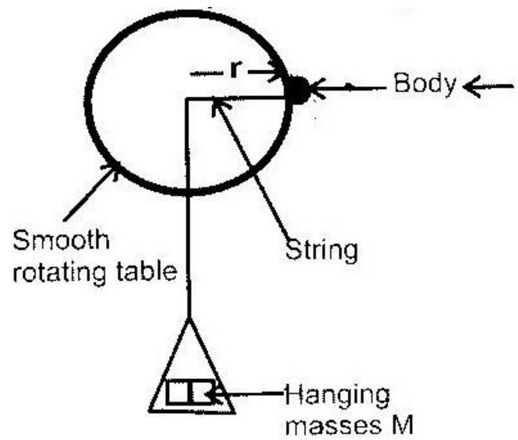
4. The rear wheel of a certain car has a diameter of 40cm. At a certain speed of the car, the wheel makes 7 revolutions per second. A small stone embedded in the tyre tread flies off initially at an angle of 45^0 to the ground. Determine the initial velocity of the pebble (take $\pi = {}^{22}/_{7}$)

5. a) Explain why a pail of water can be swung in a vertical circle without the water pouring out.

b) A car of mass 1,200kg is moving with a velocity of 25m/s around a flat bend of radius 150m. Determine the minimum frictional force between the tyres and the road that will prevent the car from sliding off.

6. a) The fig shows the diagram of a set up to investigate the variation

of centripetal force with the radius r of the circle in which a body rotates. Describe how the set up can be used to carry out the investigation



b) The table shows results obtained from an investigation similar to the one in part (a)

Mass, m(g)	60	50	40	30	20
Radius, r (cm)	50	41	33	24	16

i) Plot a graph of force, F (y-axis) on the body against the radius r (in metre)

ii) Given that the mass of the body is 100g, use the graph to determine the angular velocity.

7. A small object moving in a horizontal circle of radius 0.2m makes 8 revolutions per second. Determine its centripetal acceleration.

8. (a) Define the term angular velocity. (1mk)

(b) A body moving with uniform angular velocity found to have covered an angular distance 170 radians in t seconds. Thirteen seconds later it is found to have covered a total angular distance of 300 radians. Determine t (3mks)

(c) Fig. 8 shows a body of mass m attached to the centre of rotating table with a string whose tension can be measure. (This device for measuring the tension is not shown in the figure).

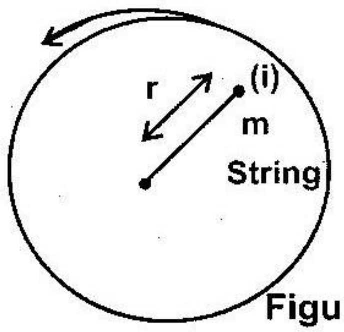


Figure 8

The tension, T, on the string was measured for various values of angular velocity, The distance r of the body from the centre was maintained at 30cm. Table 1 shows the results obtained.

Table 1

Angular Velocity (rads $^{-1}$)	2.0	3.0	4.0	5.0	6.0
Tension T (N)	0.04	0.34	0.76	1.30	1.96

(5mks)

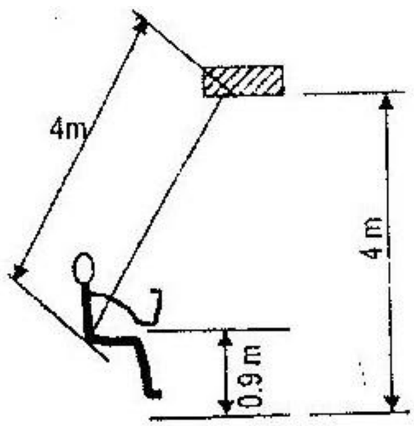
i) Plot the graph of T (y-axis) against W^2

ii) From the graph, determine the mass, m, of the body given that $T= mw^2r-C$ where C is a constant (4mks)

iii) Determine the constant C and suggest what it represents in the set up.

(2mks)

9. A child of mass 20kg sits on a swing of length 4m and swings through a vertical height of 0.9m as shown in the figure below.



Determine the:

i) Speed of the child when passing through the lowest point.

ii) Force exerted on the child by the seat of the swing when passing through the lowest point.

10. a) State what is meant by centripetal acceleration?

b) Figure 12 shows masses A, B and C placed at different points on a rotating table.

The angular velocity, @ of the table can be varied.

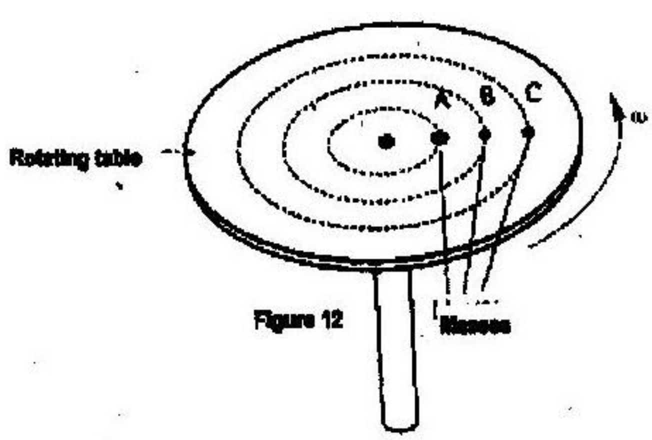


Figure 12

i) State two factors that determine whether a particular mass slides off the table or not. (2mks)

ii) It is found that masses slide off at angular velocities $@_{A,}$ $@_{B.}$ $@_{c}$ of in decreasing order. (1mk)

c) A block of mass 200g is placed on a frictionless rotating table while fixed to the centre of the table by a thin thread. The distance from the centre of the table to the block is 15cm. If the maximum tension the thread can withstand is 5.6N, determine the maximum angular velocity the table can attain before the thread cuts. (4mks)

11. Find the maximum speed with which a car of mass 100kg can take a corner of radius 20m if the coefficient of friction between the road and the tyres is 0.5.
12. An object of mass 0.5kg is rotated in a horizontal circle by a string 1m long. The maximum tension in the string before it breaks is 50N. Calculate the greatest number of revolutions per second the object can make.
13. An astronaut is trained in a centrifuge that has an arm length of 6m. If the astronaut can stand the acceleration of 9g. What is the maximum number of revolutions per second that the centrifuge can make?
14. A small body of 200g revolves uniformly on a horizontal frictionless surface attached by a cord 20cm long to a pin set on the surface. If the body makes two revolutions per second. Find the tension of the cord.

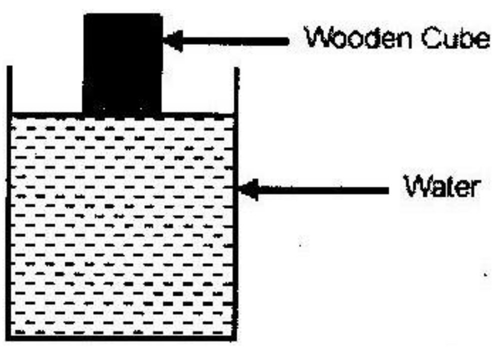
15. A circular highway curve on a level ground makes a turn 90^0. The highway carries traffic at 120km/h. Knowing that the centripetal force on the vehicle is not to exceed $^1/_{10}$ of its weight, calculate the length of the curve.
16. A turntable of record player makes 33 revolutions per minute. What is the linear velocity of a point 0.12m from the center?
17. An object 0.5kg on the end of a string is whirled around in a vertical circle of radius 2m, with a speed of 10m/s. What is the maximum tension in the string?

TOPIC 3

FLOATING AND SINKING

PAST K.C.S.E QUESTIONS ON THE TOPIC

1. State how a hydrometer may be used to test whether a car battery is fully charged.
2. Determine the density of glass that weighs 0.5N in air and 0.3N in water.
3. A mass of 120g half immersed in water displaced a volume of 20cm^3. Calculate the density of the object.
4. A solid displaced 5.5 cm^3 of paraffin when floating and 20cm^3. Calculate the density of the object.
5. The figure below shows a cube of a certain wood whose density is the same as that of water. The cube is held on the surface of the water in a long cylinder. Explain what happens to the cube after it is released.



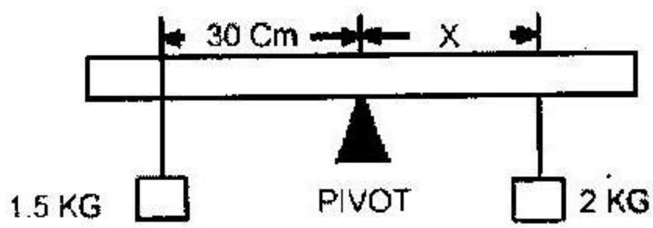
6. A right angled solid of dimensions 0.02m by 0.02m by 0.2m and density 2,700kg/m^3 is supported inside kerosene of density 800kg/m^3 by a thread which is attached to a spring balance. The long side is vertical and the upper surface is 0.1m below the surface of the kerosene.

i) Calculate the force due to the liquid on the lower upper surface of the solid.

ii) Calculate the up thrust and determine the reading on the spring balance.

7. A solid copper sphere will sink in water while a hollow copper sphere of the same mass may float. Give a reason for this.

8. A uniform plank of wood is pivoted at its centre. A block of wood of mass 2kg is balanced by a mass of 1.5 placed 30cm from the pivot as shown.



i) Calculate the distance X

ii) When the same block of wood is partially immersed in water, the 1.5kg mass need to be placed at 20cm from the pivot to balance it. Calculate the weight of the water displaced.

9. A block of glass of mass 250g floats in mercury. What volume of the glass lies under the surface of the mercury? (Density of mercury is 13.6×10^3).

10. When a piece of metal is placed on water, it sinks. But when the same piece of metal is placed on a block of wood, both are found to float. Explain this observation.

11. a) State the law of floatation. (1mk)

b) Figure 13 shows a simple hydrometer.

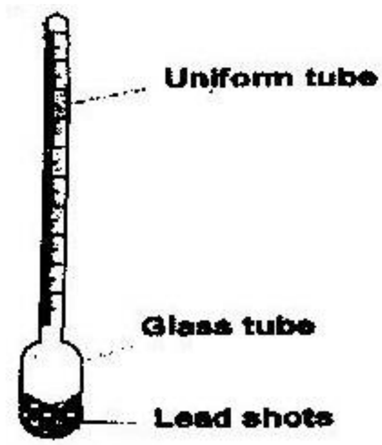


Figure 13

i) State the purpose of the lead shots in the glass bulb (1mk)

ii) How would the hydrometer be made more sensitive? (1mk)

iii) Describe how the hydrometer is calibrated to measure relative density. (2mks)

c) Figure 14 shows a cork floating on water and held to the bottom of the beaker by a thin thread

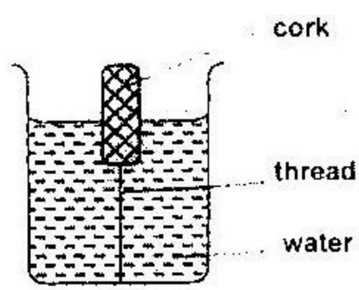
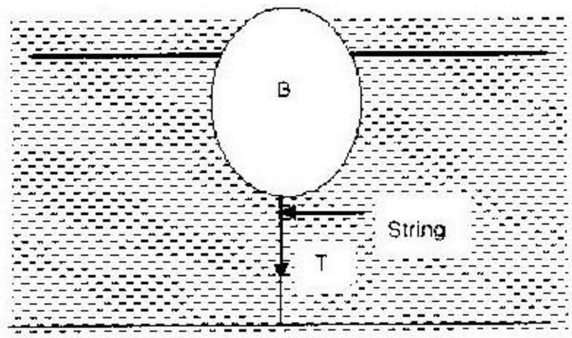


figure 14

i) Name the force acting on the cork. (3mks)

ii) Describe how each of the forces mentioned in (i) above changes when water is added into the beaker until it fills up. (3mks)

12. The ball B shown below has a mass of 12kg and a volume of 50litres. It is held in position in sea water of density 104 kgm^{-3} by a light cable fixed to the bottom so that $^4/_5$ of its volume is below the surface determine the tension in the cable.



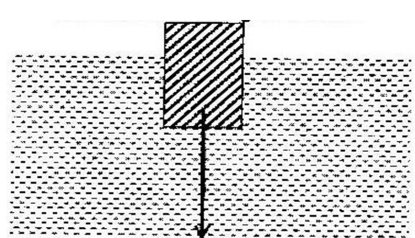
13. A balloon of volume $1.2x10^7$ cm^3 is filled with hydrogen gas of density 9.0 x 10^{-5}/g/cm^3. Determine the weight of the fabric of the balloon.

14. A boat whose dimensions are equivalent to those of a rectangular figure of 5m long by 2m wide floats in fresh water. If this boat sinks 10cm deeper as a result of passengers climbing on board, determine the total weight of these passengers.

15. One fifth of the volume of an iceberg stands above the water surface. If the density of the seawater is $1.2g/cm^3$, determine the density of iceberg.

16. A hydrometer of mass 10g is placed in paraffin of density $0.8g/cm^3$. Determine the length of the paraffin if its bulb has a volume of $4cm^3$ and its stem has a cross section area of 0.5 cm^2

17. An object of mass 50g floats with 20% of its volume above the water surface as shown below. The tension in the string is 0.06N.



a) Calculate the up thrust experienced by the object.

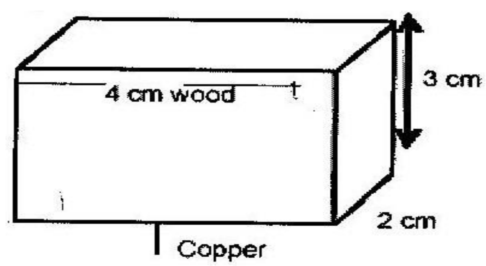
b) Volume of water displaced.

c) The density of the object

d) What would happen if the string was cut?

18. A piece of marble of mass 1.4kg and relative density 2.8 is supported by a light string from a spring balance. It is then lowered into the water fully. Determine the up thrust.

19. The block of wood of mass 80g is pulled just below the water surface by a piece of copper of density 9g/cm^3 using a string of negligible weight. What is the mass of the piece of copper?



20. If the body weight 1.80N in air and 1.62N when submerged in a liquid of relative density 0.8, find the volume of the solid.

The density of the solid

TOPIC 4

ELECTROMAGNETIC (EMS) SPECTRUM

PAST KCSE QUESTIONS ON THE TOPIC

1. State one-way of detecting ultra violet radiation.
2. Arrange the following radiations in order of increasing wavelengths.

   Ultraviolet Gamma Rays

   Radio Waves Infra Red

3 Name two types of electromagnetic radiations whose frequencies are greater than that of visible light.

4. Calculate the wavelength of the KBC FM radio waves transmitted at a frequency of 95.6 mega hertz.
5. The chart below shows an arrangement of different parts of the electromagnetic spectrum. Complete the table.

Type of Radiation	Detector	Uses
Ultraviolet	Photographic paper, fluorescent material, phototransistor	
Radio waves	Balanced thermometer	Warmth sensation, making toast.
Radio waves		Communication

6. Arrange the following in order of increasing frequency. Visible light, infrared radiation, x-rays, u.v. radiation, radio waves.
7. State the difference between X-rays and gamma rays in the way in which they are produced (1mk)

8. Other than a photographic film state one other detectors of

    i) X-rays

    ii) UV,

    iii) Visible spectrum

    iv) Infra-red radiations

9. State 3 uses of infra- red radiation.

10 Name two properties of ultra-violent radiation.

11 State the origin of all em-radiation from radio waves to x-rays.

12 State where Gamma rays originate.

13. State one common property for electromagnetic waves and state one use of microwaves and one for ultraviolet radiation.

14. State one common properties for electromagnetic waves and state one use of microwaves and one for ultraviolet radiation.

15. Name the radiation represented by A.

    Radio Infrared visible A- rays Gamma Rays

16. Complete the table below to show the name and use of some types of electromagnetic radiation.

Type of radiation	Use
	Sending information to and from satellites
	Normal photography
	Producing shadow pictures of bones
Gamma rays	

17. Give one important use of each of the following em-waves.

   i) Microwaves

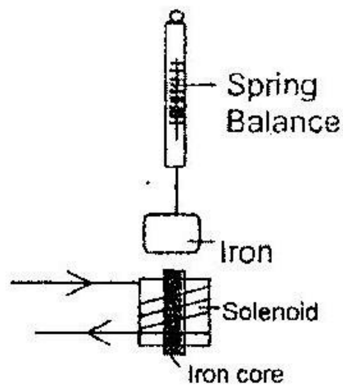
   ii) Infrared

TOPIC 5

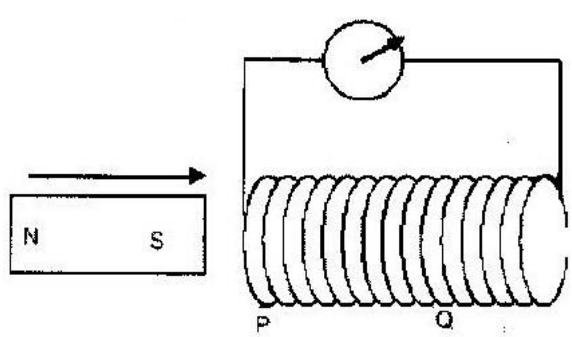
ELECTROMAGNETIC INDUCTION (EM I)

<u>PAST KCSE QUESTIONS ON THE TOPIC</u>

1. The diagram in figure 1 shows an arrangement that may be used to investigate how electromagnetic force varies with current. Explain how the arrangement may be used for this investigation.



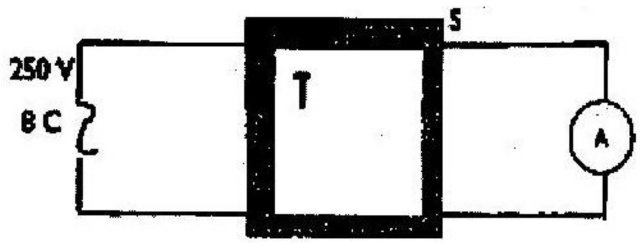
2 a) The free ends of a coil are connected to a galvanometer. When the north pole of a magnet is moved towards the coil, the pointer deflects towards the coil, the pointer deflects towards the right as shown. State with reason the behaviour of the pointer in the following cases.



i) The north pole of the magnet is held stationary near p.

ii) The south pole of the magnet is made to approach the coil from Q.

c) Two coils T and S are wound on a soft iron core as shown. T has 1000 turns while S has 600 turns and resistance of 100Ω



Calculate the maximum current measured by the ammeter.

3. Calculate the peak value of an alternating current which has a root mean square value of 3.0A.
4. A large sub station transformer is used to step down voltage from 11,000V to 450V.

   i) Determine the ratio of the turns in the primary to secondary coils.

   ii) How is the efficiency of this transformer ensured?

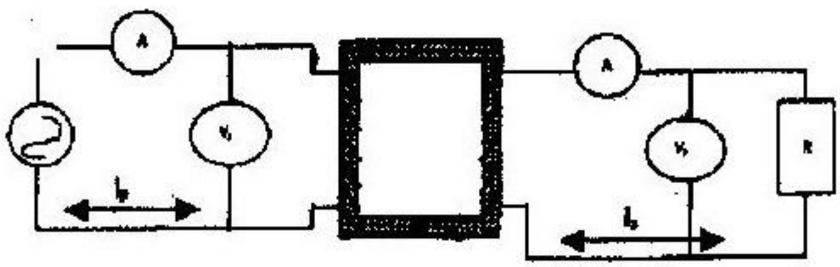
   iii) State one function of the core in a transformer.
5. A generator produces a peak voltage of 220v. What is the root mean square value of this voltage?.

6. Name any two ways by which a transformer loses energy.
7. The Fig; Represents a transformer connected to an ac source and a resistor

   R. Compare the magnitudes of the:

   i) Voltages V_p and V_s

   ii) Currents I_p and I_s



8. (a)

   i) A researcher studying the behaviour of step up transformer made the following observation. 'More joules per coulomb and fewer coulombs per second at the output than at the input terminals'. Explain why the observation does not imply a violation of the principle of conservation of energy.

   ii) A transformer of 480 turns in the primary coil used to connect a 9-volt a.c. electric device to a 240V a.c. mains power supply. Calculate the number of turns in the secondary coil

9. What causes electromagnetic damping in a moving coil galvanometer?
10. State how Eddy Currents are reduced in a transformer.

11. A transformer in a welding machine supplies 6 volts from a 240V mains supply. If the current used in the welding is 30A. Determine the current in the mains.

12. A hair drier is rated 2500W, 240v. Determine its resistance. (3mks)

13.

A heater of resistance R_1 is rated 2p watts, v volts, Determine R_1/R_2 (3mks)

14.

a) State Len's law of electromagnetic induction. (1mk)

b) Figure 13 shows a simple microphone in which sound waves from the person talking cause the cardboard diaphragm to vibrate.

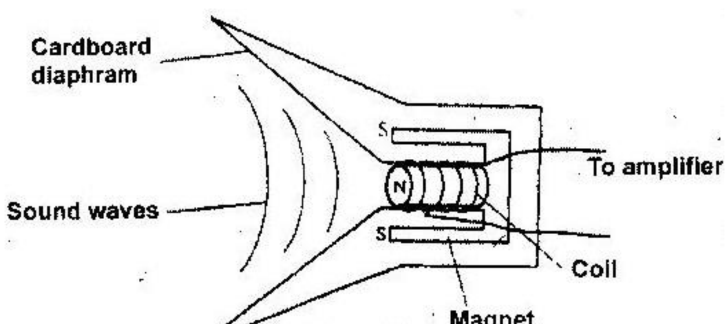


Figure 13

i) Explain how a varying current is induced in the cell when the diaphragm vibrates. (3mks)

ii) State two ways in which the induced current (i) above can be increased.

(2mks)

c) A transformer with 1200 turns in the primary circuit and 120 turns in the secondary circuit; it produces heat at the rate of 600w. Assuming 100% efficiency, determine the:

i) Voltage in the secondary circuit. (2mks)

ii) Current in the primary circuit. (2mks)

iii) The current in the secondary circuit. (1mark)

15. An ac flows in a resistor of 100Ω. If the peak value of the voltage across the resistor is 60V. Calculate.
    a) The rms. Voltage
    b) The rms. Current
16. A student designed a transformer to supply a current of 10A at a potential difference of 60V to a motor from an A.C mains supply of 240V. If the efficiency of the transformer is 80%, determine the;
    a) Power supplied to the transformer
    b) Current in the primary coil.
17. An immersion heater rated 300W is used continuously for 45 minutes per day. Calculate the cost per week at 60cts per unit.
18. A radio transmitter directs pulses of waves towards a satellite from which reflections are received 10 millisecond after transmission. Determine the distance of the satellite from the radio transmitter. (Speed of radio waves= $3 \times 10^{8} ms^{-1}$)
19. An electric bulb with a filament resistance 300Ω is connected to a 2v main supply, determine the energy dissipated in 2 minutes.

20. A 50w bulb is used continuously for 36 hours. Determine the cost of energy consumed at a cost of Kshs. 2 per unit.

TOPIC 6

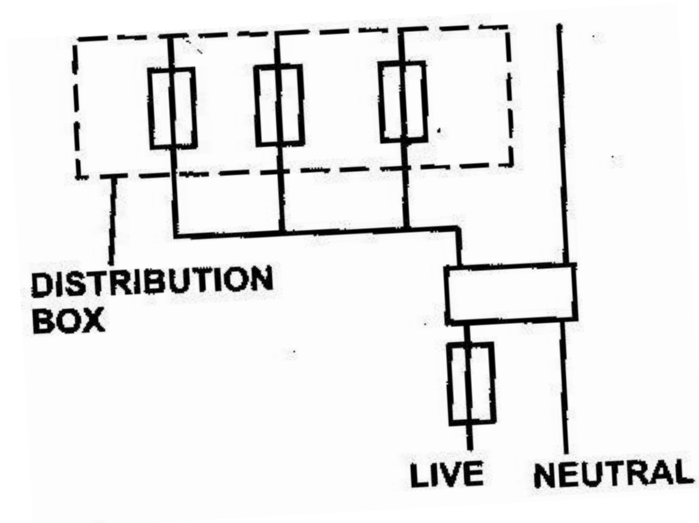
MAIN ELECTRICITY

PAST KCSE QUESTIONS ON THE TOPIC

1. What current will a 500Ω resistor connected to a source of 240V draw?
2. Name a device used to change light energy directly into electrical energy.
3. When a current of 2.0A flows in a resistor for 10 minutes, 15000 Joules of electrical energy is dissipated. Determine the voltage across the resistor.
4. An electric bulb rated 40W is operating on 240v mains. Determine the resistance of its filament.
5. An electric heater rated 240V, 3000V is to be connected to a 240V mains supply, through a 10A fuse. Determine whether the fuse is suitable or not.
6. A 60W bulb is used continuously for 36 hours. Determine the energy consumed, giving your answer in kilowatt hour (kwh)
7. How many 100W electric irons could be safely be connected to a 240V mains circuit fitted with a 13A fuse?
8. Find the maximum number of 75W bulbs that can be connected to a 13A fuse on a mains supply of 240V.
9. Determine the cost of using an electrical iron box rated 1500W, for a total of 30 hours given that the cost of electricity per kwh is Kshs. 8.

10. State Ohm's law.
11. Electrical energy costs Kshs. 1 per Kwh unit. Find the cost of using an electric heater of power 1.5 Kw for a day.

12. The figure below represents part of the main circuit.



i) Explain why it is not advisable to fix a fuse on neutral line.

ii) Explain why there are fuses of different rating in the distribution box.

13. Calculate the power of a devise which has a p.d of 250V applied across it when a current of 0.5A passes through it.

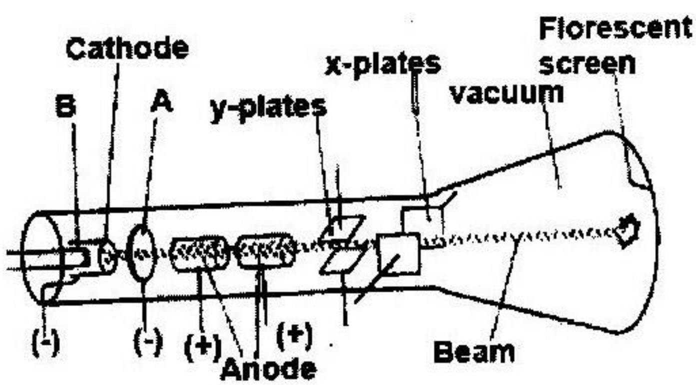
14. An electric iron box is rated 2500W and uses a voltage of 240V. Given that electricity costs Kshs. 1.10 per Kwh, what is the cost of using it for 6 hours?

TOPIC 7

CATHODE RAYS AND CATHODE RAY TUBE

PAST KCSE QUESTIONS ON THE TOPIC

1. State two differences between the cathode ray tube (CRT) of a T.V and the cathode ray oscilloscope (CRO)
2. Distinguish between a photon and a quantum.
3. How does the energy of ultra violet light compare to that of yellow light given that the energy E of a wave frequency f, is given by E = hf, where h is plank's constant?
4. A photon has an energy of $5x10^{-19}$J. Calculate the wavelength associated with this photon.
5. The control grid in a cathode Ray Oscilloscope (CRO) is used to control brightness of the beam on the screen. How is this achieved?
6. a) Figure 14 shows the features of a cathode ray tube.



i) Name the parts labelled A and B. (2mks)

ii) Explain how the electrons are produced in tube. (2mks)

iii) State two functions of the anodes. (2mks)

iv) At what part of the cathode ray tube would the time base be connected? (1mk)

v) Why is a vacuum created in the tube? (1mk)

b) The graph in Figure 15 was obtained on a cathode ray oscilloscope (CRO) screen when the output of an a.c generator was connected to the input of the CRO. The time-base calibration of the CRP was set at 20 milliseconds per centimeter and the y- gain at 5 volts per centimeter.

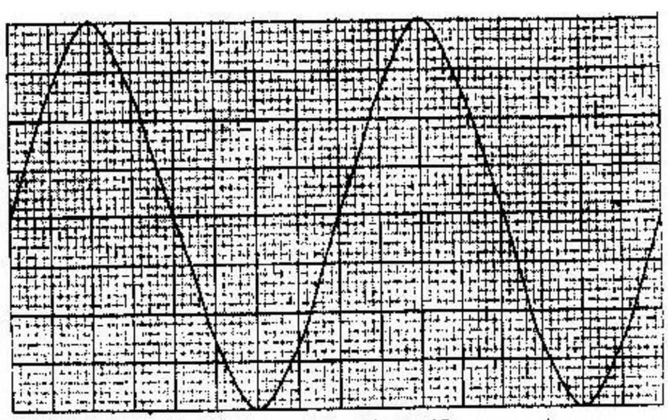


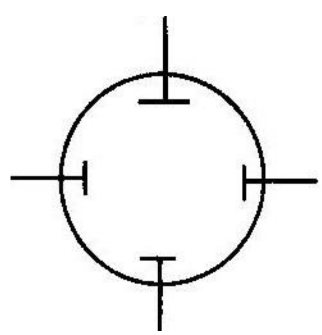
Figure 15

i) Determine the pick voltage of the generator. (2mks)

ii) Determine the frequency of the voltage. (3mks)

iii) On the same grid, redraw the graph for the same voltage when the time base calibration is set at 40 milliseconds per centimeter and the 7-gain at 10volts per centimeter. (Show at least one complete cycle). (2mks)

7. Sketch the picture seen on the screen of a cathode ray oscilloscope when the oscilloscope is adjusted so that the spot is in the middle of the screen and the output terminals from a transformer connected to the mains are connected across the Y-plates.
8. The diagram shows the screen of a cathode ray tube, and behind it the position of the X and y plates which deflect the electron beam. The beam forms a spot on the screen.



a) Draw a labelled diagram showing a side view of the cathode ray tube.

b) How is the brightness of the spot controlled?

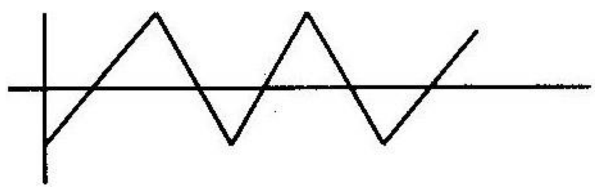
c) The "X-shift" control on the front of the cathode ray oscilloscope moves the spot sideways on the screen. What kind of voltage direct, alternating or zero) does it apply to:

i) The X plates

ii) The Y plates

The ‘time–base’ voltage normally applied to the X-plates in a RCO varies with time as shown.

i) Describe the motion of the spot when the time-base is on.



ii) Illustrate on the diagram above what is seen on the screen if an alternating voltage is applied to the Y-plates with the time-base on.

State two uses of the CRO.

9. The control grid in a cathode ray oscilloscope (CRO) is used to control the brightness of the beam on the screen. Explain how this is achieved.

10. State and explain three uses of main parts of a CRT in an oscilloscope.

TOPIC 8

X-RAYS

PAST KCSE QUESTIONS ON THE TOPIC

1. An X-ray tube is operating with an anode potential of 10kV and a current of 15.0 mA.
   - a) Explain how the
     - i) Intensity of X-rays from such a tube may be increased.
     - ii) Penetrating power of X- rays from such a tube may be increased
   - b) Calculate the number of electrons hitting the anode per second.
   - c) Determine the velocity with which the electrons strike the target.
   - d) State one industrial use of X-rays.
2. a) For a given source of X-rays, how would the following be controlled.
     - i) Intensity
     - ii) The penetrating power
     - iii) The exposure to patients
   - b) An accelerating potential of 20kv is applied to an X-ray tube.
     - i) What is the velocity with which the electron strikes the target?
     - ii) State the energy changes that take place at the target.
3. Explain why X-rays are appropriate in study of the crystalline structure materials.
4. Name the metal used to shield X-rays operators from the radiation. Give reasons why it is used.

5. State the properties of X-rays, which makes it possible to detect cracks in bones.

6. State one difference between hard X-rays and soft X-rays. (1mk)

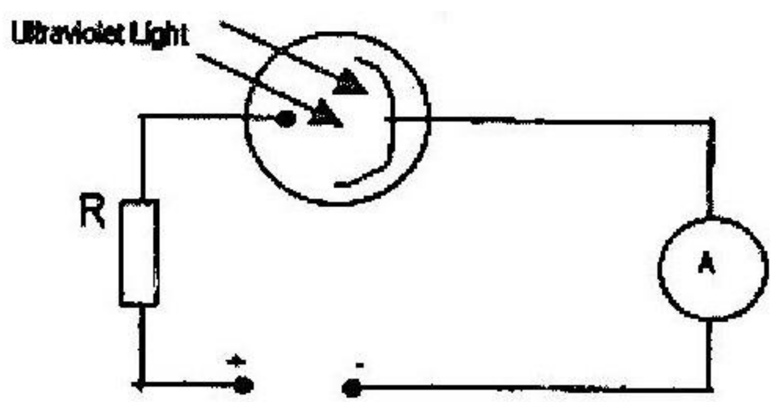
7. A target was bombarded by electron accelerated by a voltage of 10^6 V. If all the K.E of the electrons was converted to X-rays, calculate:-
   a) The K.E of the electrons
   b) The frequency of the photons emitted.
8. An X-rays tubes gives photons of 5.9×10^{-15} J of energy. Calculate:-
   a) The wavelength of the photons.
   b) The accelerating voltage
   c) The velocity of the electrons hitting the target.
9. If accelerating voltage in an X-ray tube is 40kV, determine the minimum wavelength of the emitted X-rays. (Electronic charge = $-1.6 \times 10^{-}19$C, planks constant = 6.6×10^{-34}Js, velocity of electromagnetic waves = $3.0 \times 10^8 ms^{-1}$)
10. State the purpose of cooling fins in the X-ray tube.
11. X-rays are produced by a tube operating at 1 x 104V. Calculate their wavelength. (Take h= 6.6×10^{-34} Js, e= 1.6×10^{-19}C, c= $3 \times 10^8 ms^{-1}$)
12. State and explain the effect of increasing the EHT in an X- ray tube on the X-rays produced.

TOPIC 9

PHOTOELECTRIC EFFECT

PAST KCSE QUESTIONS ON THE TOPIC

1. Light of frequency 5.5x 10^{14} HZ is made to strike a surface whose work function is 2.5ev. Show that photoelectric effect will not take place. H= 6.6 X 10^{34}Js
2. Photoelectrons emitted by illuminating a given metallic surface constitute a "photocurrent". What is the effect of increasing the intensity of the illumination of the magnitude of the photocurrent?
3. The diagram shows a photocell in action



   i) The photocell is either evacuated or filled with an inert gas at low pressure. Give one reason for this
   ii) What is the function of the resistor R in the circuit?
   iii) State one reason for using a particular radiation such as ultraviolet for a given photocell.
   iv) Explain how the set-up shown in the diagram may be used as an automatic switching device for a burglar alarm.
4. A monochromatic beam of radiation is directed on a clean metal surface so

as to produce photoelectrons. Give a reason why some of the ejected photoelectrons have more kinetic energy than others.

5. (a) Describe with the aid of a labelled diagram an experimental set-up for observing the photoelectric effect.

b) The table shows the relationship between the wavelength of a radiation falling on a surface and the energy, k of the emitted electrons.

λ(m) x 10^{-7}	1.0	1.5	1.0	0.5
K(J) x 10^{-19}	10	13	20	40

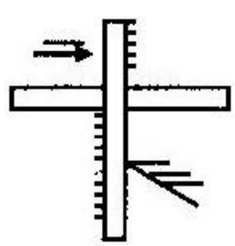
i) Plot a graph of energy k(Y-axis) against the frequency, f, of the incident light.

ii) Determine the work function of the surface used (h=6.663 x 10^{-34}JS)

6. Name a device used to convert light energy directly into electric energy.

7. Electrons emitted from a metal when light of a certain frequency is shone on the metal are found to have a maximum energy of 8.0 x 10^{-19} J. If the work function of the metal is 3.2 x 10^{-19} j, determine the wavelength of the light used.

8. The figure below shows ultra violet light striking a polished zinc plate placed on a negatively charged gold leaf electroscope.



Explain the following observation

i) The leaf of the electroscope falls.

ii) When the same experiment was repeated with a positively charged electroscope, the leaf did not fall.

9. The work function of a certain material is 3.2 ev. Determine the threshold frequency for the material. (1 electron volt (eV) = 1.6 x 10^{-19} and planks constant H= 6.62 x 10= 34Js)

10.

State what is meant by the term accommodation as applied to the human eye. (1mk)

The graph in figure 8 shows the variation of photoelectric current with applied voltage when a surface was illuminated with light of a certain frequency. Use this information in the figure to answer questions 11 and 12.

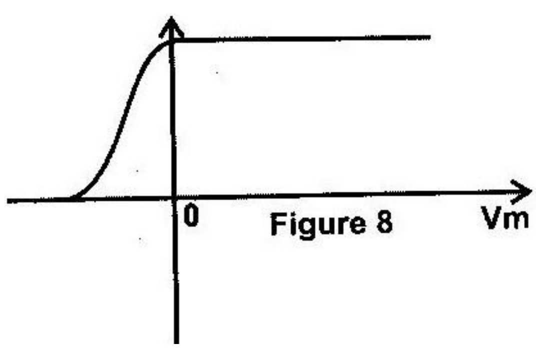


Figure 8

11. On the same axes, sketch the graph of when light of higher intensity but same frequency is used to illuminate the surface. (1 mk)

12. Explain your answer in 11 above . (1 mk)

12. Calculate the energy of a photon of red light and ultra-violet light
   ($\lambda_R = 7.0 \times 10^{-7}$m: $\lambda_v = 4.0 \times 10^{-7}$m)
13. The wavelength of light from a sodium lamp is 5.9×10^{-7}m. A 200W sodium vapour has an efficiency of 40%. Calculate:
   a) The energy of one quantum of sodium light.
   b) The number of quanta emitted in one second
14. The threshold frequency for potassium is 5.37×10^{14} HZ. When the surface of potassium is illuminated by another radiation, photoelectrons are emitted with a speed of 7.9×10^5 m/s

   Calculate:
   a) The work function for potassium
   b) The k.e of the photoelectrons
   c) The frequency of the second source
15. Explain the term "work function"
16. A metal has a work function of 2eV. Calculate the threshold wavelength of the metal given that e= 1.6×10^{-19}C and h= 6.63×10^{-19}C and Me = 9×10^{-31}kg.

TOPIC 10

RADIOACTIVITY

PAST KCSE QUESTIONS ON THE TOPIC

1. a) What is meant by the following terms:

    Radioactive decay and isotope.

    b) The table shows how the activity (disintegrations per minute) of a sample of carbon-14 varies with time (in years).

Time (grs)	0	2500	5000	7500	1000	12500	17250	20000
Disintegrations/min	15	11	8	5	4.0	3.2	1.6	1.2

    i) Plot a graph of activity against time (x-axis).

    ii) Estimate the half-life of carbo-14 from the graph.

    c) i) Draw a labeled diagram of a Geiger- Muller tube.

    ii) Explain how it detects radioactive particles/rays.

    d) State one use of radioactivity in each of the following;

    i) Medicine

    ii) Agriculture.

    iii) Radon gas $^{222}_{86}Rn$ decays by emission of $\propto$ particles. Show by use of an equation the transformation of the gas.

    iv) Give two uses of cobalt - 60 as a Radioactive source.

2. One of the isotopes of Uranium has a half life of 576 hours.

i) Complete the table to show how the mass varies with time from an initial mass of 1280 mg.

Time (Hours)	576	1152	1728	2304
Mass (Mg) 640				

ii) Explain whether the mass of the isotope will eventually reduce to zero.

3. State two factors that determine the extent of the damage to the body cell caused by the radiation from radioactive substances.

4.

How many neutrons does the nuclide u contain?

86

5. Name the quantities, which must be measured so as to determine the half-life of a radioactive sample whose half-life is known to be a few hours.

6. Explain why ∝ particles are more ionizing than β particles.

7. A radioactive carbon -14 decays to Nitrogen by beta emissions as shown. Determine the values of x and y in the equation.

14 X u

C = —N B

6 7 y

8. Alpha particles are more ionizing than Beta particles. Give one reason for this.

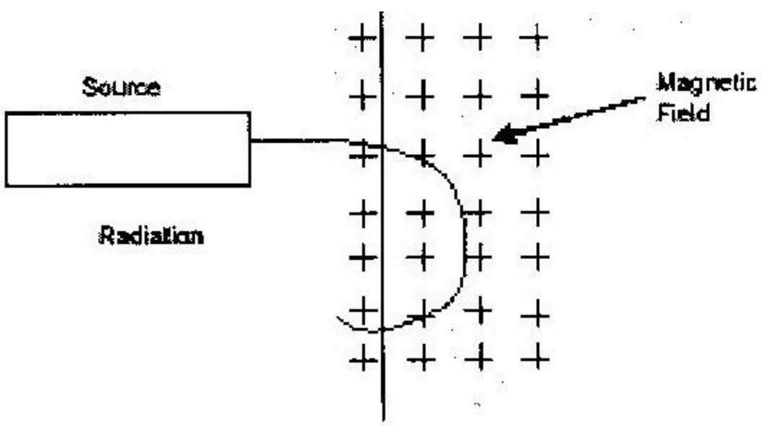
9. In a sample there are 5.12 x 10^{20} atoms of Krypton 92 initially. If the half-life of Krypton is 3.0s, determine the number of atoms that will have decayed after 6s

10. Cobalt 60 is a radioisotope that has a half-life of 5.25 years. What fraction of the original atoms in a sample will remain after 21 years.

11. A nucleus is represented by $^{107}_{32}x$

State the number of neutrons in a nucleus.

12. a) Fig 2 shows the path of radiation from a radioactive source after entering a magnetic field. The magnetic field is directed into the paper and is perpendicular to the place of the paper shown in the figure.



Identify the radiation.

Give a reason for your answer.

b) Below is a nuclear reaction

232 228 (gamma)

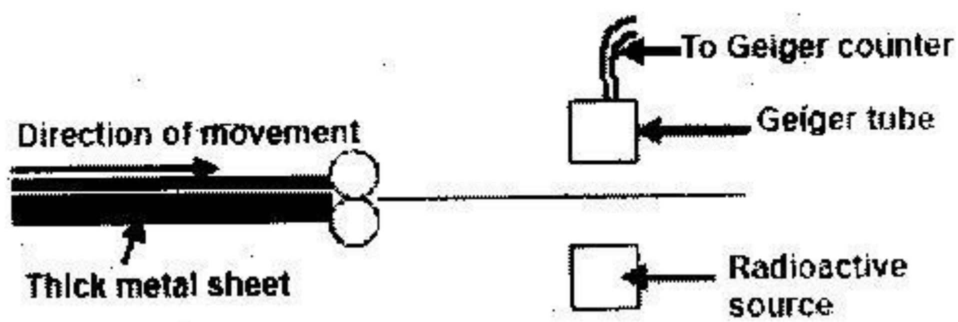
A ⟶ K B Y x Y C

90 88

i) Identify the radiation k.

ii) Determine the values of X and Y.

c) The figure below shows a device for producing metal foils of constant thickness. Any change in the thickness can be detected by the Geiger tube and recorded by the Geiger cooler. The pressure exerted by the roller is then adjusted to keep the thickness constant.



i) State the change in the metal foil that will lead to a decrease in the Geiger counter reading.

ii) Give a reason for your answer in (c) (i) above.

iii) State the change in the roller pressure that should be made as a result of this decrease in the Geiger counter reading.

iv) Give a reason for your answer in (c) (iii) above.

v) Explain why a source emitting (alpha) particles only would not be suitable for this device.

vi) Explain why a radioactive source of a half-life of 1,600 years is more suitable for use in this device than one of half-life of 8 minutes.

13. The following is part of a radioactive decay series.

$$^{234}_{83}\text{Bi} \xrightarrow{\beta} {}^{a}_{84}\text{X} \longrightarrow {}^{230}_{b}\text{Y}$$

Determine the values of a and b.

14. a) A nucleus of an element X of atomic mass 238 and atomic number 92 decays by emitting 8 alpha particles and 10 beta particles and finally forms a nucleus of an element y. Write the equation of the reaction.

b) Each of the following sentences describes a particular radiation from different radioactive source. In each case name the type of radiation described and give a reason to support your choice.

(i) The radiation is not affected by either a magnetic or electrostatic field.

Type or radiation

Reason

(ii) The radiation is emitted from 238u when it decays to $^{234}_{90}\text{U}$

Type or radiation

Reason

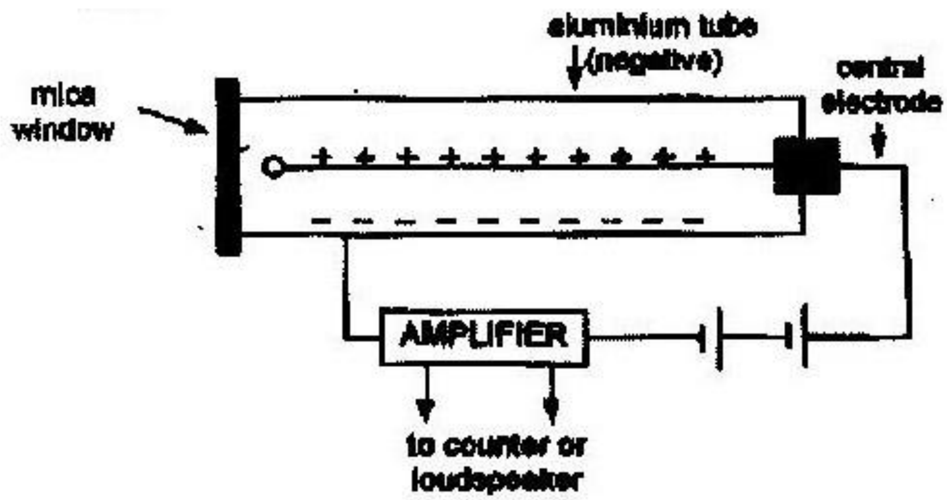
(iii) The radiation is very strongly deflected by a weak magnetic field.

Type of radiation

Reason

15. The half-life of a certain radioactive substance is 57 days. Explain the meaning of this statement.

16. The figure below shows a Geiger Muller (G.M.) tube.



(i) Give the reason why the mica window is made thin.

(ii) Explain how the radiation entering the tube through the window is detected by the tube.

(iii) What is the purpose of the halogen vapour?

17. Balance the nuclear reaction equation below.

$$^{24}_{11}Na \rightarrow y + {}^{0}_{-1}e$$

18. Given that 5g of cobalt-60 is kept in a laboratory and it has a half-life of 5 years.

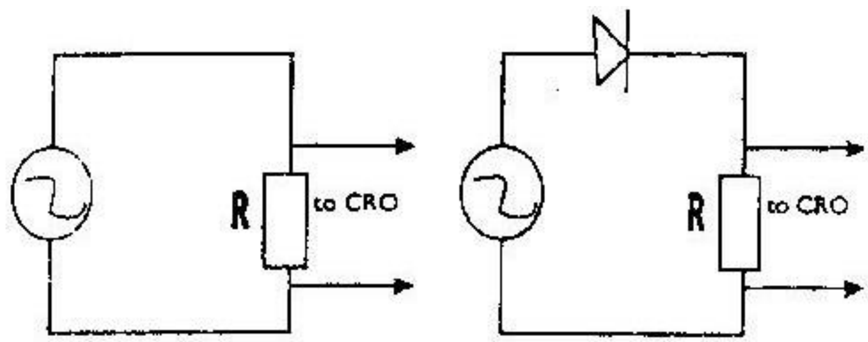
Calculate its mass after 15 years.

TOPIC 11

ELECTRONICS

PAST KCSE QUESTIONS ON THE TOPIC

1. 1989: Sketch curves to show the variation of current and time as displayed on the CRO in each of the



2. State the majority carriers for a p-type semi conductor.

3. a) Using examples explain the difference between a semiconductor and a good conductor.

   b) A radio repairer wishes to use an ammeter to detect a faulty diode. With the aid of a circuit diagram describe how he will go about this task.

4. Using examples, explain the difference between a semi conductor and a good conductor.

5. p- type and n-type semiconductors are made from a pure semiconductor by a process known as "doping".

   i) What is doping?

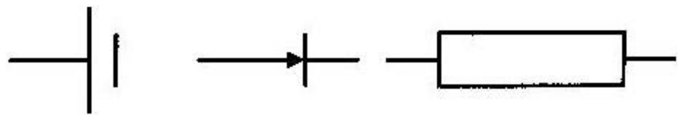
   ii) Explain how the doping produces an n-type semiconductor.

6. Sketch a current-voltage characteristic of a junction diode with a forward

bias.

7. Using the components symbols shown in the fig, sketch a series circuit

    diagram for a forward biased diode.



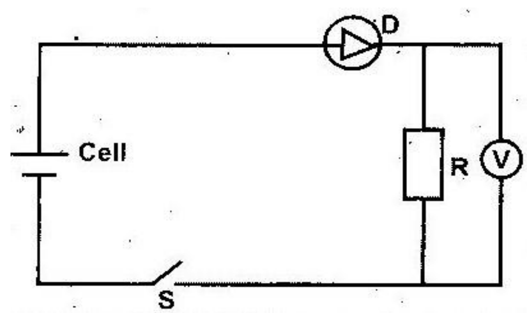
8. (a)

    i) Distinguish between semiconductors and conductors

    ii) Give an example of a semiconductor and one for a conductor.

9. In the circuit below, when the switch s is closed, the voltmeter shows a

    reading.



When the cell terminals are reversed and the switch is closed, the

voltmeter reading is zero.

Explain these observations.

10. What is meant by Donor Impurity in semiconductors.

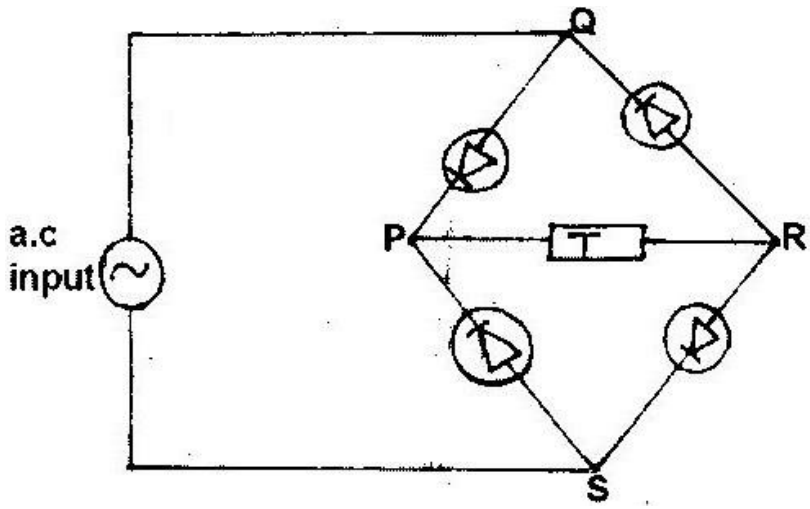
11. You are provided with a diode, a resisitor R, an a.c source of low voltage

    and connecting wires. In the space provided, sketch the circuit diagram for

    a half-wave rectifier and indicate the terminals where the output voltage v_0

    may be connected. (2mks)

12. Explain how doping produces an n-type semiconductor for a pure semiconductor material. (3mks)
13. Distinguish between intrinsic and extrinsic semi-conductors.
14. The diagram below shows a rectifier circuit for an alternating current (a.c) input.



i) Describe the rectification process.

ii) Draw the traces of the signal obtained on CRO connected across QS and PR.

ANSWERS TOPICAL QUESTIONS

FORM ONE

<u>1. MEASUREMENT I</u>

1. height, base area

2. Put 0.5kg mass together with meat and balance them against the 2 kg.

3. Volume of one molecule = 18/ $(6x10^{23})$ = $3x\ 10^{-23}$cm

   $X^3 = 3x\ 10^{-23}\ cm^3$

   $X = 3.11\ x\ 10^{-8}\ cm^3$

4. d= m/v=40g/ 30 x 4 x $3cm^{3} =$ 0.1111 g/cm^3

5. 1.5 kg

6. Vol. of 1 drop = $(^{9}/_{55})\ cm^3 = 0.163cm^3$

7. D= m/r $=^{567}/_{(150-80)} = {}^{576-80}/_{70g/cm3}$

8. 4.1 X 10^{-8}M

9. a) 4.06 X 10^{-10}m

   b) That atoms are spherical and that mass is uniformly distributed on the atom and not in the nucleus.

10. 0.001mm

11. i) $5x10^{-7}$m

    ii) -Atoms spherical

    -Mass uniformly distributed

12. 2000 cm^3

13. 1.12g/cm^3

2. FORCES

1 Mass is constant everywhere

2. Up thrust and frictional force.

3. By going between two moving parts so that the parts slid on oil instead of each other.

4. - Weight is a vector quantity while mass is a scalar quantity.
   - Weight varies from place to place while mass is constant.
   - Weight is measured using a spring balance while mass is measured using beam balance.

5. To lubricate the engine/ reduce frictional force.

6. Magnetic, electrostatic and gravitational.

7. k.e of molecules increase hence the pressure increases.

8. Because gravitational force varies with distance from the centre of the earth. Since weight depends on the gravitational pull, then it also varies.

9. The soap reduces the surface tension and hence the weight of pin becomes greater the surface tension.

10. Draw two arrowed lines one from C1 downwards and the other from O upwards.

    Anticlockwise moment is reduced hence the clockwise moment becomes relatively more.

11. let c.o. g be X cm from pivot.

    $1000N \times X = 20N \times 2m$

    $X= 0.04m$

12. Over all c.o g lower since the heavier the base the lower the C.O.G.

13. When the melts the c.o.g. is lowered hence it becomes more stable

-Anticlockwise moment is reduced hence the clockwise moment becomes relatively more.

14. c.o.g is at 50cm mark which is 20cm from pivot.

$0.2 \times W = 0.3 \times 5$

$W = 7.5N$

15. a) Very low density hence, a very big column required (≡11m)

b) i) p=F1

F2

ii) $F_2/A_2=F_1/A_1 \therefore F2 = A_2/\ A_1\ F_1 = 25 \times 100 = 2500N$

iii) Gas is compressible hence it does not transmit pressure equally throughout the system.

16. For neutral equilibrium the cylinder will be horizontal.

17. In (a) adhesive forces between glass and wax are weaker than cohesive forces between water & water. The opposite is true (b)

18.

-Taking moments and equating

- 0.6N x 70cm = mgN x 30cm

- w = mg = 1.4N

19. 83.3kg

20. 1.6m /s^2

21. 40N

22. 3.33cm

23. 25N

24. 20N

25. 250k Pa

26. i) 9N   ii) 0.8m

3. PRESSURE

1.

i) Dirty water is drawn to the larger container through capillary action in the cloth.

-Water in the tray evaporates due to heat from the sun.

- Condensed water on the glass window collects at its lower end and pure water is collected in its lower container.

ii) a) Increases/enhances/speeds up the absorption of heat

b) Increases surface area for evaporation OR it removes coloring and gases Or it absorbs radiant heat to increase evaporation.

iii) Retained heat causes evaporation

iv) Infra red rays can pass through the glass. Re radiated rays are of longer wavelength than the infra red rays and cannot pass trough the glass, hence some heat is trapped, hence some heat is trapped inside.

2.

i) - Heater

- Scale (Measuring Device)

- Pinter/ Indicator

ii) Making the wire straight/ remove kinks; making it steady / taut/ tensional force/ vertical position.

3. Concrete mixture and steel have approximately the same linear expansively.

   They expand / contract at the same rate.

4. X2 should be made larger than X1 since B receives radiation at a higher rate. It must be moved Radiation

5. further from source for rates to be equal.

4. PARTICULATE OF MATTER

1.

   Sucking air reduces pressure inside the tube; so that atmosphere pressure forces the liquid up the tube.

2.

   a) Smoke particles- smoke particles are large than air molecules and light enough to move when bombarded by air molecules.

      Lens- focuses the light from the lamp on the smoke particle; causing them to be observable.

      Microscope- enlarges the smoke particles so that they are visible.

   b) Smoke particles move randomly/zigzag

      - Air molecules bombard the smoke particles.

      - Air molecules are in random motion

   c) The speed of motion of smoke particles will be observed to be higher/move faster/ speed increases.

5. THERMAL EXPANSION

1.

Since the quantity of water in A is smaller, heat produces greater change of temperature in A; a decrease in density causing the cork to sink further.

6. HEAT TRANSFER

1. Can B is a good absorber of radiation/better absorber of radiation or heat.
2. Glass flask expands first (creating more volume for water)

   - Water then expands using the tube.
3. In (i), Gauze conducts heat away temperature above is lower than ignition temperature of the gas. In (ii)Gauze is hotter than ignition temperature of the gas (Required to ignite it).
4. To reflect heat outwards or inwards hence reduce heat loss by radiation.
5.

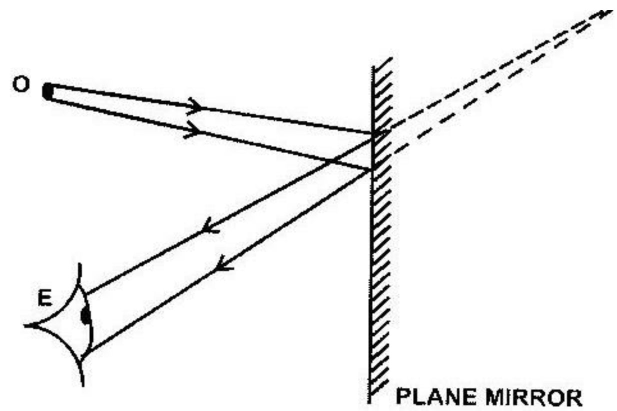
   - x^2 is made larger than X_1
   - Since B receives radiation at a higher rate, it must be moved further from source for rates to be equal.
6. Since the quantity of water in A is smaller, heat produces greater change of temperature in A; a decrease in density causing the cork to sink further.

7. RECTILINEAR PROPAGATION OF LIGHT AND REFLECTION AT PLANE SURFACE

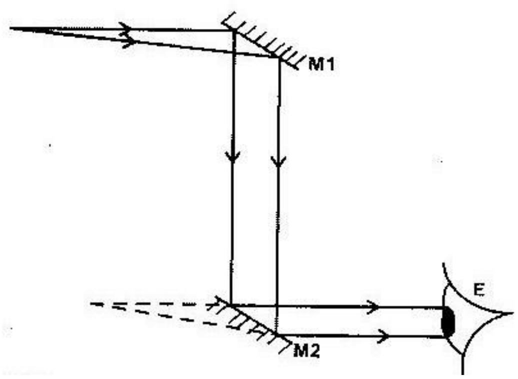
1.

- Image that cannot be formed on screen.
- Always on the opposite side of the object

2.



3.



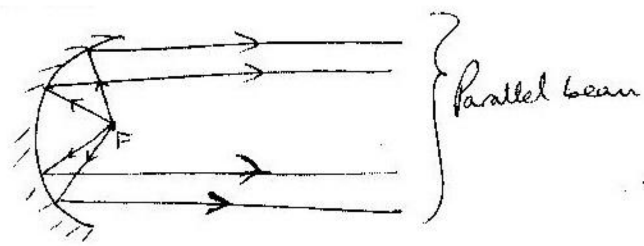
4.

Angle of rotation of reflected ray = 2(angle of rotation of mirrors)

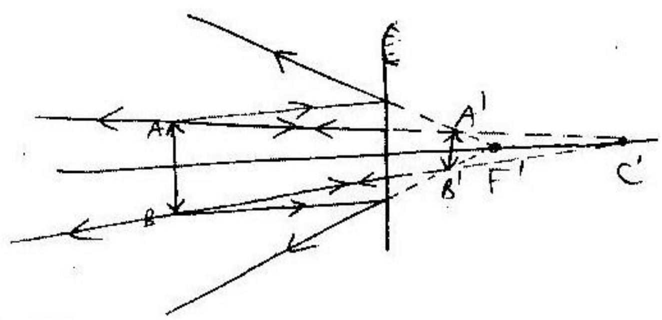
$= 2x\ 30^0$

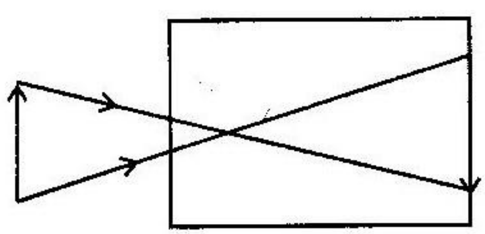
$=60^0$

5.

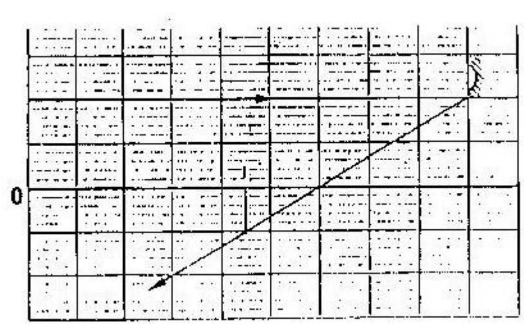


6:

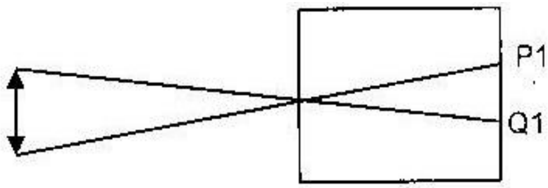




7.



8. Measure P1Q1 in cm (i.e. length of image on the screen as shown below)



Divide this value by 3 seconds i.e. vel =dis/time

9. 4:05 p.m

10. a) -Key form real inverted images

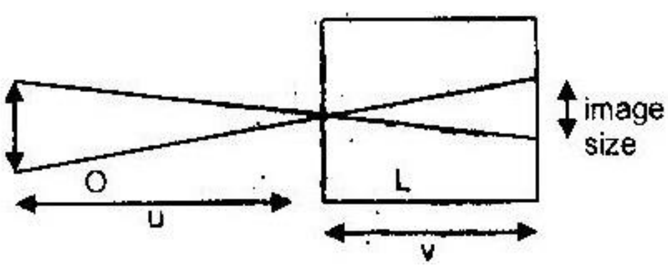
-Highly magnified images which give a wrong perception of object distance.

-Small field of view.

b) Very small images, giving the illusion that the objects are far away.

11. Can from magnified, erected images.

12.



Where o= object

h= pin-hole

u- Object distance

v- Image distance

13. u =100m

hi= 0.5cm

v=10cm

v/u = hi/h_0

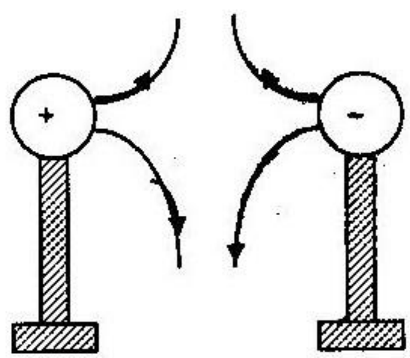
$\therefore$ ho = hi x u/v

= 5m x $^{100m}/_{10cm}$

h_0=50m

8. ELECTROSTATICS I

1.



2. The leaf in the electroscope falls

3. Metal roofed house. Because there is less resistance of the flow of charges to the ground so if struck by lighting it would conduct it to the ground. The other one would burn or have the people inside struck by the lightening.

4. At x the capacitor is charged only once and the keeps charging and

discharging in opposite directions hence current keeps alternating at the a.c frequency. This lights the bulb continuously.

5. : Earthing the machines/using spikes.
6. Material used between the two plates of the capacitor.
7. Well insulated / avoid touching
8.

a) Ability to store charge given by the quantity of charge it can store per unit p.d

b) Bring it near a charged electroscope (say +vely). If not, charge the electroscope – vely and bring the rod near. If divergence is observed then they have the same charge. Note that if decrease in divergence is observed in both cases then the rod is simply a conductor and it's not charged.

c) Nothing would happen to the leaf of the electroscope. This is because in a hollow charged conductor, the charged conductor and not inside

d) - Earthing or using another
   - Charged body

e) i) Q= CV

= 2x10

= 20μC

ii) Series = 1/c = 1/3 + 1/3

1/c = 2/3

C= 3/2 = 1.5uF

Parallel Ct = 1.5 + 2 =3.5 uF.

9. CELL AND SIMPLE CIRCUITS

1. Dry cells have a very high internal resistance hence give very little current that start a vehicle.

2. Secondary cells are rechargeable while primary are not.

3. I = V/R = 240/500 = 0.48A.

4. Q = it =0.08 x 2.5 x 60 =12c.

5. When connected in parallel, the total effective resistance is much less. The heating effect is reduced.

6. Large amounts of current can be drawn from them without damaging them while in lead acid batteries.

7. Q=it

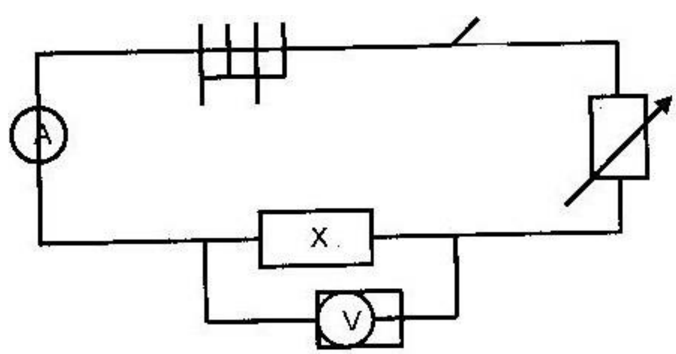
   - = 0.5 x 4x60
   - = 120c

8. The overall resistance of cells and bulb is least and hence more current flows

9. Each will provide about half of the power supplied to the bulb. So they are drained of power at a slower rate than rate than in figure 10(a).

10. To oxidize hydrogen to water hence reduce polarization/internal resistance.

11.



12.

- Alkaline cell last longer than lead acid cell.
- Alkaline is more rugged than lead acid cell.
- Alkaline cell is lighter than lead acid cell.

13.

$$1 = \frac{1.5}{R+r}$$

$$0.13 = \frac{1.5}{10+3}$$

$R = 1.5\Omega$

14.

a) The ratio of the pd across the ends of a metal conductor to the current passing through it is a constant.

b) i) It does not obey Ohm's law; because the current – voltage graph is not linear throughout;

ii) Resistance= v/1 = inverse of slope

$$= \frac{(0.74 - 0.70)V}{(80-50)mA}$$

$$= \frac{0.40V}{30 \times 10^{-3} A}$$

$= 1.33\Omega$

iii) From the graph current flowing when pd is 0.70 is 60mA

pd across R = 6.0- 0.7 = 5.3V

$R = \frac{5.3V}{60mA}$

$= 88.3\Omega$

c) i) Parallel circuit $^1/_{30} + ^1/_{20} = ^5/_{60}$

R= 5.3V

Total resistance = 10 + 12 = 22Ω

ii) I = V/R = 2.1/22 = 0.095A

iii) $V = 1R = 10 \times \frac{2.1}{22}$

$= 0.95V$

15. i) The level of the acid in the accumulator should be inspected regularly. Add distilled water.

ii) The terminals should be kept clean and smeared with grease.

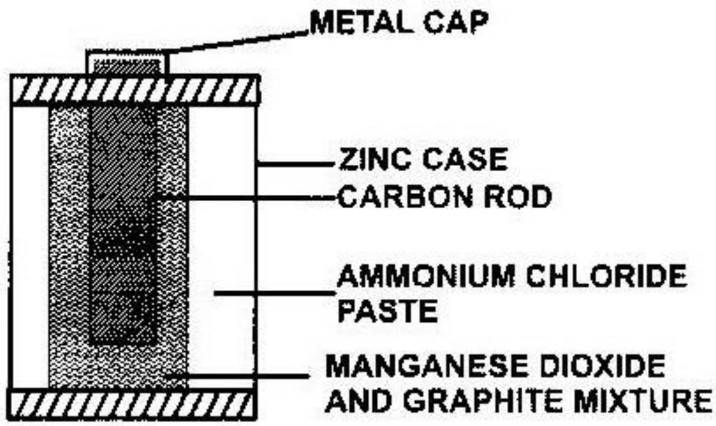
iii) While charging the current used should be that specified by the manufacturer.

iv) The level of acid should be maintained 1cm above the plates.

16.

- They have a much longer life than the lead-acid ones.
- They supply larger amounts of current and for a longer period.
- Can be left unused for months without any damage.

17.



18. Electrical energy is produced by chemical reaction between the plates of the cell (Zinc and copper) and the dilute sulphuric acid. Electrons are produced which flow on the external circuit and detected by the ammeter.

FORM TWO WORK

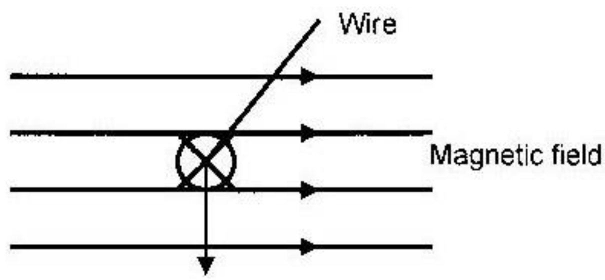
1. MAGNETISM II

1.

- With current switched off record the initial reading of spring balance (Fo)
- Vary the current (I) and each time record the corresponding values of I and the force F.
- Tabulate these values.
- For each value of F, subtract F-to get the magnetic force due to the current on the iron (fm)
- Plot a graph of Fm against I.
- The graph will help show the relationship.

2. 1990: When the current increases the domains align themselves more until all of them are the same perfectly lightened direction (magnetic saturation). The magnetic force of attraction becomes constant.

3



4. Wire curves/ jacks upwards according to Fleming's Left Hand Thumb Rule.

5. Suspend each of them in the earth's magnetic field. Change their rest

position and record the final direction in which key will rest. Repeat this procedure several times and record the directions. Do this experiment on each of the rods. It is noted that, the magnetized rod will rest in the earths North-south direction each time it is disturbed. The unmagnetised rod rests in random directions.

6. The a.c magnetises the magnet alternately in the opposite directions 50 times in one second. When withdrawn slowly, different parts attain random polarities.

7. It gains and loses magnetism easily. It is only magnetized if there is a magnetic field around it and looses its magnetism immediately the field is withdrawn. It also requires very little energy to magnetise and demagnetise.

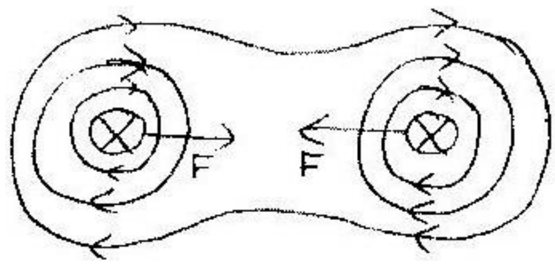
8. In fields the lines are parallel and the force acting on a small magnet/conductor is uniform. The opposite is the case for the non-uniform field.

9. - Increasing current by decreasing resistance
   - Turning wire AB to an angle of 90^0
   - Increasing number of cells.

10. - Amount of current
    - Strength of magnetic field
    - Angle between magnetic field and direction of conductor.

11. Attraction can be between opposite poles or a magnet and a non-magnetized magnetic material.

12.



13. a) i) and ii) 1996 1992 suspend each of them in the earth's magnetic field. Change their rest position and record the final direction in which key will rest. Repeat this procedure several times and record the directions. Do this experiment on each of the rods. It is noted that, the magnetized rod will rest in the earth North-south direction each time if is disturbed. The unmagnetised rod rests in random directions.

b) When magnetizing current is increased, the dipoles align more and more until magnetic saturation is attained where the magnetization becomes maximum and remains constant. Substance P requires less current than Q to attain saturation. This means that P is easily magnetized and also easily demagnetise- than Q. This also means that P can form temporary magnet while Q can for permanent magnet $\therefore$ P is soft and Q is hard magnetic materials.

14. Soft magnetic material is more easily magnetized and demagnetised compared to hard ones. Soft ones form temporary magnets while hard ones form permanent magnets.

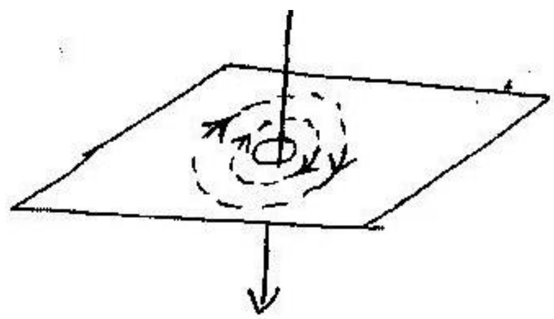
15. 1 Vibration energy helps to turn the dipoles since they are in constant repulsion from dipoles contained in adjacent domains.

16. By using iron powder; more of it is attracted to the poles than at the sides.

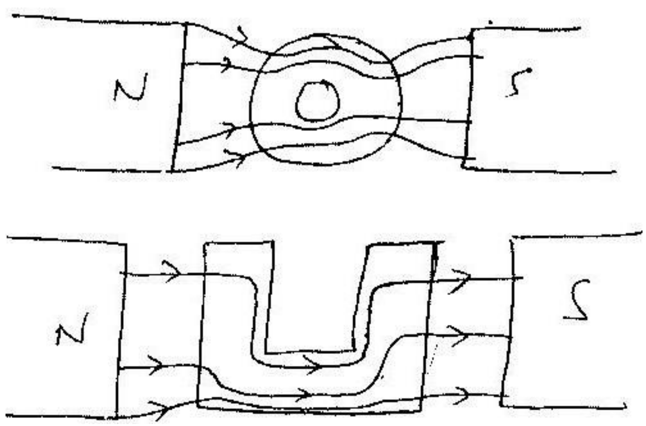
17. Upwards

18. By making the magnetic ends to be removed and create complete loops which reduce the repulsion of the dipoles in different domains which cause them to turn sideways.

19.

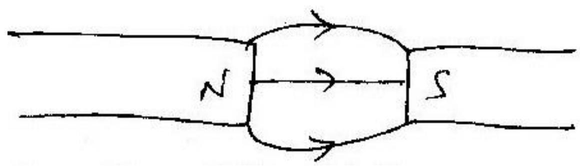


20. Upwards



21. Rider rolls inwards i.e. into the U-shaped magnet.

22.



23. x is north Y is North both correct

2. MEASUREMENT II

1.

i) When dropped at centre, the drop starts spreading outwards. To ensure uniform spread, the wooden planks are moved outwards very slowly at the same speed when in parallel. The powder helps to show the extent of spread otherwise it would be difficult to see the clear oil on the water surface.

ii) Radius = 100mm = rp, radius of drop, rd = 0.25mm

Volume of patch = volume of drop

Let diameter of oil molecule = d

$$\therefore d = \frac{4}{3} \times \frac{(0.25)^3}{(100)^2} \text{ mm}$$

$d = 2.083 \times 10^{-6}$mm

$= 2.083 \times 10^{-9}$m

iii) Assumptions:

- The patch is assumed to be monolayer.
- The molecules are assumed to be spherical, which is not true
- The patch is assumed to be perfectly circular.
- The drop is assumed to be perfectly spherical.

2.

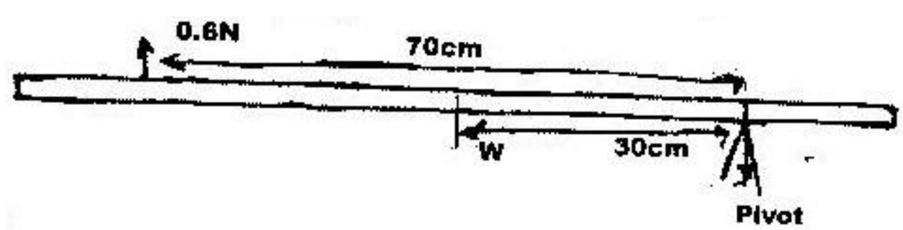
- 0.550 cm; 0.562 – 0.012
- 5.62 – 0.12 = 5.50mm.

3. Density p = m/v;

$$\frac{1.75g}{(0.550)^3\ cm^3}$$

$= 10.5cm^3$

3. TURNING EFFECT OF A FORCE



1. Taking moment and equating Clockwise moments = anticlockwise moments

0.6 x 70cm = w x 30

$$W = \frac{0.6 \times 70}{30}$$

$W = mg = \frac{4.2}{3}$

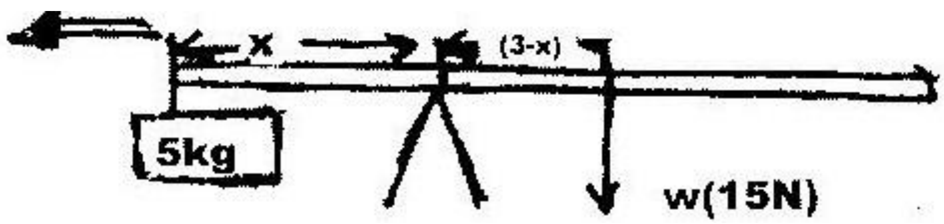
$= 1.4N$

2. Since the system is in equilibrium, then (P x A) 15 = w (15+45)

$2.0 \times 10^5 \times 4 \times 10^{-4} \times 15 = 60W$

$W = \frac{8 \times 15 \times 10}{60}$

Weight, w= 20N



3. Solution

5kg = 50N

50x = 15 x (3 – x)

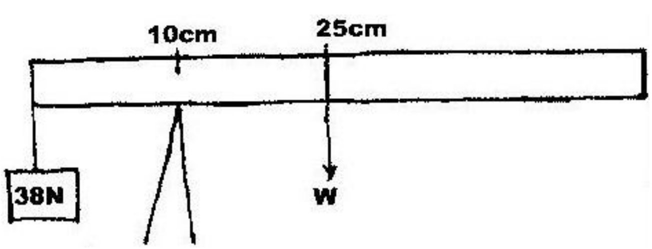
50 x = 45-15x

50x=45-15x

65x= 45

$X = {}^{45}/_{65} = 0.692m$

4. For a system in equilibrium. The sum of clockwise moments about the same point must be equal to the sum of anticlockwise moments about the same point.
5.
   - Steering a wheel in a vehicles
   - Tightening a nut using spanner
   - Peddling a bicycle
   - Opening/closing a door
   - Closing /opening a water/gas tap
6. The distance is small hence the moment produced is not enough to open the door. A lot of force will be required.
7. It provides them with the necessary support and also makes them stable as they move about.
8. <u>Solution</u>



Clockwise moment = Anticlockwise moment

$38 \times {}^{10}/_{100} = w \times {}^{25}/_{100}$

$3.8 = 0.25W$

$W = \frac{3.8}{0.25}$

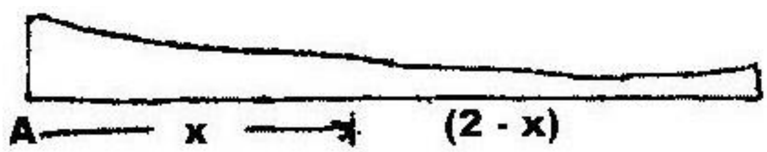
$= 15.2N$

9. a) Weight = total upward force

= (10 +20) N

= 30N

b) Let position of c.o.g be xm away from A i.e



Using pt A as pivot thus

30x= 20x2

30x=40

X = 4/3 = 1.33 m

C.o. g is at 1.33m from A or 0.667 m from B

10. Solution

Sum of clockwise moment = sum of anticlockwise moment

8x0.2 = (y-0.25)3 + 0.55

1.6 = 3y- 0.75 + 0.55

1.6= 3y -0.2

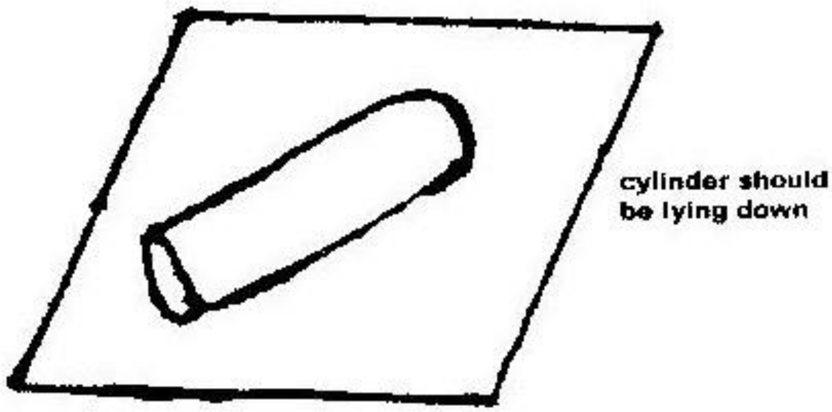
$3y = 1.6 + 0.2 = 1.8m$

$Y = 0.6m$

$Y = 60cm$

4. EQUILIBRIUM AND CENTRE OF GRAVITY

1. The c.o.g is lower since the heavier base the lower the c.o.g.
2. Cylinder should be lying down.



3. -Position of centre of gravity

   -Width of its base i.e. length of axle

4. i) The sum of upward forces should be equal to the sum of downward forces.

   ii) The sum of clockwise moments should be equal to the sum of anticlockwise moments.

5.
   - Luggage compartments are located on the lower part of the bus.
   - Engine is located as low as possible.
   - Floor of the bus is carpeted by a heavy gauge metallic material.
   - Light material is used for making the upper part of the bus.

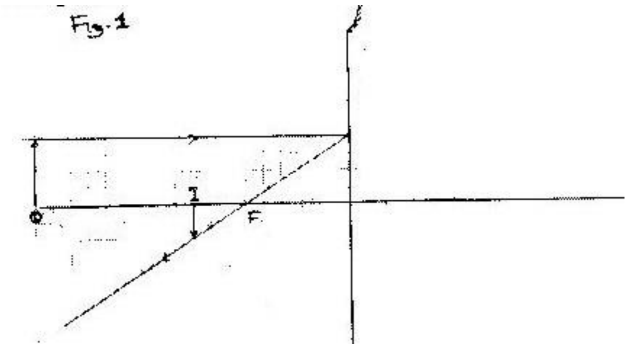
6. When the ice melts, water contracts hence centre of gravity lower. The beaker becomes more stable

7. -Beaker becomes less stable.

   -Water expands on freezing raising the centre of gravity of the beaker.

5. REFLECTION AT CURVED SURFACE

1. On the graph



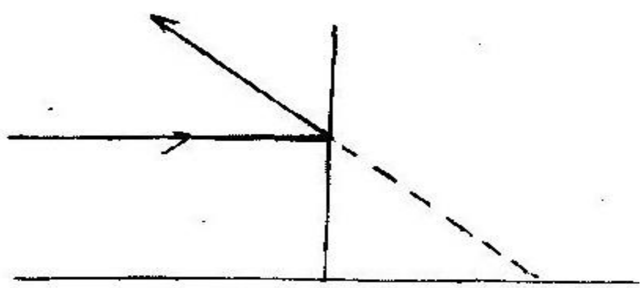
$F = 3 \times 5$

$= 15$ cm

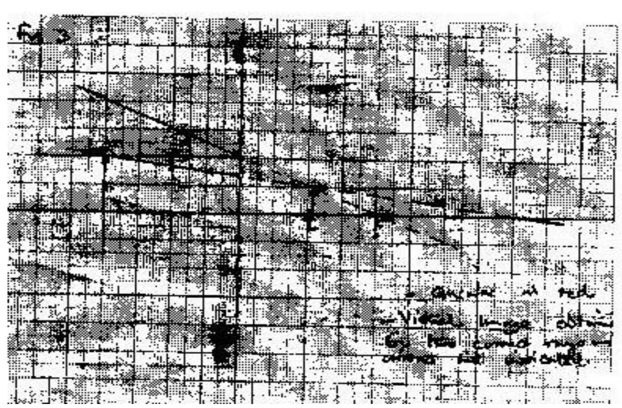
2. Reflected ray is extended backward to cut the x-axis at 1.5cm

r= 1.5x 2

= 3.0 cm



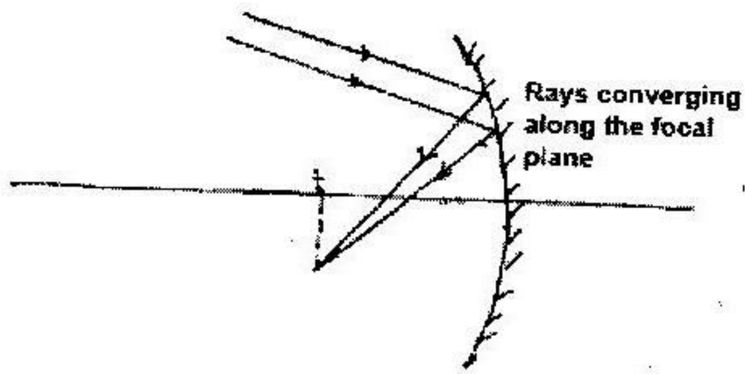
3.

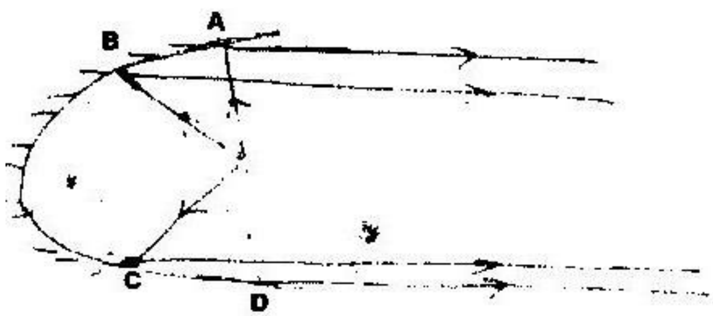


4. -Image that cannot be formed on a screen.

   -Image which is always on opposite side of object

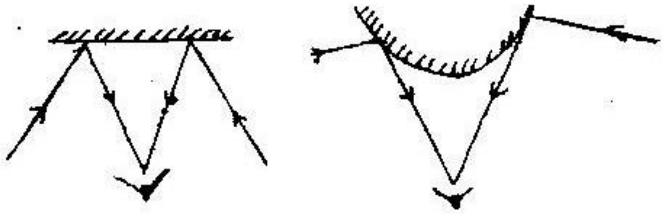
5.



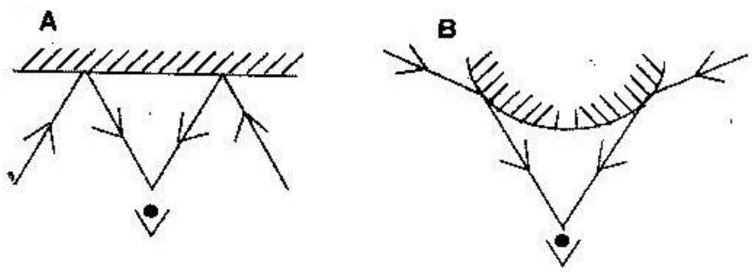


6.

7.



8.



9.

Real image	**Virtual image**
• Informed by rays converging on same side as the objects	• Formed when only imaginary rays appear to converge on opposite side of object
• Formed on a screen	• Not found on screen

10. (i)

- Convex mirror
- Driving mirrors in vehicles
- Used in supermarkets

(ii)

- Parabolic mirrors
- Solar heater reflectors

- Car headlights

(iii)

- Concave mirrors
- Shaving mirrors
- Used by dentists

11.

- Has a wide field of view
- Produces an upright diminished image

12.

- Magnified
- Upright
- Virtual
- Behind the mirror

13. Virtual image

$^1/_u - ^1/_v = ^1/_f$

$^1/_u - 1/_{2u} = 1/_{10}$

$^{2-1}/_{2u} = ^1/_{10}$

14.u= $^{10}/_2$

U= 5cm

Real image

$1/u + 1/v = 1/f$

$1/u + 1/2u = 1/10$

$^{2+1}/_{2u} = 1/10$

$U = {}^{3x10}/_{2} = 15$

U= 15cm

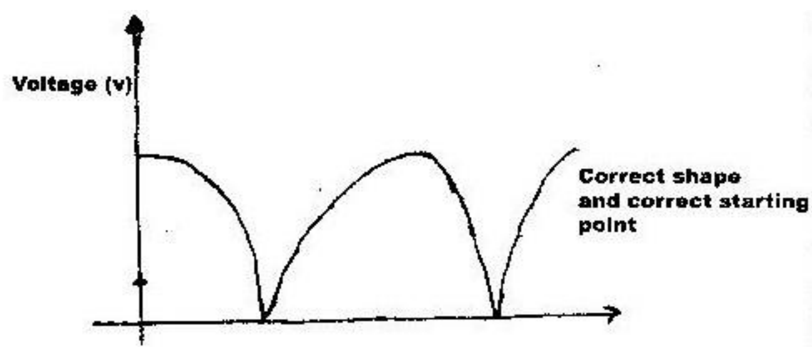
6. MAGNETIC EFFECT OF AN ELECTRIC CURRENT

1. a) As the diaphragm vibrates, it causes the coil to move back and forth, in the magnetic field cutting the field lines. This causes varying current to be induced in the coil. Varying current flows.

   b) -Increasing the number of turns in the coil.

   -Increasing the strength of the magnet.

2.



3 a) -Number of turns or number of coils.

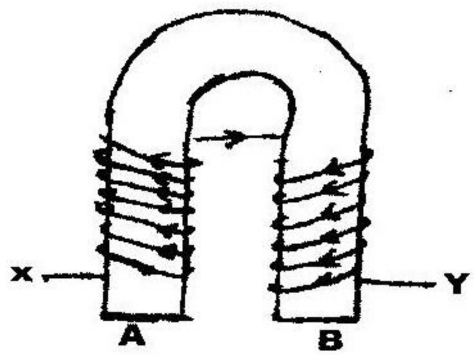
-Strength of magnetic field.

-(Angle of inclination)

b) To reduce eddy current in the armature.

4. Downwards (or into the paper)

5.



6. Soft iron – Iron produces a stronger magnet but looses it magnetism quickly. Also it is more easily magnetized than steel.

7. i) Heating the magnet strongly until it is red hot and then cooling it suddenly.

   ii) Keeping it in a solenoid through which an alternating current is flowing when the current is still passing the magnet is slowly removed to a distance from the solenoid.

8. -Increasing the number of turns of the coil.

   -Increasing the strength of the current.

9. Solution A – South Pole

10. i) Towards the right

    ii) Using the Fleming's left hand rule.

    First finger- Field

    Second finger- Current direction

    Thumb – Motion

    iii) -When the wire is positioned at right angle to the magnetic field.

    -It is minimum when the wire is parallel to the magnetic field.

    iv) No effect

    v) - Reducing the amount of current.

- Replacing the magnet with a weaker one.

6. a) -Commutator

   -They are the split - rugs which reversed the current in the coil every half-cycled and hence allow rotation to continue.

   b) They provide electric connection to the coil.

   c) -The lengths AB and CD of the coil are current carrying conductors in a strong magnetic field which is perpendicular to the wires.

   -Each side of the coil has force acting on it

   -AB has a downward force while CD experience and upward force.

   -Overall the coil experiences an anticlockwise motion.

   c) -Increasing the amount of current

   -Increasing the strength of magnetic field

   -Using more turns in the coil

   -Winding the coil on a soft iron core

7.

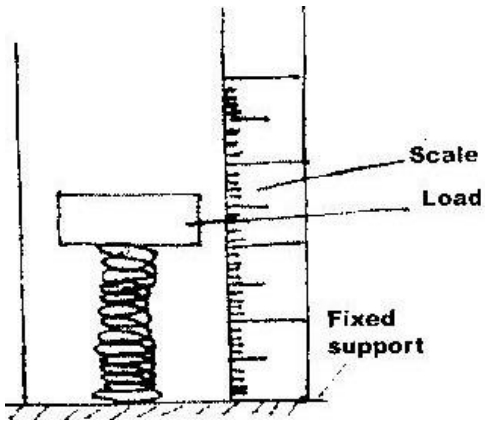
- Energy loss due to friction between brushes and commutators.
- Resistance of the coil
- Energy loss due to heat during magnetization and demagnetization
- Flux leakage

8. - Electric bell

   - Telephone receiver

7. HOOKE'S LAW

1. (a) i)



ii) 0-19N or 0 – 18N

iii) The spring becomes shortest possible (NO further compression is possible)

b) Each spring experiences a force of

$^{30}/_{2N}$N = 15N

F= ke

E= $^{15}/_{3}$ = 5cm

Each spring extends by 5cm.

c) - Diameter of the coil

- Number of turns per unit length.

- Thickness (diameter) of the wire

- Length of the spiral spring.

2. Ductile materials undergo plastic deformation while brittle materials break immediately after attaining plastic limit.

3. a) Provided the elastic limit is not exceeded their extension e of a spiral spring is

directly proportional to the external applied force.

F(N)	0	0.2	0.4	0.6	0.8	1.0
E(mm)	0	11	19	29	41	51

4. i) Strength – this is the ability of a material to resist breakage when subjected to a stretching, compressing or shearing force.

   ii) Brittleness- This is the quality of material which makes it to break just after exceeding the elastic limit.

   iii) Ductility- This is the quality of a material which leads to permanent change in size and shape.

   iv) Stiffness- This is the resistance of a material to withstand forces which tends to change its shape or size or both.

5. a) The extension (e) of spring is directly proportional to the applied force (f) Provided the elastic limit is not exceeded.

   b) i) Y-axis – Extension

   X-axis – stretching force

   ii) OP- Shows that the extension on the spring increases in proportion to the stretching force. Obeys hookes law.

   PN- spring not obeying Hookes law. It does not regain original length.

   iii) Spring gets a permanent stretch.

6. F=ke

F= Ke but e= $^{6}/_{10}$cm = $^{6}/_{10}$ x100

F= mg = ($^{300}/_{1000}$ x 10) N

= 3N

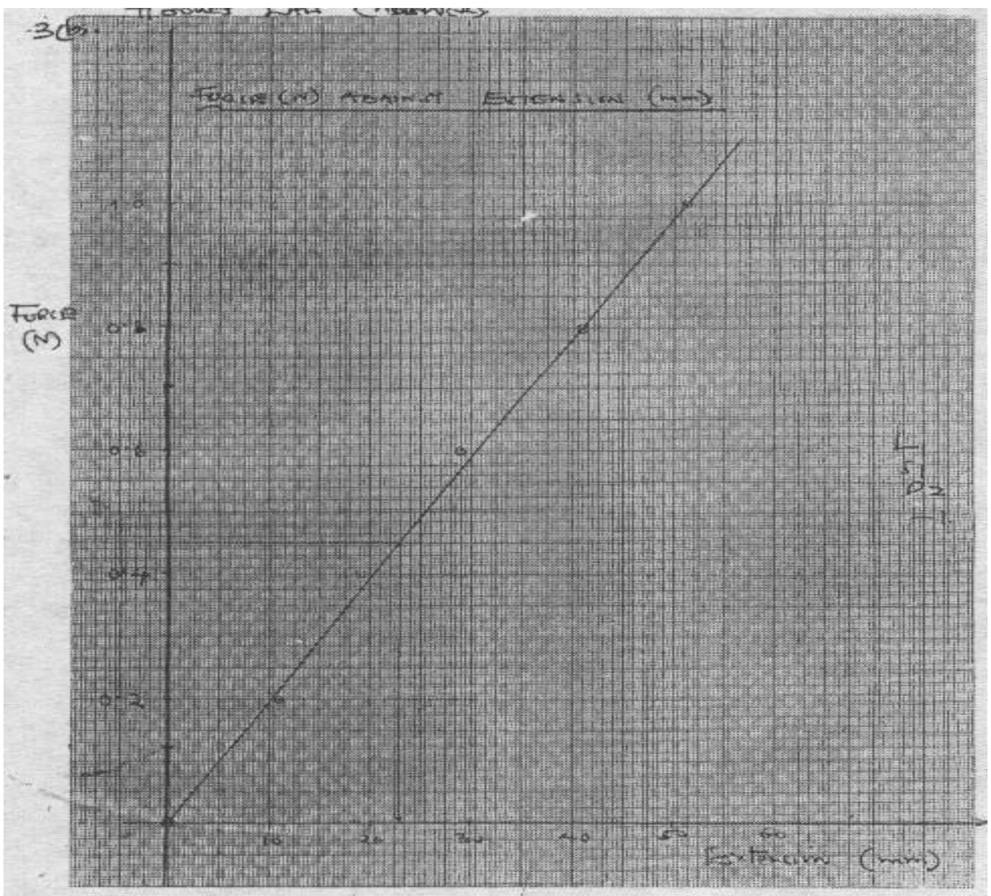
Spring constant. K = $^{f}/_{e}$

= (3 ÷$^{6}/_{100}$)

= (3 x $^{1000}/_{6}$) $^{N}/_{m}$

= 500Nm^{-1}

b)



7. Solution

Extension of parallel springs

e1 = $^{F}/_{K}$ = $^{8N}/_{4N/cm}$ = 2cm

Extension of lower spring

e2 = $^{F}/_{K}$ = $\frac{16N}{4N/cm}$ = 4cm

Total extension = e1 +e2

= (2 +4)cm

= 6cm

8. Solution

a) F= ke

k= $^{f/}e$ = $^{mg}/e$

but mg = $^{210}/_{1000}$ x 10

= 2.1N

e= 10.5cm = 0.105

= $^{2.1}/_{0.105}$ Nm^{-1}

= $20Nm^{-1}$

Using the block

F= ke

= 20x $^{7.5}/_{100}$

= 2x $^{7.5}/_{10}$ =$^{15}/_{10N}$

=1.5N

b) e=f/k

= $^{550}/_{100}$ x 10÷20

= $^{5.5}/_{20}$m

= 0.275m

= 27.5cm

9. Solution

Extension, e produced by 10g mass

e= (10.8-6) cm = 4.8cm

= 0.048m

F= $^{100}/_{1000}$ x 10

= 1N

K= $^{f}/e$ = $^{1N}/_{0.048m}$

= 20.83 N/m

Extension e produced by 10g mass

E = (7.8 - 6) cm = 1.8cm – 0.018m

F = ke

= (20.83 x 0.018) N

= 0.375n

But m = F/g= $^{0.375}/_{10}$

= 0.075kg

= 37.5g

8. WAVES I

1. $1\frac{1}{2} \rightarrow 3.5 \times 10^{-3}$

$1 \rightarrow T$

$\therefore T = 1 \div {}^{3}/_{2} \times 3.5 \times 10^{-3}$

$= 1 \times {}^{2}/_{3} \times 3.5 \times 10^{-3}$

$= {}^{7}/_{3} \text{ X } 10^{-3}$ Sec

But f = 1/T

$1 \div \frac{7}{3} \times 10^{-3}$

$= 1 \times \frac{3}{7 \times 10^{-3}}$

$= \frac{3 \times 10^{3}}{7}$

=429Hz

2. Speed and wavelength decreases

3. f= 40Hz λ=8.5m

$V = f\lambda$

$= 40 \times 8.5$

$= 340$m/s

$T = {}^{d}/_{s} = {}^{102}/_{340}$

= 0.3sec

4. It can be polarized
5. Mechanical waves requires a material medium to travel through. Electromagnetic waves don't.
6. i) Wavelength- This is the distance between two successive crests or troughs. SI Unit is Metre (m)

   ii) Amplitude – It is the maximum displacement of particles of a medium from the mean/fixed position in either direction. SI Unit is metre (m)

   iii) Periodic time – It is the time taken to complete one oscillation. SI Unit is second(s)

   iv) Frequency – Is the number of complete oscillations made by a particle in unit time. SI unit is Hertz (Hz)
7.

Light waves	**Sound waves**
Transverse	Longitudinal in nature
Require no material; medium	Need a medium
Have short wavelength	Have very long wavelength

8. a) i) Transverse wave

   ii) Longitudinal wave

   b) Transverse wave is one in which the movement of each particle is at right angle to the direction of travel of the wave. While longitudinal is where the movement of each particle is parallel to the direction of travel of the wave motion.

9. (a) i) Amplitude = 0.6cm

ii) Period = 2 seconds

iii) Wavelength

λ=Vt

= 50 x 2

=100cm

iv) Frequency

$F={}^{1}/_{T}$

= ½

= 0.5HZ

b) Frequency

10. In refraction of water waves, the wave speed is reduced in shallower region in a ripple tank.

11. Water waves hitting the beaches have energy which causes weathering.

12. i) The speed of radio wave in m/s

Solution

V= fλ

= (1200 x 250 x 1000)ms^{-1}

= 3.0 x 10^8 m/s

ii) Wavelength = v/f

$\frac{3.0 \times 10^8}{2.0\times10^5}$

$= 1.5 \times 10^3$

$=1500m$

9. SOUND

1. 1990: Stationary waves
2. 1991: Refraction of sound waves
3. At rest
4. i) Ups and down in the loudness of sound i.e. loud and soft sounds as crosses on nodal and antinodal lines. (Constructive and destructive interference)

   ii) Constant loud sound since he is equidistant from both speakers and constructive interference takes place.
5. i) Plot the graph of f2(y-axis) against T.

   ii) Determine its gradient (1800) from y= mx +c

   f^2 = (grad) T + C)

   Obtain y intercept and substitute

   f^2=(grad) T +C)

   Obtain y intercept and substitute

   f^2=2800 T + y-intercept
6. 1994: $2x =330 \times 0.5$

   $x =82.5m$
7. 1995: By making the wire tighter

   Decreasing length of the wire
8. 1997: $D= vt =340 \times 2 = 680m$

9. 1996: (i) Transverse-oscillations are perpendicular to direction of wave propagation.

Longitudinal – oscillation are parallel to direction of wave propagation.

Speed of sound

2.5 x s = 400 x 2

S=320 m/s

ii) $2\frac{(d-400)}{320} = 2.5 + 2$

d= 1,120m

10. 2003: Distance covered by sound

= 600 x 2 = 1200m

$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{1200}{3.5} = 342.9 \text{ m/s}$

11. It is the reflected sound

12. A source of sound i.e. an electric bell is suspended inside a bell jar. Using a suction pump air is pumped out of the jar when the lowest pressure is attained, one can see the hammer striking the bell but the ringing can no longer be heard. Sound cannot travel through a vacuum.

13. a) Box act as amplifiers. The air inside the box is forced to vibrate as the box vibrates.

b) X-Compressions

Y-Rarefaction

c) Longitudinal – The movement of air molecules is parallel to the direction of travel of the wave motion.

d) Solution

Since V= fλ

Then x = $^{v}/_{f}$

$$\left(\frac{330}{800}\right) m$$

= 0.4125m

14. Solution – Air is less dense at the top of mountains or high altitude regions making transmission poor.

15. i) Intensity and loudness- Intensity is the power carried by a wave and it depends on the distance from the source while loudness is the power of sound to reach the ear and it depends on amplitude of the source.

ii) Frequency and pitch – Frequency is the number of cycles made per second while pitch is how high on musical scale the note produced by an oscillator is.

16. Solution -Vibrating length

-Tension

10. FLUID FLOW

1. Velocity
2. Forward (upstroke) - The valve opens, pressure forces water flow into the air chamber and air is compressed. Backward (down stroke) - valve closes; compressed air expands hence continuous flow of water.
3. The paper rises up because the pressure above becomes less than the pressure below.
4. Balls move towards each other; pressure in the space between them decreases to below that on the outside.
5. hx=hz.>hy
6. Pressure is inversely proportional to the speed; or speed increases as pressure decreases.
7. At low speeds the speed is streamlined while at high speeds, the flow is turbulent.
8. Air over the mouth of the bottle moves faster than air under.

   Pressure above the mouth of the bottle is less than pressure inside the bottle (hence dynamic lift of ball)
9. At steady rate the sum of the pressure, the potential energy per unit volume and kinetic energy per unit volume in fluid is a constant

   Provided a finish is non-viscous, incompressible and its flow streamline and increase in its velocity produces a corresponding decrease in pressure.

   When the speed of a fluid increases, the pressure in the fluid decreases and vice versa.
10. 2007: V2, V4, V1, V3
11. $A_1V_1 = A_2V_2$

    $30 \times 4 = 7.5 \times A_2$

$A_2 = 16\ cm^2$

12. a) 50(cm/s)

    b) 26.53 (cm/s)

FORM THREE WORK

1. <u>LINEAR MOTION</u>

1.

a) AB- ball rising to max height

BC- ball falling to ground

CDE- ball rebouncing/ changing velocity from +ve to –ve

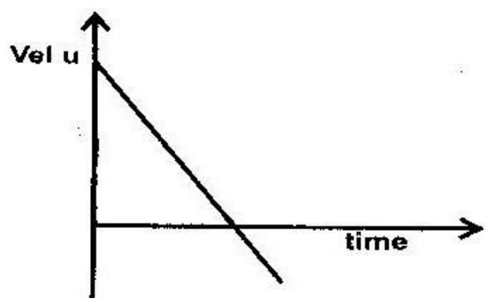
b) Acceleration = gradient = 19.8 = 9.9 m/s^2

c) Displacement = area

= ½ x 2 x 19.8 = 19.8m

d) Upon hitting the ground the ball looses some energy.

2.



3 Time interval between any two dots = 1/50 =0.02S

Dist d1 between 1^{st} and 2^{nd} dots = 2.2 cm

$= V_1 = \frac{0.022m}{0.02S} = 1.1ms^{-1}$

Dist d_2 between 4^{th} and 5^{th} dots = 3.3cm, $v_2 = \frac{0.033}{0.02} = 1.65 m/s$

Note: the average velocity between any two dots = the velocity of a point half way between the pts. Label the pts A.B.C.D & E label a pt x and y half way between D and E respectively (i.e. halfway in time not distance)

T x y = 0.01+ 0.02 x 2 + 0.01 = 0.06s

Therefore $a = \frac{V_2 - V}{T} = \frac{1.65-1.1}{0.06} = \frac{0.54}{0.06} = 9m/s^2$

4. Speed is a scalar quantity while velocity is a vector quality.

5. v-u +at

0=15-10t

t= 15s (to max height) therefore total time = 2 x 1.5=3s

6. (a) Initial vertical velocity = 0, a=10, S=4m

Therefore: $S= ut + {}^1/_2\, gt^2$

$4 = 0+5t^2$

t = 0.8944

Range (horizontal dist) = initial vel. (constant) x time

= 12 x 0.8944

= 10.73m

b) Initial and final horizontal velocities are equal =12m/s

Final vertical velocity = V= u + at

V= 0+10x0.8944

V= 8.944m/s

7. OA = OB therefore OAB is isosceles

Displacement is distance covered in a straight line i.e. AB since <OBA = AOB = 60 then the triangle is equilateral. So AB=AO=4m

8. (a) t=1/f= 1/50 = 0.02S

(b) 0.1s is equal to 5 time intervals

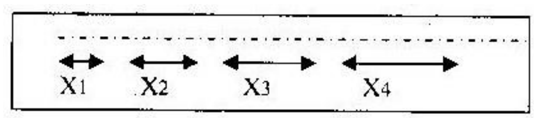


Diagram not drawn to scale (refer from the actual paper)

Average vel between - 0.02S to 0.02 = X_1/0.04 (=vel at t=0s)

Similarly for 0.08 to 0.12, $V2 = \frac{X2}{0.04}$ = vel at t = 0.1s

For 0.18 to 0.22, $V3 = \frac{X3}{0.04}$ = vel at t = 0.2s

For 0.28 to 0.32, $V4 = \frac{X4}{0.04}$ = vel at t= 0.3s

(d) Note: The average velocities above represent the actual velocities halfway between the three dots.

<u>Tabulating the results</u>

Time	0	0.1	0.2	0.3
Vel	V_1	V_2	V_3	V_4

Plot v against t and draw the best line of fit. Find gradient = acceleration.

9. (a) Initial vertical velocity = 0, a = g; s= 5m

$S=ut+{}^{1}/_{2}gt^{2}$

$S = 0 + 5t^2$

T= 1s

(b) Range = Uμ x t = 30 x 1 = 30m

(c) $V_v = U_V + gt$

$V_v = 0 + 10 \times 1 \quad = 10m/s$

10. (a) Plot the graph

Note: the graph is a straight line for the first 4 seconds then a curve

(b) Velocity constant

(c) Draw tangents to the graph at t = 4, 5 s and t = 6.5 s. Obtains the gradients of the tangents g1 and g2 which are equal to velocities at t = 4.5 s (V_1) and at t = 6.5s (V_2)

$$Acc = \frac{V_2 - V_1}{6.5-4.5} \quad \approx 4.9m/s^2$$

11. (a) acc = (change in vel/time)

a = (v - u) t

v = u + at.... (i)

Displacement = average vel x time

$$s = \frac{(u + u + at)t}{2} = ut + 2t^2$$

Square equation (ii)

$v^2 = (u + at)^2$

$v^2 = u^2 + 2aut + a^2t^2$

Factorizing $v^2 = u^2 + 2a\,(ut + {}^1/_2at^2)$

but ut+ ${}^1/_2at^2$ = (from equ.(ii) .

$v^2 = u^2 + 2as$

(b) u = 50m/s

a =2m/s^2 V = 0

$v^2 = u^2 + 2as$

0 = 2500 - 4s

S= 625m

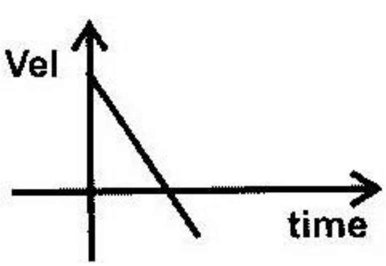
mgh = 1/2mv^2

${}^1/_2\ v^2 = gh$

${}^1/_2$ x 36/10 = h

L = 1.8m

13. (a)



(b) (i) $u = 20m/s, t=2s, v=0$

$V = u + at$

$0 = 20 + a \times 2$

$A = -10m/s$

Deceleration = $10m/s^2$

(ii) Distance traveled before starting to break = $0.2 \times 20 = 4m$

Distance moved after breaks are applied,

$U=20, a=-10, v=0$

$v^2 = u^2 + 2as$

$0 = 400 - 20s$

$s = 20m$

Total distance = 24m

14.

(i) Initial horizontal velocity of the bullet (50m/s) does change so it will move horizontally and parallel to the track despite its vertical movement.

(ii) $Uv= a =-10m/s^2, s=45, v=0$

$V^2=u^2 + 2as$

$a= u^2-900$

$u=30m/s$

Therefore time to max height (t) horizontal distance covered in that time $=6 \times 50=300m$

15. (a) (i) Time between two dots = 1/f =1/50 = 0.02s

$\frac{1.5 \times 10^{-2}}{0.02 \times 5}$ m/s = 0.15m/s

$V_2 = \frac{3.2 \times 10^{-2}}{0.02 \times 5}$ m/s = 0.32m/s

(ii) From half way between AB to half way between CD time

= (0.02 x 20 + ($2^1/_2$ x 2x 0.02)

= 0.4 + 0.1

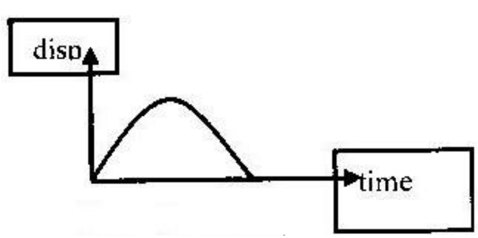
= 0.5s.

Therefore acc= (V2-V1)/t = (0.32-0.15/0.5 = 0.34m/s^2)

(b) P.e is converted to k.e or u=o, a=g, s=h, v=?

P.e is converted to k.e	or u=o, a=g, s=h, v=?
Therefore mgh= $^1/4$ mv^2	Sub: $V^2 = U^2 + 2as$
V^2=2gh	V^2=0+2gh
V=√2gh	V=√2gh

(c)



16. (a)

(i) Particle stationary/at rest.

(ii) Increasing vel. (grad=vel)

(iii) Particle moving at cost. vel in the opp. direction i.e. towards origin.

(b)

(i) Uv=0, S=45m, a=10m/s^2t=?

$S=ut+ {}^1/_2 \, at^2$

$45 = 0+5t^2$

t=3S

(ii) Range =50m

t=35

U_m=50/3=16.67m/s

(iii) Vv = Uv + at

Vv = 0 + 10 x 3

Vv = 30m/s

Total distance =area bound by x-axis and the line of graph

=20m + 20m

=40m

Note: Since distance is scalar quantity the -ve area is taken to be +ve.

17. s=15, Um=300m/s, a_v=10m/s^2, Uv=0m/s

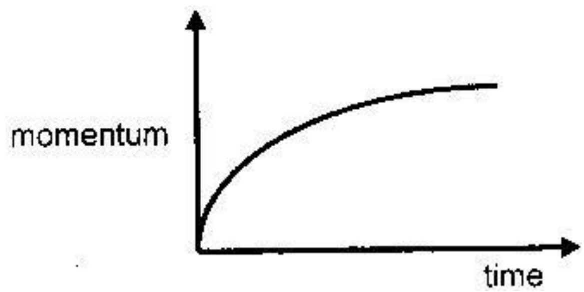
Therefore $s=ut+{}^1/_2 \, at^2$

$15 – 0 + 5t^2$

$t=3.873s$

Therefore $d=U_H$ x $t=300$ x $3.873 = 1161m$

18.



19. Distance = area under curve between 0 and 3.0 second.

= 120 x 3x 0.2 = 72m

Accept 70.5, 73.5, 76.5

20. Acceleration = slope of graph at t = 4.0s

$\frac{16 \times 3}{17 \times 0.2} = 14.11 m/s^2$

21. 24.45s, 2445m, 264.2m/s or 67.8^0 to the horizontal

22. 1936.5m

23. 2s, 80m/s

24. 0.5s, 2.5m, 1.25m

25. Upwards, 18s, 180m/s, 1620m, 1,600m

26. 20.6m/s

27. 40.9°

28. 50m/s, 125m, 10s

29. 31.25m, 2.5s

30. 0.0333s, 18m/s.

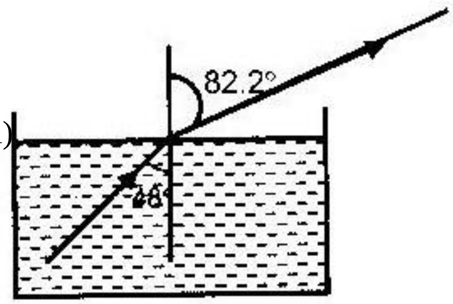
2. REFRACTION OF LIGHT

1. 1989:

(a) (i) $\frac{\text{Sin } 48}{\text{Sin r}} = \frac{3}{4}$ Sin r = 0.9906

= 82.2^0

(ii)



(b) Sin C = $\frac{1}{n}$ = 0.75

C= 48.6^0

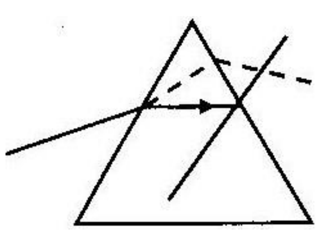
i.e. when r= 90, I= C

$\frac{Va}{Vw} = n$

$\frac{3 \times 108}{Vw} = \frac{4}{3}$ $\therefore$ Vw=2.25×10^8 m/s

2. a) n= $\frac{Va}{Vp} = \frac{3.00 \times 10^8}{1.88 \times 10^8}$ =1.6

b)



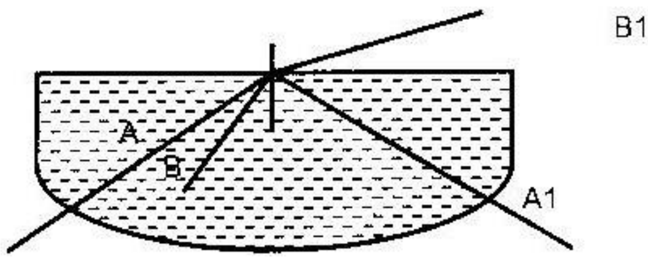
Sin C=$^1/_{1.6}$

C=38.8

c) $\frac{\text{Sin Q}}{\text{Sin 21.2}} = 1.6$

Q= 35.4^0

3

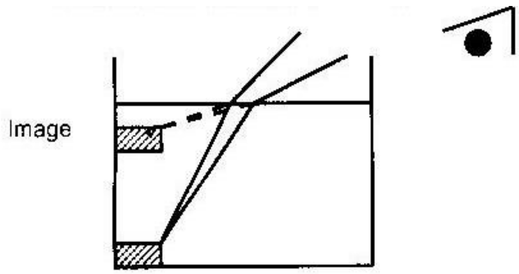


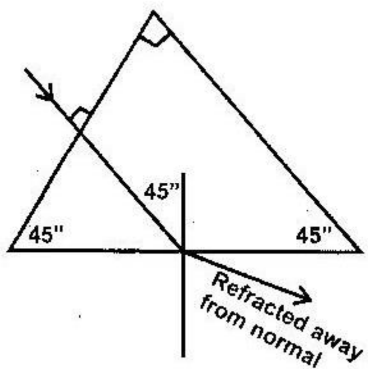
4. Sin C= $^1/_n$ = $^1/_{1.4}$

C= 45.6

$\therefore$ Total internal reflection will take place.

5.





6.

7.

${}_a n_g$ = Velocity of light in air

= Velocity of light in glass

= $3x\ 10^8$

= 2.4×10^8

= 1.25

8. η_g = Real thickness

Apparent thickness

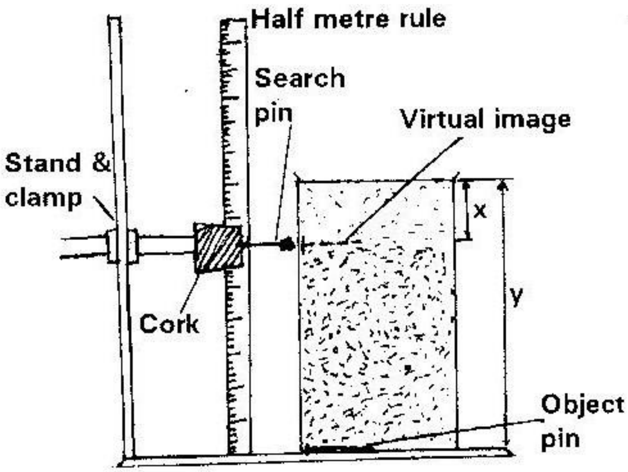
1.58= 10

Apparent thickness

Apparent thickness = $^{10}/_{1.58}$ = 6.33cm

The apparent thickness of crown glass block = 6.33cm

9 a)



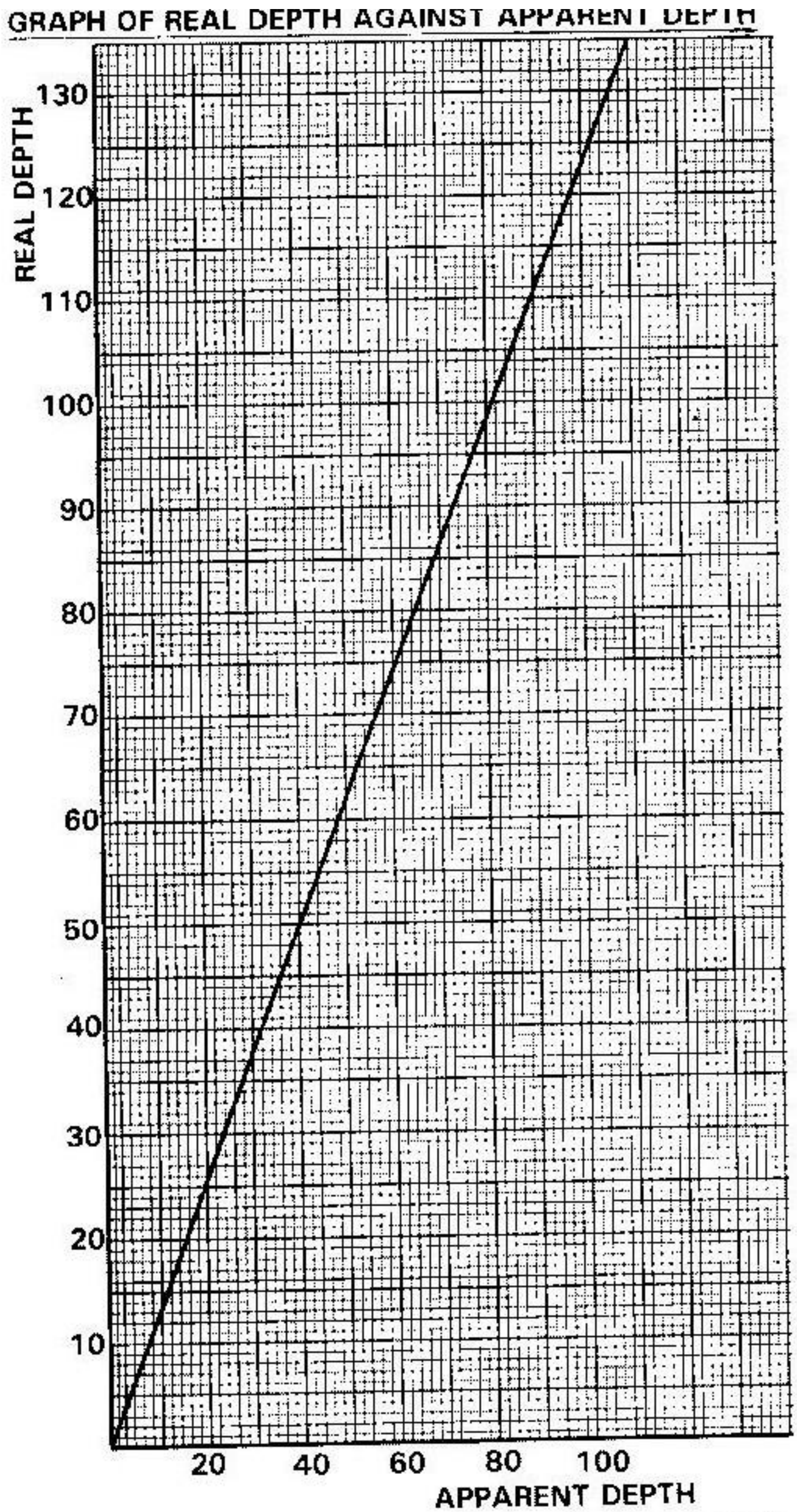
- Set the apparatus as shown above.
- Adjust the search pin to no-parallax position.
- Using the metre rule, measure the apparatus distance x and the real depth y of the water.
- Repeat the experiment for other values of y
- Plot a graph of y against x.

Refractive index = gradient of graph

$$= \frac{\text{Real depth}}{\text{Apparent depth}}$$

$\eta_w = y/x$

i) Graph


GRAPH OF REAL DEPTH AGAINST APPARENT DEPTH
REAL DEPTH
130
120
110
100
90
80
70
60
50
40
30
20
10
20
40
60
80
100
APPARENT DEPTH

ii) $\eta_1 = \dfrac{\text{Real depth}}{\text{Apparent depth}}$ = gradient of the graph

Gradient = $\dfrac{135}{100}$ = 1.35

$\therefore$ Refractive index, η_1==1.35

10. Bending of light is more in paraffin than in water.

Thus speed of light in paraffin is less than that in water.

11. a) Ratio of sine of angle of incidence to sine of angle of refraction is always a constant i.e.

$\eta = \dfrac{\text{Sin I in medium 1}}{\text{Sin r in medium 2}}$

b) i)

$a\eta_1 = \dfrac{\text{Sin i}}{\text{sin r}}$

$= \dfrac{\sin 40^0}{\text{Sin } 24^0} = \dfrac{0.6428}{0.4067}$

= 1.581

(iii) $_a\eta_1 = \dfrac{1}{\text{Sin C}}$ Where C is the critical angle then

$1.581 = \dfrac{1}{\text{Sin C}}$

$\dfrac{1}{\text{Sin C}} \quad \dfrac{1}{1.581} = 0.6325$

$C = \sin^{-1} 0.6325$

$= 39.23^0$

Critical angle $= 39.23^0$

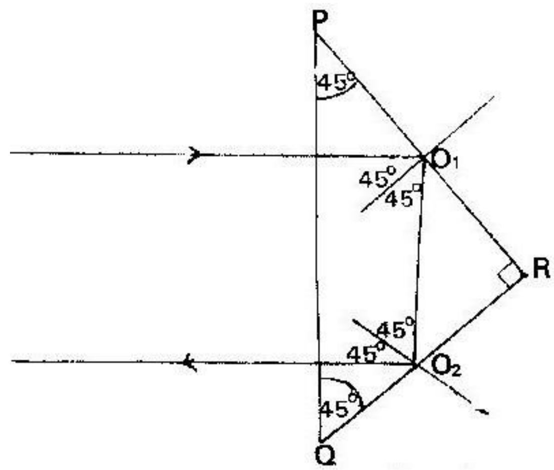
(iv) $_a\eta_1 = \dfrac{\sin I \text{ in } 1}{\sin r \text{ in } 2}$

$= \dfrac{\sin 24^0}{\sin 26^0} = \dfrac{0.4067}{0.4384}$

$= 0.9277$

12. Solution;

Use a right angled prism.



Ray meets longest side of prism at 90^0 and passes undeviated. It makes an angle of 45^0 with normal at O_1 and is totally internally reflected. The reflected ray makes an angle of 45^0 with normal at O_2 and is totally reflected as shown. Total deviation = $(4 \times 45)^0 = 180^0$

13. Frequency or wavelength
14. Used in;
    - Prism periscope
    - Optical fibre
    - Prism binocular
15. Solution;

    Gradient of the graph = $\dfrac{\text{Apparent depth}}{\text{Real depth}}$

    $= {}^{10}/_{20} = ½$

    But refractive index = $\dfrac{\text{Real depth}}{\text{Apparent depth}}$

    $\eta_g = {}^{1}/_{gradient}$

    $\therefore$ Refractive index of glass = 2
16. Solution;

    For light passing from water to air then

    ${}_w\eta_g = {}^{3}/_{4}$

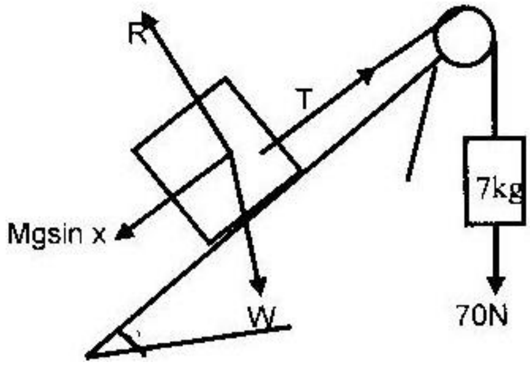
3. NEWTON'S LAW OF MOTION

1. 1989

R - Reaction

W - Weight

T - Tension



(ii) Net force= 70N – mgsinx= 70N- 30Xsin 30sin 30

F= ma

55= (7 + 3) a

a= 5.5m/s^2

2. The rocket will accelerate due to 2 reasons

   - The total mass of the rocket decreases as the fuel burns but thrust force is constant

- The gravitational pull decreases with increase in distance from the centre of the earth so it will be less.

3. P.E = K.E

$Mgh = \frac{1}{2} mv^2$ therefore $V = \sqrt{2gh} = \sqrt{20x5} = 10m/s$

Momentum before collision = Momentum after collision

$M_1U_1 = (M_1 + M_2)20$

10 x 2 5 x 20

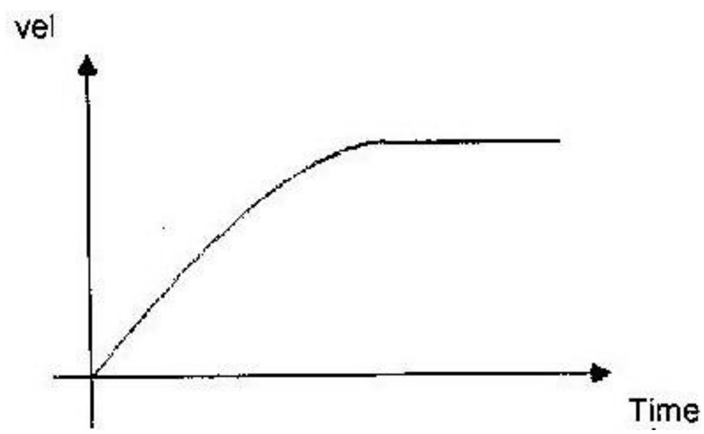
V= 4m/s

4. Total force downward = weight of the girl = 400N. Since the lift is moving upwards the upward force T, is greater than 400N therefore from F=ma

(T-400)=40x2

T= 480N= reading

5.



6. Force upward = 600N, Force downward = 50N (wt).Therefore Net force = 550N upwards.

$F= ma = m(v-u)/t = m (v)/t$ since $u= 0$

$550 = (50 \times v)/0.1$

$V = 11m/s$

7. (a) (i) The body continues in its uniform state of motion velocity

(ii) U= 25m/s, V=0, S= 20m a=?

$V^2 = U^2 + 2as$

$0= 625 + 40a$

$a= -15.625m/s^2$

$F= ma = 800x – 15.625$

$= -12500N$

Therefore decelerating force= 12500N

(b) Since one is moving towards the other one is +ve while the other is –ve.

Momentum before collision = momentum after collision

(i) $M1u1 + m_2u_2 = (m_1+m_2) v$

$(2x\ 0.25) – (1.5 \times 0.4) = 3.5 \times v$

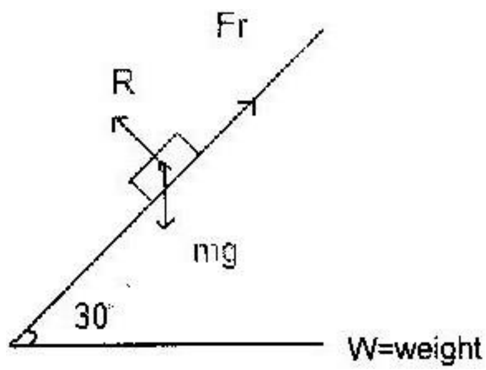
$0.5 – 0.6 = 3.5 V$

$v= -0.02867m/s$

$= -2.867 \times 10^{-2}m/s$

(ii) The original direction of the 1.5kg mass

8. (a) (i)



Fr= Frictional force

(ii) Force= mg sin 30-6

= 5 x 10 x 0.5-6

= 19N

(ii) F= ma

19=5a = a = 3.8m/s^2

U= 0m/s

S= 0.25m

t =?

s= ut + ½ at^2

0.25 = 0+ $1.9t^2$

t^2 = 0.3627s

= 0.36s

(b) (i) Plot the graph

(ii) Let it touch y and x – axis

(I) Time taken by bullet = x intercept (30ms)

(II) Impuse = force x time = area bound between x – axis and the line of the graph (6Ns)

(iii) V= 200m/s m=?

Impulse = Ft = Mv – Mu

= $6N_s$ = M x 200-0 since u= 0

Therefore m= 0.03kg

9. M tends to remain in its state of uniform rest due to its inertia. This protects string A

10. Propelling force= 0.5 x 10= 5N

Opposing force= frictional force = 3 N

Net Force = 5-3 = 2N

Using F= ma

2= (2+ 0.5)a

a= 0.8m/s^2

s= 0.6m

u=0

$V^2 = U^2 + 2as$

= 0+ 2+ 0.8 + 0.6

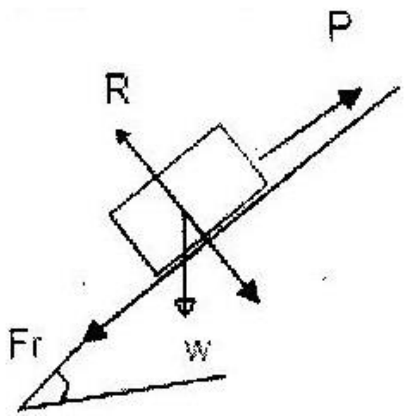
= 0.96

Therefore V= 0.9798

V= 0.098m/s

11. Speed decrease. Since momentum before collision is equal to momentum after collision i.e $M_1V_1 = M_2V_2$ then increase in mass implies/cause a decrease in velocity.

12. (a) (i) R=Reaction



(ii) Mg sin 10 = 30 x 10 sin 10

= 52.1 + 20

(iii) Since the velocity is constant then the net force = 0

p= $mg\sin\Theta + Fr$

p= 52.1 + 20

72. 1N

(b) (i) Frictional force

(ii) F= ma

(52.1- 2.0) = 30a

32.1 = 30a

a= $1.07m/s^2$

13. The mattress increase time taken to land. Thus from

f= $\frac{\text{(Change in momentum)}}{\text{Time taken}}$

When time is more the force that will decelerate the jumper will be smaller (safer)

Fr= frictional force

F= ma

F= 2ma

Dividing

$1 = \frac{a_1}{2a_2}$

i.e. $a_2 = (½)\, a_1$ OR read the value of x- intercept i.e. when a=0 m=mo and

substitute in the equation to get m.

14. Since one is moving towards the other one has +ve vel while the other is –ve

Momentum before collision = momentum after collision

(i) $m_1u_1 + m_2u_2 = (m_1m_2)v$

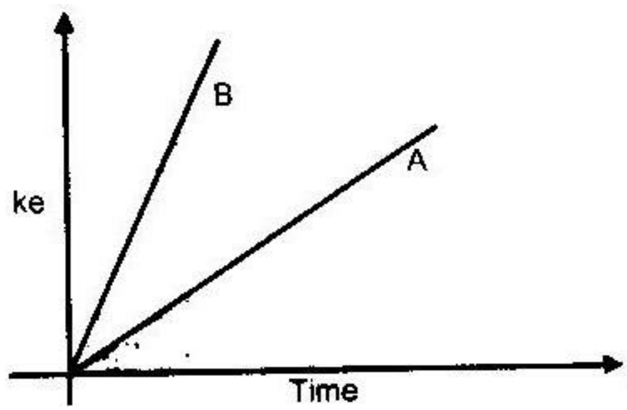
(2 x 0.25) - (1.5x0.4) = 3.5 x v

0.5 – 0.6 = 3.5 v

$V = 0.02867 m/s$

$= -2.867 \times 10^{-2} m/s$

(ii) The original direction of the 1.5 kg mass

15. 

16. Speed decreases. Since momentum before collision is equal to momentum after collision i.e. $M_1V_1 = M_2V_2$ then increase in mass implies/cause a decrease in velocity.

(a) A body at rest or in motion at uniform velocity tends to stay in that state unless acted on by an unbalanced force.

(b) (i) Slope $s = \frac{97.5 - 0}{16 - 0} (^m/_s)^2$

$20k = s = 6.09$

(ii) $k = \frac{6.17}{20} = 0.304$

(iii) Increase in roughness increase k and vice versa

(c) Applying equation

$V^2 - U^2 = 2as$

$V^2 - 0 = 2 \times 1.2 \times 400$

Momentum P = mv

$= 800 \times \sqrt{2 \times 1.2 \times 400}$

24787.09

24790 (table)

PREDICTION QUESTIONS ON THE TOPIC

17. 2N

18. 7.75m/s

19. 5.4m, 0.66N

20. (a) 10m/s, -3.33m/s, (b) 0.333 (c) 50,000J

21. 875N

22. (a) 7.07 m/s, 0.71s,

(b) (i) 0.071kgm/s (ii) 0.71N (iii) 0.71N

23. 30000N

4. WORK, ENERGY, POWER & MACHINE

1. Kinetic- potential – kinetic

2. (a) Steam has more energy and would release its latent heat of vaporization before turning to water at 100^0C.

(b) (i) Q= m1

= 0.03 x 336000

= 10080J

Power output = $\frac{10080}{180}$ = 56W

$\frac{Po}{Pi}$ x 100 = 60

$\frac{56}{Pi}$ x 100 = 60

Pi = 93.33w

(ii) E= Pt = 93.33 x 180

= 16,800J

Energy wasted = 16800 – 10080

= 6720J.

(c) $^1/_5$ g of alcohol will give 2.7 x 10^4J

$^4/_5$ of petrol will give 3.84 x 104 J

$\therefore$ 1g of mixture gives

= 5.4 x 103 + 38.4 x 103J

= 43. 8 x 103J

w.d = mgh = 1000 x 200 x 10 = 2 x 106

Energy required = $(2 \times 106) \times \frac{100}{40}$

Mass required = $\frac{2 \times 10^7}{4 \times 43.8 \times 10^3}$

= 114.2g

(d) P.E → Heat

Heat →K.e

3. : K.e

4. : Air resistance causes damping of vibration

5. : Quality of heat = k.e = ½ mv^2

= ½ x 0.8 x 10^{-3} x 400 x 400

= 64J

6. Pitch=distance the screw moves in or out when turned one

revolution=0.5mm

7. Rotational K.e

8. u= 25m/s, v= 0m/s

s= 20m

$v^2 = u^2 + 2as$

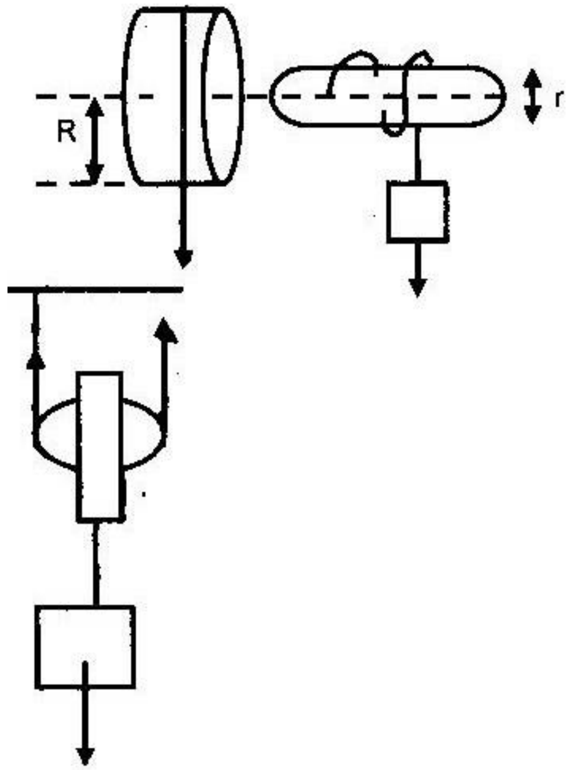
O= 625 + 40a

a= -15.625 m/s^2

F= ma = 800 x – 16.625

= 12, 500N

9. (a)



(a) If E = 100% then M.A = V.R = R/r= 15/1.5 = 10

(b) 2E = L or 2 = L/E = M.A

Wheel and axle is more advantageous

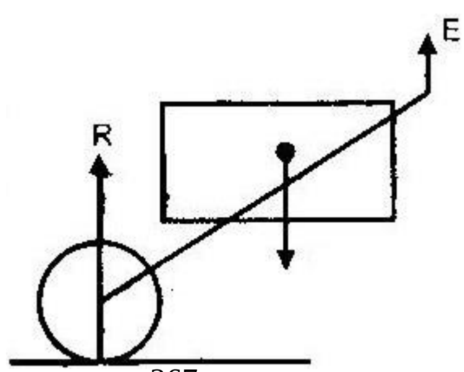
10. $16 = \frac{1}{2} mv^2$

K.e = ½ m $(2V1)^2$ =

Dividing K.e = $^4/_{16}$ Ke2 = 64J

11. Ratio of work output to work input expressed as a percentage.

12. (a)



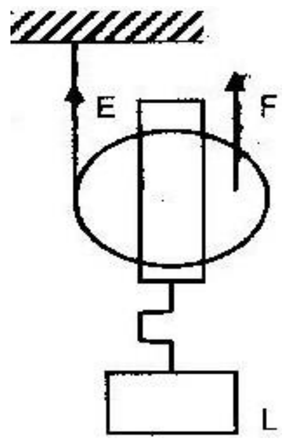
E= Effort

W= Weight

R= Reaction

(b) Effort decreases because the far the force applied is from the pivot, the smaller the value of force required to produce the same moment/turning effect.

13.



14.

(a) Total work done= area under graph i.e between the x-axis and the line graph

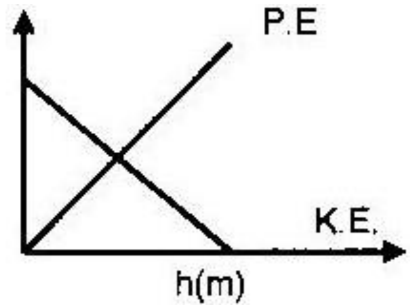
w.d = 240000J. (Note that w.d is a scalar quantity and thus the –ve is consider as +ve)

(b) Power output = $\frac{mgh}{T} = \frac{3 \times 10 \times 10 \times 360}{3600}$ = 300 KW

Power input = power output + power loses

= 300 + 200 = 500KW

$$E = \frac{Po \times 100}{P1} = \frac{300 \times 100}{500} = 60\%$$

15. 

$$MA = \frac{1800}{400} = 4.5$$

$$\frac{MA}{VR} \times 100 = 65$$

$$VR = \frac{4.5}{65} \times 100$$

v.r = 6.9

= 7

16. (i) w.d = F x d

= 20,000 x 3

= 60000J

(ii) $P = \frac{W.d}{t} = \frac{60000}{6}$

$= 10kw$

(iii) $E = {}^{Po}/_{pi} \times 100 = {}^{10}/_{12.5} \times 100 = 80\%$

17. 2005: $\frac{MA}{VR} \times 100 = 75\%$

But $MA = {}^{600}/_{400} = 1.5$

$\frac{1.5}{VR} \times 100 = 75$

$VR = 2$

18. 1250W, 875J

19. 50kg

20. 2000J, 40W

21. 2.08×10^4

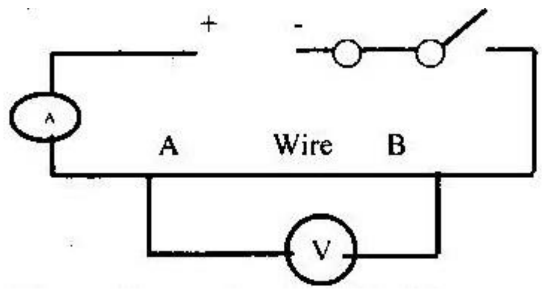
22. 0.676J

23. 0.05m

5. CURRENT ELECTRICITY II

1. Dry cells have a very high internal resistance hence give very little current that start a vehicle.

2. (i)



(ii) - Measure length of wire (L)

- Take readings of ammeter (I) and voltmeter (V)
- Calculate its resistance R
- Then find the value $^R/_L$

(b) (i) The current flowing through a resistor is directly proportional to the p.d. applied as long as the physical factors remain constant.

(ii) If the temperature is controlled to remain constant then they obey ohm's law. If temp is changed, they don't obey.

(c) Every time the current is reversed the direction of key pointer also reversed. This would give an average of zero.

(d) (i) For the two 3Ω resistors in parallel their total = product/sum=1.5 Ω

For series connection i.e. 3.3 and 1.5Ω, total 7.5 Ω

∴RT = 7.5 Ω

(ii) $I = \frac{E}{RT} = \frac{10v}{7.5} = 1.33A$

3. RT = product/ sum = 9x18= 4.5 Ω

I = 12/4.5 = 8/3 Amps

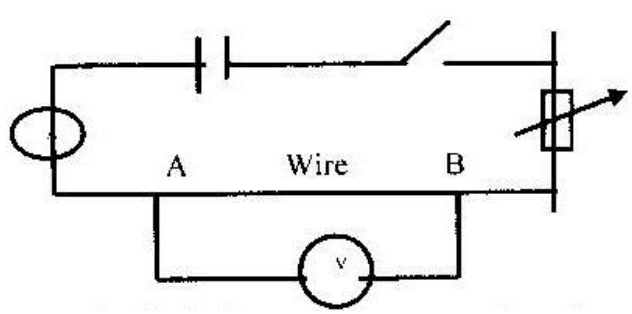
I through the 3 Ω is equal to I through the Ω since total resistance in each route are equal = $^8/_3$A x ½

p.d = $^4/_3$ x 3 = 3V

4. Constant temperature, magnetic field, tension, compression, kinks etc.

5. (a) The current flowing through a resistor is directly proportional to the p.d applied as long as the physical constants are held constant.

(b)



- By varying R obtain a set of corresponding values for I and p.d readings
- Tabulate them
- Plot V against I
- If it is a straight line the law is obeyed, over wise not.

(c) (i) When R_1 only is connected I = 0.8a

$R_1 = E/I = 10/0.8 = 12.5\ \Omega$

When both are connected, then

$(R_1 + R_2)\ 0.5 = 10$

$(R_2 + 12.5) = 20$

$R_2 = 7.5\ \Omega$

(ii) When in parallel RT = products/ sum = 4.6875 Ω

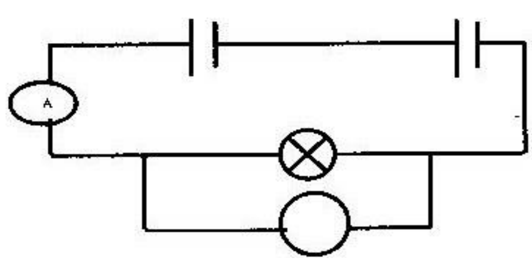
I= 10/4.6875 = 2.133A

(d) - Rod of the acid

- Voltage emf of the battery

6. Q= It = 0.08 x 2.5 x 60 = 12C

7.



8. $\underline{1} = \underline{1} + \underline{1} + \underline{1} = \underline{4} = \underline{2}$ $\therefore$ RT = 1.5 Ω

R_T 6+ 3 + 6 = 6 = 3

(b) For the whole circuit Rt = 1.5 + 2.5 = 4 Ω

Main current = $\underline{E} = \underline{2}$ = 0.5A

RT 4

p.d across YZ = IR = 0.5 x 1.5 = 0.75V

p.d across any of the resistors in parallel

3 x 1 = 0.75A

I = 0.25 A

9. (i) For parallel connection RT = Products/ sum

= $\underline{(5 \times 5)}$ = 2.5 Ω

(5 + 5)

$\therefore$ Total resistance = 2.5 + 5.5 = 8.0 Ω

(ii) Current= main current = R/R_T = 4/8 = 0.5 Ω

(iii) Note currents through Y and Q are equal since the resistance values are equal – through the two routes.

Let potential be rep. by P

Py – Pp = 0 (earthed)

$\therefore$ Py = IV

PQ = P_P = $P.d_{QP}$ = 0.25 x 2 = 0.5V

P_Q – 0= 0.5

P_Q = 0.5V

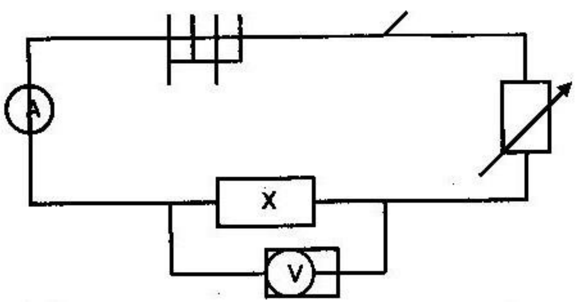
(iv) $P.D_{YQ} = P_y - P_Q = 0.5V$

10. $E = Pt = \frac{V^2}{R} \times 2 \times 60 = \frac{240 \times 240 \times 120}{480}$

$= 14400J$

$= 14.4KJ$

11.



12. $I = \frac{1.5}{R + r}$

$0.13 = \frac{1.5}{10 + r}$

$R = 1.5\Omega$

13. (a) The ratio of the pd across the ends of a metal conductor to the current passing through it is a constant.

(b)

(i) It does not obey Ohm's law; because the current – voltage graph is not linear throughout

(ii) Resistance = $^{V}/_{I}$ = inverse of slope

$$\frac{(0.74 - 0.70)V}{(80 - 50)mA}$$

$$= \frac{0.40V}{30 \times 10^{-3}A}$$

= 1.33 Ω

(iii) From the graph current flowing when pd is 0.70 is 60mA

Pd across R= 6.0 – 0.7 = 5.3V

$$R = \frac{5.3V}{60mA}$$

= 88.3 Ω

(c) (i) Parallel circuit $\frac{I}{30} + \frac{I}{20} = \frac{5}{60}$

R= 12 Ω

Total resistance = 10 + 12 = 22 Ω

(ii) I = $^{V}/_{R}$ = $^{2.1}/_{22}$ = 0.095 A

(iii) V= IR = $10 \times \frac{2.1}{22}$

= 0.95V

- Alkaline cell last longer than lead acid cell
- Alkaline cell is more rugged than lead acid cell
- Alkaline cell is lighter than lead acid cell

$I = \frac{1.5}{R + r}$

$0.13 = \frac{1.5}{10 + r}$

R= 1.5 Ω

(a) The ratio of the pd across the ends of a metal conductor to the current passing through it is a constant.

(b) (i) It does not obey Ohm's law because the current – voltage graph is not linear throughout

(ii) Resistance = $^{V}/_{I}$ inverse of slope

$= \frac{(0.74 - 0.70)\text{ V}}{(80 - 50)\text{mA}}$

$= \frac{0.40\text{V}}{30 \times 10^{-3}\text{ A}}$

= 1.33 Ω

(iii) From the graph current flowing when pd is 0.70 is 60mA

Pd across R = 6.0 – 0.7 = 5.3V

$R = \frac{5.3\text{V}}{60\text{mA}}$

= 88.3 Ω

(c) (i) Parallel circuit $\frac{1}{30} + \frac{1}{20} = \frac{5}{60}$

R = 12 Ω

Total resistance = 10 + 12 = 22 Ω

(ii) $I = \frac{V}{R} = \frac{2.1}{22} = 0.095$ A

(iii) V= 1R = 10 x $^{2.1}/_{22}$

= 0.95V

14. 2V

15. 4 Ω, 0.5A

16. 1.43 Ω

17. 1.5v, 0.5 Ω

18. b i 1.5, ii 1Ω, 4 Ω

19. 10s, 0.792w

20. No answer

6. WAVES

1. Make the glass sooty. Make very small markings with the edge of a razor blade. The marking (slits) run parallel, to each other light passes through the slit as the rest of the glass has been blacken.

2. The longer the wavelength the lower the frequency.

   $$\text{Wavelength} = C = \frac{3 \times 10^8}{0.5 \times 10^6} = 600\text{m}$$

3. Speed and wavelength decrease

4. T = 0.45

   $F = {}^{1}/_{T} = {}^{1}/_{0.4} = 2.5$ Hz

5. The wave length decrease

6. $f = 40.\lambda = 8.5$m

   $V = f\lambda = 40 \times 8.5$

   $= 340$m/s

   $T = {}^{d}/_{V} = {}^{102}/_{340} = 0.3$s

7. The slit and the wavelength of the wave have to be of the same order.

8. (a) $$T = \frac{I}{F} = \frac{1}{4} = 0.25\text{s}$$

   So no. of waves S= t/T

   = 1.25 = 5 wavelengths

   (b) (i) Same wavelength & same frequency

   (c) $S_2P - S_1P = 9\lambda - 7\lambda$

9. n= $\underline{\quad V\ air \quad}$

V medium

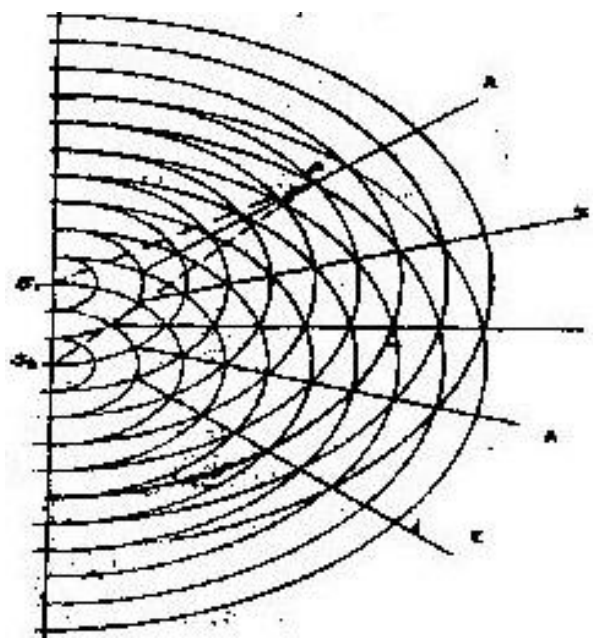
$V = 3 \times 10^8 = 2 \times 10^8 m/s$

10. Light can be plane polarized

11. $C = f\lambda$

$F = c/\lambda$ where c is constant so f is inversely proportional to λ. If f decreases by ¼ then value of λ is tripled

12. (a) Stationary waves has nodes and antinodes but progressive wave does not have them



(b) (i) By using a pin to rule two parallel lines about a third of a millimeter apart on a piece of thin glass coated with graphite and allowed to dry.

(ii) Path difference = (n+ ½), where n= 0, 1, 2, 3, 4…….

(c) (i) Copy diagram of on 17

(ii) Light meters

(iii) A is formed when path difference of the waves is zero so there is constructive interference. B is also due to constructive interference, but path differences is equal to one wavelength, C is as a result of destructive interference due to path differences being equal to half of one wavelength.

13. Wavelength

14. Tank becoming shallower outwards from the centre. The speed of waves decreases and hence the wavelength decreases outwards.

15. They block certain directions of vibration of the light going through the glass

16. Diffract the light waves and give interference

(i) To produce 2 coherent monochromatic sources

(ii) Fringes of light separated by areas of some darkness

(iii) (i) More fringes

(ii) Central white fringe and fringe of different colours on either side of central fringe

17. (i) Fringes of light

(ii) Central white fringe and fringes of other colours on either side of white fringe

18. Transverse- oscillations are perpendicular to direction of wave propagation

Longitudinal – oscillations are parallel to direction of wave propagation

(b) (i) No energy was lost, therefore the intensity remained the same and there was no amplitude change.

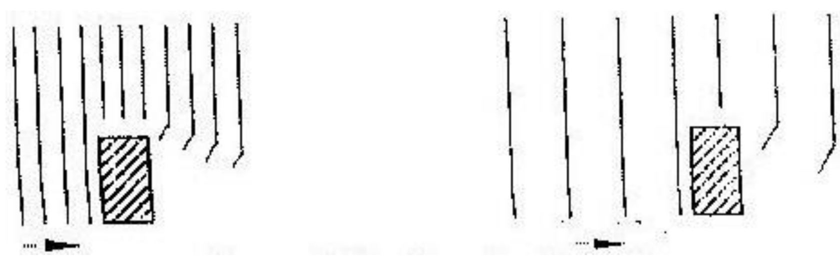
(c) (i) 0.5 Hz (ii) 6m

19. Mechanical waves require a material medium to travel through while the em waves do not.

T = <u>0.007s</u> f= 3 x 5 = 15 cm

3

F= $^{1}/_{T}$ = $^{3}/_{0.007}$ = 429 Hz



Correct diffraction effect for both

20. 0.35S

21. 85M

22. 680M

7. ELECTROSTATICS II

1. (a) (ii) Ability to store charge given by the quality of charge it can store per unit p.d

   (b) Bring it near a charged electroscope (say +ve). If there is divergence then the rod is +vely charged. If not, charge the electroscope -vely and bring the rod near. If divergence is observed then they have the same charge. Note that if decrease in divergence is observed in both cases then the rod is simply a conductor and its not charged.

   (c) Nothing would happen to the leaf of the electroscope. This is because in a hollow charged conductor, the charges are distributed on the surface of the charged conductor and not inside.

   (d) Earthing or using another charged body

   (i) Q= CV

   = 2 x 10

   = 20 μC

   (ii) Series = $^1/_C = ^1/_3 + ^1/_3$

   $^1/_c = ^2/_3$

   C= $^3/_2$ = 1.5 u F

   Parallel C_t = 1.5 + 2

   = 3.5 Uf

2. Parallel = $C_T = C_1 + C_2$

   Series = $1/C_T = 1/C_3 + 1/ (C_1+ C_2)$

$1/C_T = (C_1 + C_2) + C_3$

$C_3 (C_1 + C_2)$

$C_T = C_3 (C_1 + C_2)$

$C_1 + C_2 + C_3$

3. Like charges repel while unlike charges attract.

4. (a) When S1is closed V= 3V

Charge stored in C2 is Q = CV = 3C

When S1 is opened, ½ Q is transferred from C1 to C2

Since they are in parallel p.d = 1.5V

(b) (i) RT = 6 + 5 + 0.5 = 11.5 Ω

$\therefore I = \frac{E}{R_T} = \frac{3.0}{11.5} = 0.26A$

$\therefore Q = CV = 1.4 \times 3$

$= 4.2 \mu C$

5. $Q_T = CV = 400 \mu c$

$C_T = (2 + x)$

$Q_T = 80$

(400uc) = 80

(2+x)

X= 3 μF

6. (i) Ct = (5+ 10) μf = 15 μf

Q= 200 x 5

= 1000 μf

$\frac{Q}{V} = 15\ \mu f$

$\frac{1000}{15} = V$

V= 66.7V

(ii) $\frac{Q}{V} = C$

$\frac{Q}{66.7} = 5$

Q= 66.7 x 5

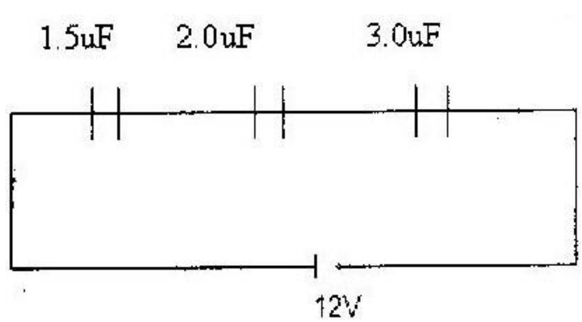
= 333.5 μf

$\frac{Q}{V} = 10$ $\frac{Q}{66.7} = 10$

Q= 66.7 x 10

= 66.7μf

7.



(a) $\underline{1}$ = 1/1.5 + ½ + $^1/_3$

C_1

= 0.67 + 0.5 + 0.33

$1/C_T = 1.5$

$C_t = 0.67$ μc

(b) $Q= C_TV$

= 0.67 x 12

Q= 8.04 μc

(c) 8.04uc this is because they are in series arrangement therefore the quantity of charge is equal in all the capacitors.

8. For parallel $C_T = C1 + C2$

= 1.0 μF

Series C_T = product/ sum = 2/3 = 0.667 μF

Q_T = CV = 2/3 x 6 = 4 μC

$QC_1 = CV = Q_T = 4$ μC

$VC_1 = Q_T = 4/2 = 2V$.

9. (a) Graph of change against p.d

(b) $Q = CV$

$C = \text{gradient} = \frac{0.24 - 0.08}{6.0 - 2.0}$

$= \frac{0.16}{4.0}$

$= 0.04\ \mu F$

(c) Energy stored = ½ QV = area

$= \frac{1}{2} \times 40 \times 10^{-6}$

$= 2.00 \times 10^{-4} J.$

8. HEATING EFFECT OF ELECTRIC CURRENT

1. $P = \frac{V^2}{R}$

   $40 = 240^2/R$

   $R = 1440\ \Omega$

2. $P = V1$

   $W/t = V1$

   $^{15000}/_{10 \times 60} = V \times 2$

   $V = \frac{15000}{10 \times 60 \times 2}$

   $= \frac{150}{12} \qquad = 12.5V$ Voltage across resistor is 12.5V

3. Solution

   (No. of ions) x 1000 = IV

   No. of ions $= \frac{13 \times 240}{1000}$

   $= 3.12 \qquad = 3A$

4. Solution

   $R1 = V^2/p$………….. (i)

   $R2 = (V/2)^2 \div 2P = V^2/_4 \div V^2/4 \times 1/2p = v^2/8p$……. (ii)

   $\therefore R1/R1 = V^2/P \div V^2/8p$

   $= V^2/_p \times {}^{8p}/_{V2} \qquad = 8$

5. Solution

(i) Amount of current, I

(ii) Resistance, R of the conductor

(iii) Time t for which the current flows

6. Is the rate at which electrical energy is converted to useful work per unit time?
7. Solution: That the appliance operates at a voltage of 240 volts. When it is operating normally, the electrical power outputs is 200 watts i.e. 200J of electrical energy is converted to other useful energy per unit time
8. (a) Solution

Electrical power P = VI

$120 = 240I$

$\therefore\ I = {}^{120}/_{240} \qquad = 0.5A$

(b) From Ohm's law

V= 1R

R= V/J

$= {}^{240}/_{0.5} \qquad = 480\Omega$

The resistance of element = 480Ω

9. Solution

$P= V^2/R$

$R= V^2/P$

$$= \frac{240 \times 240}{100}$$

$= 24 \times 24 \qquad = 576\Omega$

9. QUANTITY OF HEAT

1. 1989

(i) Heat absorbed by ice from – 10^0 = 1x 2,100 x 10 = 2.1 x 104

Heat absorbed by melting ice= 1 x 334 x 10^4 = 3.34 x 10^5

Heat absorbed by water from 0^0 to 100^0 = 1 x 4,200 x 100J = 4.2 x 10^6J

Heat absorbed water at 100^0 = ML = 1 x 2,260 x 10^3 J= 2.26 x 10^6J.

Total heat absorbed = 301.5 x 10^4 = 3.035 x 10^6J

Heat given out by heater = power x time

Time = 3.035 x 10^6 =

6 x 10^3

= 0.5025 x 10^3

= 505 .83s = 8.43min

(ii) Some heat is used to heat up the heater, some is absorbed by the container/ due to energy losses more time for heating will be required.

2. 1991: (a) It has more heat energy than water at the same temperature.

(b) (i) At 60%, Q = ML = 0.03 x 3.36 x 10^5

At 100% power = 93.3 V or

$P = \frac{E}{T} = \frac{0.03 \times 3.36 \times 10^5}{100}$

= 56W

(ii) 100% energy = $\frac{100 \times 10080}{60}$

$= 16{,}800J$

$\therefore 40 \times 16{,}800 = 6{,}720J$

$= 60J$

(c) (i) $^{1}/_{5}$g alcohol gives $5.4 \times 10^{3}J$

$^{4}/_{5}$ petrol gives $38.4 \times 10^{3}J$

1g mixture gives $(5.4 \times 10^{3}\ J) + (38.4 \times 10^{3}J)$

(ii) Work done= Mgh = 1000 x 20x 10

$\frac{1{,}000 \times 20 \times 10}{43.8 \times 10^{3}} \times \frac{100}{40} = 1.14 \times 102g$

OR $\frac{\text{Energy output}}{\text{Energy input}} \times 100 = 40\%$

Energy output = 2 x 106J

Energy input $= \frac{100 \times 2 \times 10^{6}J}{40}$

Mass $= \frac{100/40 \times 2x\ 10^{6}}{43.3 \times 10^{3}}$

(d) PE→ Heat energy

Heat → Kinetic Lost

3. 2002: Heat gained = Heat Lost

$MC\Delta\ \theta = Vlt$

2 x C x 10 = 90 x 15 x 60

$C = \frac{9 \times 15 \times 60}{20} = 4050\ Jkg^{-1}K\ K^{-1}$

4. 2004: - Increased Pressure

   - Impurities

5. 2003:

   (a) Specific Latent Heat of vaporization is the quantity of heat required to change 1kg of liquid at 1s boiling point completely to vapour at constant temperature.

   (b) (i) (I) 123 – 120 = 3g or 0.003 kg

   (II)

Heat for water	Heat calorimeter
0.070 x 4,200	0.05 x 390
x 25	x 25
= 7,350J	= 487.5J

Total = 487.5 + 7,350 = 7,837.5J

(ii) I. $ML + MC\Delta\ \theta = 7837.5$

II. $0.003L + 0.003 \times 4200 \times 70 = 7837.5$

$0.003L + 882 = 7837.5$

$L = 2.3185 \times 106$

Or $L = 2.32 \times 10^6$J/kg

6. $p \times t = MC\ \Delta\ \theta$

   $2.5 \times 1000t = 3 \times 4200 \times 50$

   T= 252s

= 4.2 min

7. 2004: Decrease in V increases I hence the heating rate increase ($P= 1^2R$)

8. (a) Current, time, mass of water formed

(b) Power x time = MLf.

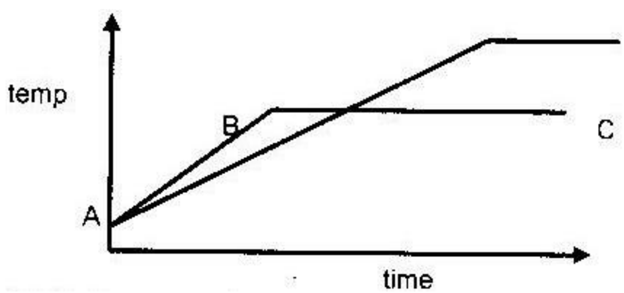
$$\text{Power} = \frac{\text{m x Lf}}{\text{Time}}$$

(c) Energy lost is not accounted for

e.g energy absorbed by heater, container and radiation.

9. BC- Liquid boiling at constant temp (at boiling pt)

10.



11. 2007: Pressure impurities

12. 2007

(a) Quantity of heat required to change completely into vapour 1kg of a substance at its normal boiling without change of temperature.

(b) (i) So that it vaporizes readily/ easily

(ii) In the freezing compartment the pressure in the volatile liquid is lowered suddenly by increasing the diameter of the tube causing vaporization; in the cooling finns, the pressure is increased by the compression pump and heat lost to the outside causing condensation.

(iii) When the volatile liquid evaporates, it takes away heat of vaporization from the freezing compartment; reducing the temperature of the later; this heat is carried away and dissipated at the cooling finns where the vapour is compressed to condensation giving up heat of vaporization.

(iv) Reduces rate of heat transfer to or from outside (insulates)

(c) (i) Heat lost by steam = $0.003 \times 2.26 \times 10^{b}$

Heat lost by steam water = $0.003 \times 4200\ (100- T)$

$= 6780 + 126\ (100-T)$

(ii) Heat gained by water = $MC\ \theta$

$= 0.4 \times 4200\ (T- 10)$

(iii) Heat lost = heat gained

$1680\ (T- 10) – 6780 + 12.6\ (100- T)$

$1680T – 16800 = 6780 + 1260 – 12.6T$

13. 7g

14. 1167s

15. 875 J/kgK

16. 32.51g

17. 84000 J/s, 2.8g

18. 57.5^0C

19. 3120J

20. 180 J/kgK

10. GAS LAWS

1. 1989: (a) (i) Plot the graph (straight line)

(ii) From $\frac{PV}{T} = k$, since P = const.

$V = \text{Const} \times T$

Or $y = mx$

Where the constant = gradient of the graph

(b) $P_1V_1 = P_2V_2$

But $P_2 = \frac{1}{3} P1$

$\therefore V_2 = \frac{P_1 \times V_1}{P_2} = \frac{P_1 \times 10}{\frac{1}{3} P_1} = 30cm^3$

2. 1989:

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

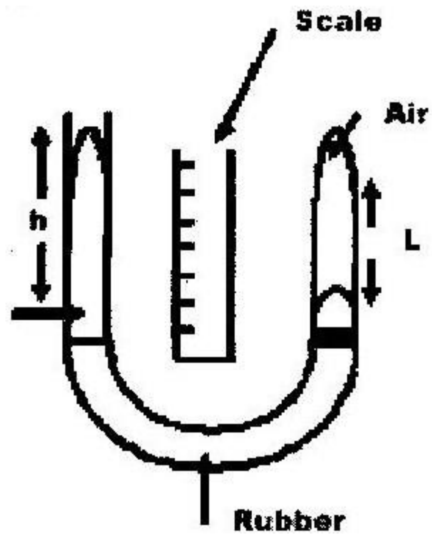
$\therefore P_2 = \frac{P_1 T_2}{T_1} = \frac{740 \times 290}{310}$

$= 692.3$ mm Hg

3. 1990:

(i) Obtain reciprocal values for L

(ii)



Raise or lower the open end and record corresponding values of pressure (dgh) against length of trapped air L (it represents volume)

Plot a graph of pressure against reciprocal values of length.

4. (A) (i) Directly proportional since X- sec is uniform.

   (ii) Area of x- section is assumed to be constant

   (iii) Pressure above atmospheric pressure

   (B) (i) Pressure is below atmospheric value

   (ii) Plot the graph (straight line)

   (iii) Plot = K x $^1/_V$

5.

(a) A short pallet of mercury/ concentrated sulphuric acid is introduced into the glass tube. As the temperature of air in the tube rises, it expands and pushes the mercury index further up the tube. The volume of air can be got from the length up to the level of the mercury index and temperature from the thermometer. The mercury thread is always at the same length so the total pressure in the tube remains constant. Plotting a graph of volume against temperature gives straight line which when extrapolated cuts the temperature axis at approximately 273^{0}C.

(b) $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$V_2 = \frac{20 \text{ x } 327}{300}$

$= 21.8\text{cm}^3$

(c) For a fixed mass of gas, pressure is inversely proportional to volume if temperature is kept constant.

$P \alpha \frac{1}{\text{Volume}}$

$\alpha \frac{1}{\text{Mass/ density}}$ or $\frac{\text{density}}{\text{mass}}$

$P \alpha$ Density

6. (a) Charle's Law – For a fixed mass of gas at constant pressure the volume is directly proportional to the absolute temperature.

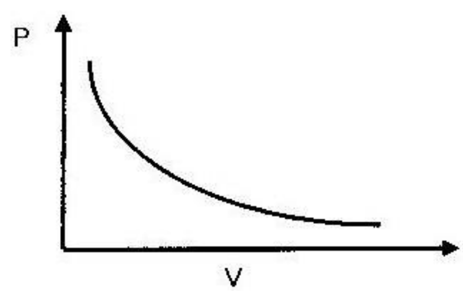
(b) (i)

- Volume of gas is trapped by a drop of H_2SO_4. Water is heated and the gas is heated in a water bath.
- Volume / height of gas in tube is increased as the temperature rises
- Value of height, h, and temperature T are tabulated.
- A graph of volume V against temperature T is plotted
- A straight line graph cutting temperature axis at 273^0C is obtained.
- Therefore volume is directly proportional to the absolute temperature.

(ii) Limitations

- Short temperature range
- Keeping pressure constant is difficult

7.



8. B, Hydrogen is higher than oxygen hence moves faster, molecules collide more frequently with walls of container causing pressure to be more.

9. (a) - Heating of water/gas

- Recording values of temperature, pressure at intervals of different values
- Conversion of temperature to kelvin
- Plot a graph of temperature against absolute temperature or find the values of P/T = K
- Straight line graph obtained

(b) (i)

C is the intercept and C=O

K is the gradient given by

$$\frac{15.2\ 10^4 - 4 \times 10^4}{400 - 105}$$

$$\frac{11.2 \times 10^3}{295} = 380 + 10$$

(ii) The gas would liquify

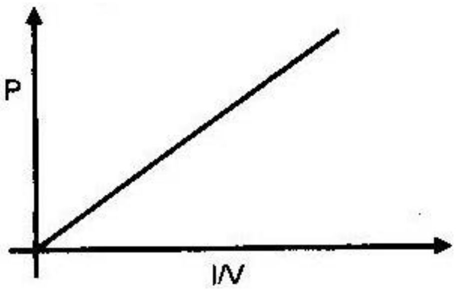
(c) C= 27^0C= 300K

327^0C = 600K

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} = \frac{2.1 \times 10^5}{300} = \frac{P_2}{600}$$

$P_2 = 4.2 \times 10^5$ p.a

10.



11. 2004: $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$V_2 = \frac{T_2}{T_1} \times V_1$

$= \frac{353}{293} \times 200$ ml

= 241 ml

12. 2007: Kelvin (K)

13. 2007 The pressure of a fixed mass of gas is directly proportional to its absolute (Kelvin) temperature provided the volume is kept constant.

$P \alpha T$ at constant volume

14. 1416 cm^3

15. 0.0022m^3

16. 1.25m

17. qa 0.08m

18. b 75N

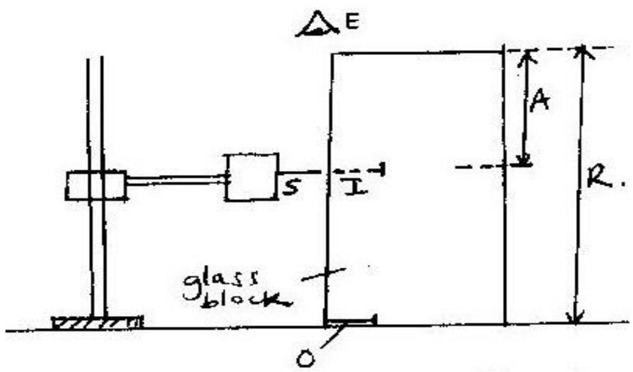
FORM FOUR

1. THIN LENSES

1. (i) Short sightedness (myopia)

   (ii) Concave lens (diverging lens)

2. (a) Arrange the apparatus as shown below



Adjust the position of the search pin until there is no parallax. Measure A and R

$$\text{Refractive index} = \frac{\text{Real depth}}{\text{Apparent depth}} = \frac{R}{A}$$

(b) (i) u = 15cm, f = 10cm

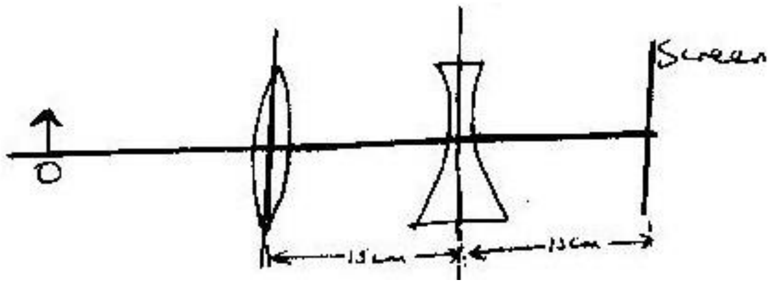
$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

$\underline{1} = \underline{1} - \underline{1} = \underline{1}$

v 10 15 30

$\therefore$ v= 30 cm

(ii)

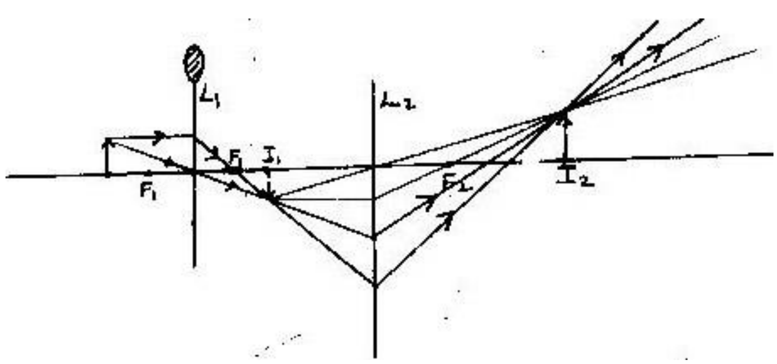


- Now for the diverging lens, V= -15cm since the image is vertical

$\therefore \frac{1}{v} = \frac{-1}{37.5} + \frac{1}{15}$ (note that for concave is –ve)

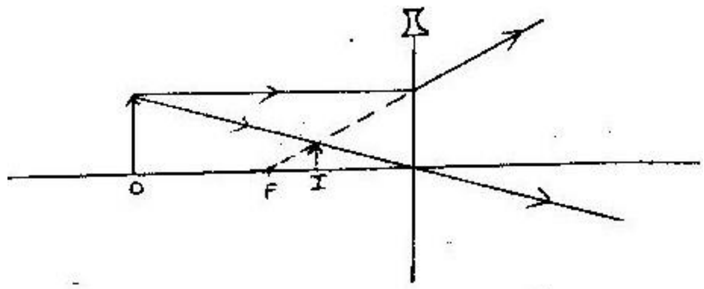
V= 25 cm

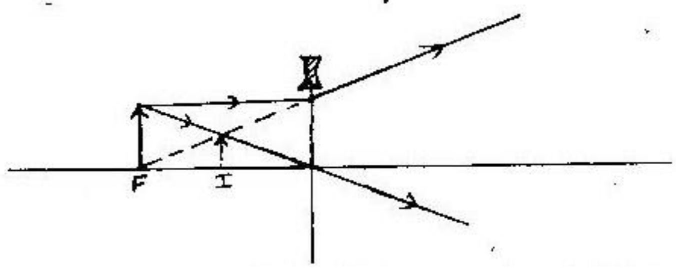
(c) (i) Draw rays to form 1st image due to L1. This image will be treated as the object for L2. Use lines (Not rays to obtain the position of the final image I2 then complete the rays as shown below.



(ii) Measure height of I2 and divide by height of object

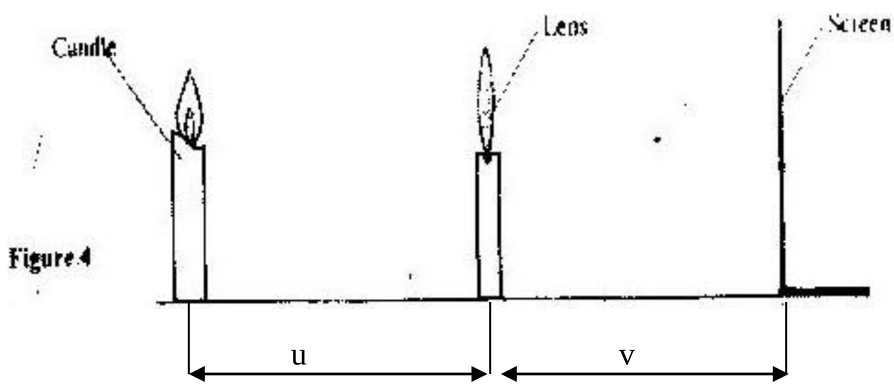
3.





4.

5. 2004: Place candle at a distance as shown below

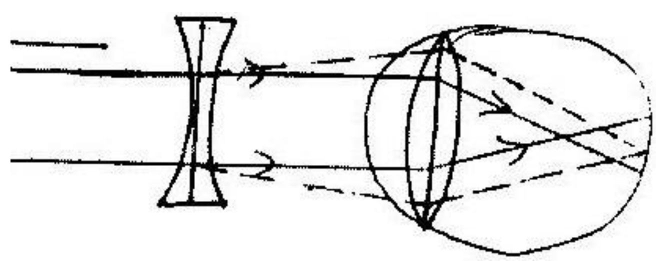


- Adjust until a sharp image is formed
- Measure U and V and record
- Repeat this procedure for other values of u
- For each set of values find using $^1/_f = ^1/_u + ^1/_v$
- Calculate the average value

(b) Draw one ray from top of object straight through the optical centre of the lens a

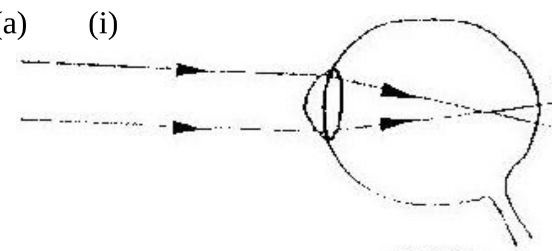
- Draw another ray parallel to the principal axis which should pass through principal axis after refraction
- Where they meet, draw the image.

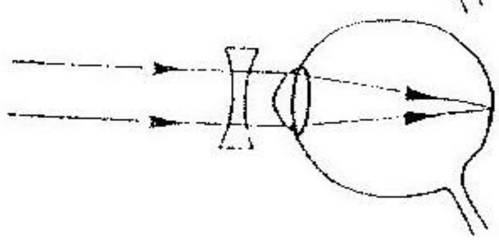
(c) Short sightedness



6.

(a) (i)





(ii)

(b) (i) A-Diaphragm

B-Film

(ii) The distance between the lens is adjusted so that the image is formed on the film

(iii) Shutter- Opens for some given time to alloy rays from the object to fall on the film creating the image impression.

A (Diaphragm) controls intensity of light entering the camera

B (Film) – coated with light sensitive components which react with light to create the impression

(c) (i) Magnification $= \frac{V}{U} = 3$

Since v + u = 80

U = 80 – v

$\frac{V}{80 - v} = 3$

V= 240 – 3v

V= 60 cm

(ii) From above u = 20cm

I = I + I + I + I

F v u 60 20

7. f= 15cm

8. f= 14.3cm

9. Given information

10. u= 16cm

f = 12cm

Applying l = l + l

f u v

then I = l + l

v f u

= 1 – 1

12 V16

= l = 4 -3 = 1

V 48 48

Hence distance = 48

(ii) Nature: image is real

- Inverted
- 48 cm from the lens
- Magnified

(iii) Magnification, m= v = 48 cm = 3

u 16 cm

11. Solution

Given information

V= -6 cm

U = + 15cm

Applying $\frac{I}{F} = \frac{I}{u} + \frac{I}{v}$

$= \frac{I}{15} - \frac{I}{6}$

$\frac{2-5}{30}$

$\frac{I}{F} = \frac{-3}{30} = \frac{-1}{10}$

F= -10

F= 10 cm

12. Solution

$P = \frac{I}{F}$

$P = {}^{1}/_{10} = {}^{1}/_{10/100}$ m

$= 1 \div {}^{10}/_{100}$ m

$= 1 \times {}^{100}/_{10}$

Power = 10 dioptre (D)

13.

Similarity	Differences
- Both have converging lens - In the eye, retina act as the screen while in the camera a light sensitive film act as one	- Focal length of the eye lens is variable while that of the camera is fixed.

2. UNIFORM CIRCULAR MOTION

1. When tension is max then r= l

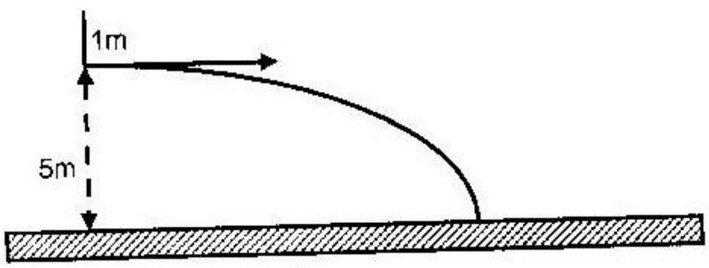
$T = F = \frac{Mv^2}{r}$

$2 = \frac{0.1 \times V2}{1.25}$

$\therefore V2 = \frac{2 \times 1.25}{0.1}$

V= 5m/s

2. (a) (i) & (ii)



(b) (i) $S = Ut + ½ at^2$

$t = \sqrt{\frac{(2 \times 5)}{10}}$

= 1 seconds

(ii) S = Ut = 30 x 1 = 30m

(iii) $V^2 = U^2 + 2as$

$V = \sqrt{(2 \times 10 \times 5)}$

$= 10m$

3. Principal of conical pendulum Or principle of circular motion

4. V= wr

But $w = \frac{\theta}{T} = \frac{2\pi \times 7}{1} = 14$ rads $^{-1}$

$\therefore V = 14\pi x\ 0.20$

$= 8.8$ m/s

5. Centripetal acceleration of bucket is equal or higher than gravitational acceleration of the water.

6. (a) Keep angular velocity ω_1 constant; Centripetal force provided by mg; Fix the mass m and measure r; repeat for different values of m. Tabulate the values

   (b) Force- Mg. Calculate and fill a column for force and another for radius in m

   Plot the graph

(ii) Gradient of the graph

$= \frac{0.625 - 0.1}{0.525 - 0.075} = 1.167$ N 1m

Force F, on the body = $m_b w^2 r$

Where m_b = mass of the body

$M_b w^2$ = Gradient of the graph = 1.167

$W^2 = \frac{1.167}{0.1} = 11.67$

W= □√11. 67

= 3.42 $rads^{-1}$

7. $2\pi f = 2\pi \times 8$

$\alpha = rw^2 = 0.2\ (16\pi)^2$

$=$ 505.3 m/s

8. (a) Angular displacement per second.

(b) In 13s, angle turned = 300-170 = 130 rad

$\therefore$ w= $\frac{\theta}{t} = \frac{130}{13}$ = 10rads-1

So $\frac{300}{t+13} = 10$

10t + 130 = 300

10t = 170

t = 17 sec

(c) (i) Plot the graph which is a straight line.

(ii) From $T = (mr)w^2 – C$ and $y = mx + c$

$Y = T$, grad = mr, y = intercept = -C

$\therefore$ Obtain gradient and equate it to mr.

Where r = 0.3m, to obtain m.

(iii) The y-intercept should be equated to, -C.

9. (a) Pe → Ke

$\therefore$ mgh = ½ mv^2

Or $V^2 = 2gh$.

$V = \sqrt{(2x10x0.9)}$

$V = \sqrt{18} = 1.24m/s$

(b) $F = mg + Mv^2$

$= 200 + \frac{20 \times 18}{4}$

= 290N

(a) Acceleration directed towards the centre of the orbit.

(b) (i) Roughness/smoothness of surface, radius of path, angular velocity/speed.

10. 10m/s

11. 1.59 rev.s^{-1}

12. 0.61 rev.s^{-1}

13. 6.32N

14. 1744N

15. 0.41 m/s

16. 30N

3. FLOATING AND SINKING.

1. Place it in the acid and read at the level of the acid surface. In a fully charged car battery, should read 1.25.

2. Volume of glass = Volume of water displaced

$= \left(\frac{0.2}{g} \div 10^3\right)$ kg

Mass of glass $= \frac{0.5}{g}$

Density of glass $= \frac{m}{v}$

$= \frac{0.5}{g} \div \frac{0.2}{g} \times \frac{1}{10^3}$

$= 2.5 \times 10^3 \text{ kg/m}^3$

$= 2500 \text{ kg/m}^3$

12. Volume of the object = Volume of water displaced

Density of object = $\frac{\text{Mass}}{\text{Volume}} = \frac{120}{40} = 3\text{g/cm}^3$

13. Mass of paraffin = Mass of solid = vol x dens

= 5.5 x 0.8 = 4.4g

$\therefore$ Density of solid $= \frac{\text{Mass}}{} = \frac{4.4}{} = 0.22\text{g/cm}^3$

Vol 20

14. Metal is denser than water. Metal and the piece of wood have a general density (combined density) less than that of water and floats just below the surface.

15. (i) Lower surface of solid

$P = gh$

Force = P x A = gh x A

$= 800 \times 10 \times 0.5 \times 4 \times 10^{-4}$

= 0.96N

Upper surface of solid.

Force = P x A = gh x A

$= 800 \times 10 \times 0.1 \times 4 \times 10^{-4}$

= 0.32N

(ii) Upthrust = 0.96 – 0.32 = 0.6N

Weight of the solid = Density x Volume x g

$= 2.7 \times 10^{3} \times 0.2 \times 10^{4} \times 4 \times 10$

= 2.16

Balance reading = 2.16 – 0.64

= 1.52N

16. Solid copper is denser than water hence the solid sphere sinks, weight is greater than upthrust. Hollow sphere experiences an upthrust equal ti its weight so it will float/density of hollow sphere is less than that of water i.e. volume of water displaced is a lot more than the weight of the sphere.

17. (i) Clockwise moments = Anticlockwise moment.

$2.0g\ x = 1.5g \times 30$

$2x = 45$ $\qquad x = 22.5cm$

(ii) Down force: $M \times 22.5$

$= 20 \times 1.5$

$M = {}^{30}/_{22.5} = 1.33Kg$

Upthrust = 0.67Kg.

Therefore weight of water displaced = 6.7N

18. Weight of block = Weight of mercury displaced or law of floatation.

$0.250\ Kg = V \times 13.6 \times 10^3$

$V = \dfrac{0.25}{13.6 \times 10^3} = \quad 1.838 \times 10^{-5} m^3 = 18.38 m^3$

19. The cube moves into the water, motion being opposed by liquid friction and increasing upthrust motion stops when the whole of the cube is completely under water.

(c) A floating body displaces its own weight of the liquid on which it floats.

(d) (i) To enable the hydrogen float upright.

(ii) Float hydrometer on water and on liquid of known density in turn and mark levels/divide proportionally and extend on either side.

(e) (i) Tension, upthrust, weight.

(ii) As water is added, upthrust tension increases weight remains unchanged as water is added.

20. 296N

21. 14.52 kg

22. 1000 Kg

23. 0.969g/cm^3

24. 17cm

25. (a) 0.56N

    (b) 70cm^3

    (c) 0.7143g/cm^3

    (d) It would move up until it displaces its own weight.

26. 5N

27. 3.33g

28. 22.5cm^3, 8g/cm^3

4. ELECTROMAGNETIC SPECTRUM (EMS)

1. Using a photocell/a fluorescent screen; photographic plate; also paper smeared with Vaseline or quinine sulphur.
2. Gamma rays, Ultraviolet, Infrared, Radio waves.
3. Ultra violets rays, X-rays, Gamma rays.
4. v = f x wavelength.

   $= \frac{v}{f} = \frac{3.0 \times 10ms^{-1}}{95.6 \times 106s^{-1}}$

   = 3.14 m
5. (i) Killing germs, vitamin D synthesis, fluorescent lamps/screen/signboard, vehicle reflectors, paints etc.

   (ii) Infrared radiation.

   (iii) Radio receiver.
6. Radio waves, Infrared, Visible light, U-V radiation, X-rays.
7. X-rays are produced from changes in energy from electron jumps in the shells of an atom while gamma rays are produced from energy changes in the nucleus of atoms.
8. (i) Scintillation tube, Geiger muller tube etc.

   (ii) Fluorescent materials, paper smeared with Vaseline etc.

   (iii) Eye, photometer.

   (iv) Skin, blackened thermometer etc.
9. Warmth sensation, cooking, drying clothes etc.
10. \- They cause fluorescent.

- They all travel at 3×10^{-8}m/s.
- They are part of em-spectrum and can travel through vacuum.
- Transverse

11. Electron jumps/ energy changes in electron structure of atoms.

12. Energy changes in the nucleus of atoms.

13. - They all travel at 3×10^{-8}m/s.
    - All transverse.
    - Can be plane polarized.
    - They can travel through vacuum.

14. (a) Radio waves, infrared, visible light, U-V radiation, X-rays.

    (b) Microwaves are used in cooking.

    (c) Ultraviolet are used in fluorescent paints.

15. X-rays.

16. (i) Radio waves

    (ii) Visible light.

    (iii) X-rays

    (iv) Treatment of cancer (radio therapy), detection of fault in manufacturing industry, sterilization/killing germs.

17. (a) Cooking

    (b) Drying objects.

5. ELECTROMAGNETIC INDUCTION.

1. (a) No deflection: no change of magnetic flux cutting across the coil.

   (b) (ii) The deflection is in the same direction. A south pole is created to oppose the incoming south. It is the same as north approaching the opposite end.

   (c) Assuming 100% efficiency.

   $\frac{Ns}{Np} = \frac{Ip}{Is}$ but $Is = \frac{V}{R} = \frac{250}{100} = 2.5A$

   $Is = \frac{100}{600} \times 205$

   $= 4.2A$

2. $1max = \sqrt{2} \times 3$

   $= 4.24\ A$

3. (i) $\frac{Np}{Ns} = \frac{1000}{450} = 24.4$

   (ii) Cooling it, core made of material of low retentivity and it is laminated, proper winding to reduce magnetic flux loss.

   (iii) Concentrate and reduce loss of magnetic flux.

4. $Vr.m.s. = \frac{220}{\sqrt{2}}$

   $= 155.6V$

5. - Hysteresis loses.
   - Copper loses.

- Iron loses.

6. (i) $\frac{Ns}{Np} = \frac{5}{6}$

   (ii) $\frac{Is}{Ip} = \frac{6}{5}$

7. (a) (i) Len's law – The induced current flow is a direction such as to oppose the change producing it.

   (ii) Faraday's law – Whenever there is change in magnetic flux linked to a coil, a current/e.m.f. is induced whose magnitude is proportional to the rate of change of the flux (refer from A.F. Abbot)

   (b) (i) Tables per coulombs means voltage and coulomb's seconds is current. If at the input V is high and I low then output should have low V and high I so that $V_1I_1 = V_0I_0$.

   (ii) $\frac{Ns}{Np} = \frac{Vs}{Vp} = \frac{Ns}{480} = \frac{9v}{240v}$ $\therefore$ Ns = 18 turns.

8. Eddy current/self induction.

9. Lamination the core.

10. $\frac{Vs}{Vp} = \frac{Ip}{Is}$ $Ip = \frac{Vs}{Vp} \times Is = \frac{9}{240} \times 30 = 1.125A$

11. $P = \frac{V^2}{R}$ $R = \frac{240^2}{2500} = 23.04\Omega$

(f) The indicated current flows in such a direction that its magnetic effect opposes the change producing it.

(g) (i) As the diaphragm vibrates, it causes the coil to move back and forth in the magnetic field cutting the field lines; this causes a current to be induced in the coil which causes a varying current flow.

(ii) Increasing number of turns in the coil increasing the strength of the magnet.

(h) (i) $\frac{Vp}{Vs} = \frac{Np}{Ng}$

$\frac{400}{Vs} = \frac{1200}{120}$

$Vs = 40V.$

(ii) $Ps = Pp = 600w$

$Is = \frac{600}{40} = 15A$

(iii) $Ip = \frac{600}{400} = 1.5A$

12. (a) 42.43V

(b) 0.42A

(c) 18w

13. (a) 750w

(b) 31.25A

14. 94.5 cts

15. 3×10^6m = 3000km

16. 1.6w

17. Sh. 3.60

a) MAINS ELECTRICITY.

1. $I = {}^{V}/_{R}$

$= \left(\dfrac{240}{500}\right) A$

$= 0.48$ A

2. Solar (photo) cell.

3. $\text{Power} = \dfrac{\text{Energy used}}{\text{Time taken}}$

Power = Current x Voltage

$\therefore \quad \dfrac{15000}{10 \times 60} = 2 \times v$

$\therefore \quad V = \dfrac{15000}{2 \times 10 \times 60} = \dfrac{150}{12}$

Voltage across resistor = 12.5V

4. 2000: $P = {}^{V^2}/_{R}$

$40 = \dfrac{240 \times 240}{R}$

$R = \left(\dfrac{240 \times 240}{40}\right) \Omega$

$= 140\Omega$

5. Current in the heater $= {}^{P}/_{V} = {}^{3000}/_{240} = 12.5A$

Fuse not suitable since current exceeds the fuse value.

6. E = Pt

$= 60 \times 36 \times 60 \times 60J$

$$E \text{ in Kwh} = \left(\frac{60 \times 36 \times 60 \times 60}{1000 \times 60 \times 60}\right) \text{Kwh}$$

$= 2.16$ kwh

7. 2002: (No. of irons) x 100 = IV

$$\text{No. of irons} = \frac{13 \times 240}{1000} = 3.12$$

$= 3$

8. Maximum power = VI

$= (240 \times 13)w$

No. of 75w bulbs = $^{240}/_{75} \times 13$

= 3120

= 41.6

Maximum number bulbs = 41

9. No. of kwh = $\left(^{1500kw}/_{1000} \times 30\right)$ Kwh

= 45Kwh

Cost = Kshs. (45 x 8)

= Kshs. 360/=

$R_1 = V^2/_P$, $R_2 = V^2/_{8P}$

$$\frac{R_1}{R_2} = \frac{V^2}{p} \times \frac{8p}{V^2} = 8$$

10. Current flowing through a conductor is directly proportional to potential difference across its ends provided temperature and other physical quantities remain constant.

11. No. of Kwh = (1.5 x 24)Kwh

    = 36Kwh

    Cost = No. of Kwh x price per Kwh

    = (36 x 1) = 36Kwh.

12. (a) When a fault occurs on an electrical appliances damage will still be done since current flows through the "live"

    (b) There are different circuits and each carries a different amount of current.

13. Power = current x voltage.

    = (0.5 x 250)W

    = Kshs. 125W

14. Energy dissipated in 6hrs = (2.5 x 6)Kwh

    Cost = Kshs. (15 x 1.10)

    = Kshs. 16.50

b) CATHODE RAYS AND CATHODE RAY TUBE

1. 1990: Photon – particle of light energy.

   Quantum – Packet of energy.

2. Ultra violet has a higher energy than yellow light.

3. $E = hf = \frac{hc}{\lambda}$

   $\lambda = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{5 \times 10^{-19}}$

   $\Lambda = 3.978 \times 10^{-7}$

4. Low negative voltage is applied on control grid, which controls the number of electrons reaching the screen.

5. 1998: (i) In Tv (CRT) deflection is by magnetic field while in CRO deflection is by electric field

   (ii) CRO forms a spot on screen, CRT forms an image.

   (iii) CRO displays waves while CRT displays pictures.

   (a) (i) A – Grid

   B – Filament

   (ii) Filament heats cathode electron boil off cathode (theremionic emission)

   (iii) Accelerating

   Focusing.

   (iv) Across X-plates.

   (v) to reduce collision with air molecules that could lead to ionization.

(b) (i) Height = 4cm

Peak value = 4 x 5 = 20V

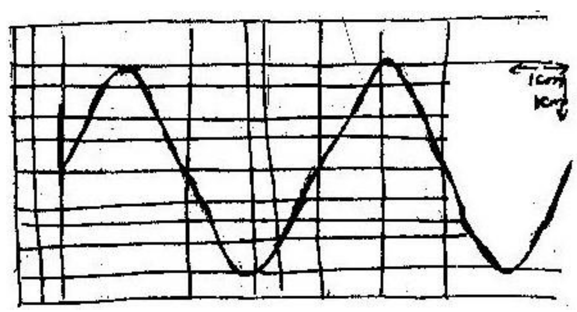
(ii) 2 wavelength = 16cm

$T = 8 \times 20 \times 10^{-3}$

= 0.16s

$F = \frac{1}{T} = \frac{1}{0.16} = 6.25Hz$

(iii)



No answers for question 1& 2

6. Low negative voltage is applied on control grid, which control the number of electrons reaching the screen.

7. (i) Electron gun – produces direct electrons.

   (ii) Deflecting system – deflecting the beam to necessitate the study of external circuit.

   (iii) Fluorescent screen – to display the pattern being studied.

7. X-RAYS

1\.

2\. (a) (i) Heater current or Filament current

(ii) Anode Potential or operating potential

(iii) Covering with protective materials where X- rays are not required

- Minimize exposure time as much as possible
- Reduce no of exposures as much as possible

(b) (i) $\frac{1}{2} MeV^2 = eV$

$V= \square\sqrt{\frac{(2eV)}{Me}}$

$= \sqrt{2 \times 1.76 \times 10^9 \times 20 \times 10^3}$

$= 6.39 \times 10^7$ m/s

(ii) KE- Heat or internal energy and energy of x- rays or radiation.

3\. X- rays have wavelengths of the order of the lattice spacing; and therefore they can be diffracted; (Diffraction due to short wavelengths of x- rays). In calculation the atomic separation is equal to slit separation- or grating separation. Lead because it is very dense, has high atomic mass.

4\. (a) (i) Increase the filament current

(ii) Increase the anode potential

(b) $Q= it = 15 \times 10^{-3}$ A x is $= 15 \times 10^{-3}$C

Electron charge = 1.6×10^{-19} C

No. of electrons in 15×10^{-3}C

$= \frac{15 \times 10^{-3}}{1.6 \times 10^{-19}} = 9.38 \times 10^{16}$ e/s

(c) $\frac{1}{2} mv^2 = ev$

$V = \frac{\sqrt{2eV}}{Me}$

$\frac{(2 \times 1.6 \times 10^{-19} \times 10 \times 10^3)^{\frac{1}{2}}}{9.1 \times 10^{-31}}$

$= 5.9 \times 10^7$ m/s

(d)
- Detecting flows/ fault in metals or other structures
- Quality control of manufactured items e.g. tyres, thickness of sheets, Paper.
- Analysis of gem stones

5. Highly penetrating in matter

6. Hard X- rays are more penetrating than soft X- rays due to their higher frequency.

7. (a) 1.6×10^{-13}

   (b) 2.424×10^{20}Hz

8. (a) 3.35×10^{-11}m

   (b) 36,875V

   (c) 1.3×10^{16} m/s

9. 3.1×10^{-11}m.

10. The fins are used to cool the copper rod which conducts heat away from the target when electrons hit the target

11. K.E on input = e.v

$= 1.6 \times 10^{-19}$ C x 1×10^{4}V

= 1.6 x 10 – 15 Houles

Energy of x- rays is hf

$$\text{Where } f = \frac{c}{\lambda \text{ mm}}$$

$$\frac{hc}{\lambda \text{ mm}} = 1.6 \times 10^{-15} \text{ Joules}$$

$$\lambda \text{ mm} = \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{1.6 \times 10^{-15}}$$

λ mm = 1.24×10^{-10}m

12. Hard x- rays produced higher EHT results in faster electrons hence higher energy x- rays.

8. PHOTOELECTRIC EFFECT

1. Energy (incoming) = hf = $6.6 \times 10^{-34} \times 5.5 \times 10^{14}$

   $= 3.63 \times 10^{-19}$ J

   $= \frac{3.63 \times 10^{-19}}{1.6 \times 10^{-19}} = 2.27$ eV

   This energy is less than work function hence no photoelectric emission.

2. $\theta = E = hf \Leftrightarrow f = \frac{E}{h} = \frac{8.0 \times 10^{-18}}{3.34 \times 10^{-34}}$

   $(8.0 + 3.2) \times 10^{-19} = 3.34 \times 10$ f

   $f = 3.35 \times 10^{15}$

   $\lambda = \frac{3.0 \times 10^{8}}{3.35 \times 10^{15}} = 2.08 \times 10^{-7}$

   $hf = hfo + \frac{1}{2} mv^2$

   $= \frac{c}{f} = \frac{3.0 \times 10^{8} \times 6.64 \times 10^{-34}}{11.2 \times 10^{-19}}$

   $= 1.76 \times 10^{-7}$m

3. Higher photocurrents or more photoelectrons produced.

   (i) Reduce/ prevent collisions of electrons with air molecules and hence increase current

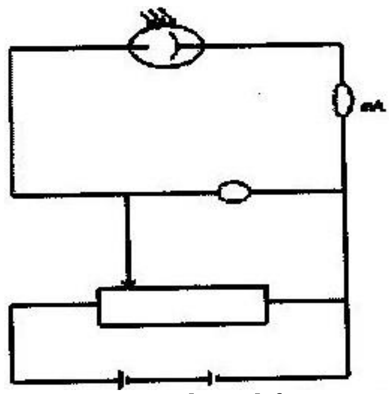
   (ii) Control/ limit current, lowers current

(iii) The energy of the radiation must be greater than the work function of the emitting surface.

(iv) Current flows when uv falls on the cathode; interruption of the uv beam cuts off the circuit: use with relay to switch on a second circuit with alarm.

4. Electrons ejected from inside the metal lose more energy on the way out while those on the surface require very little work function to be removed.

5. (i)



(ii) Work function is given by = hfo

fo is the x- intercept in the graph fo (from graph)

= 1.2×10^{15} $\Phi = 6.63 \times 10^{-34}$ js $\times 1.2 \times 10^{15}$

= 7.95×10^{-19}

6. Solar cell (photovoltaic); Photocell/ photo electric cell

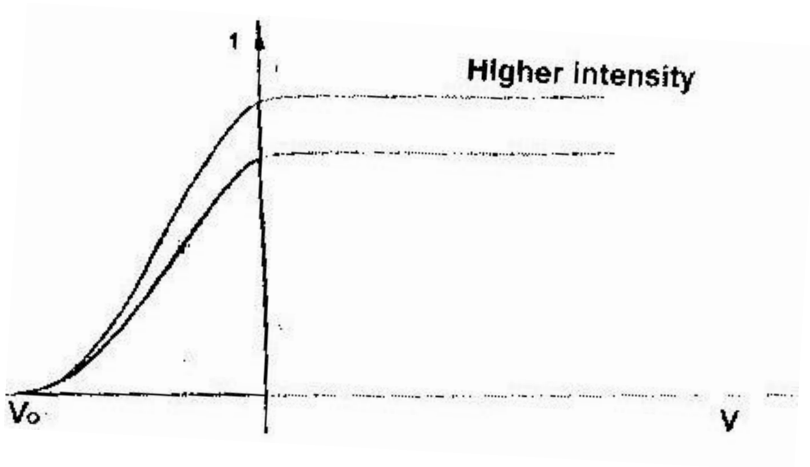
7. (i) Photo – electric effect takes place releasing the extra electrons.

(ii) The electrons released are attracted back by the positive charge.

8. $hf_0 = 3.2 \times 1.6 \times 10^{-19}$J

$f_0 = 7.76 \times 10^{14}$Hz

9. 2007: PP2



10.

- The higher the intensity
- Implies greater number of electrons and hence
- Higher saturation current

11. (a) 2.83×10^{-19}J

 (b) 4.95×10^{-19}J

12. (a) 3.37×10^{-19}J

 (b) 2.37×10^{-20}J

13. (a) 3.56×10^{-19}J

 (b) 2.84×10^{-19}J

 (c) 9.7×10^{14}Hz

14. This is the minimum amount of work required to free an electron from a metal surface

15. No = hf_0

 $\therefore f_0 = \frac{w_0}{h}$

$= \frac{2.0 \times 1.6 \times 10^{-19}}{6.63 \times 10^{-34}}$ Hz

$= 4.85 \times 10^{14}$ Hz

$\lambda o = {}^{V}/_{f}$

$= \frac{3.0 \times 10^{8} \text{ ms}^{-1}}{4.85 \times 10^{14} \text{s}^{-1}}$ Hz

$= 6.2 \times 10^{-7}$

16. $eV = \frac{1}{2} meV^2$

$V^2 = \frac{2ev}{Me}$

$V = \sqrt{\frac{2ev}{Me}} = \sqrt{\frac{2 \times 1.6 \times 10^{-19} \times 500}{9 \times 10^{-31}}}$

$= 1.3 \times 10^{7} \text{ ms}^{-1}$

9. RADIOACTIVITY

1. (a) Radioactive Decay – spontaneous disintegration of the molecules and atom or emission of or α or β accompanied by release of energy and readjustment of the nuclide.

   Isotope: Is a nuclide, which has same no. of proton but different atomic mass, same atomic number but different mass number, same chemical behavior but different properties.

   (ii) -When an alpha or beta particle or gamma ray enters the tube through the mica window, they ionize the gas inside the tube.

   -The electrons produced are accelerated by the central electrode and in turn they produce more electrons by collision.

   -This avalanche of electrons forms a pulse of current, which, after amplification, is used to operate a rate meter or counter.

   -If a small loud speaker is connected a click will be heard every time a particle or gamma photon enters the tube.

   (b) (i) Medicine: Deep penetrating gamma rays are used in the treatment of cancerous growth.

   (ii) Agriculture: To determine the age of plant material and the movement of minerals implants.

2. (i)

Time (hrs)	576	1152	1728	2304
Mass (mg)	640	320	160	80

(ii) It will be zero

3. -Dosage

-Type of radiation

-Penetrating power

-Part of body exposed

4. : 235 – 92 = 143 Neutrons

5. -Mass of that radioactive material

-Time taken to reduce to half

6. α Particles doubly charged and attracted electrons more.

α More massive i.e more momentum and not easily deflected

7. $${}^{14}_{6}C \rightarrow {}^{X}_{7}N + {}^{0}_{y}B$$

14 = x + 0 thus x = 14

6 = 7 + y thus y = -1

$${}^{14}_{6}C = {}^{14}_{7}N + {}^{40}_{-1}e$$

8. : α- particles doubly charged and attract electrons more.

α more massive i/e more momentum and not easily deflected.

9. After 3s number decayed

$\frac{1}{2} \times 5.12 \times 10^{20} = 2.56 \times 10^{20}$

Next 3s number decayed

$= \frac{1}{2} \times 5.12 \times 10^{20} = 2.56 \times 10^{20}$

$\therefore$ Total number decayed

$= (1.28 + 2.56) \times 10^{20}$

$= 3.84 \times 10^{20}$

10. No of $T_{½} = 4$

Thus fraction $= (^1/_2)^4 = {}^1/_{16}$

11. : Number of neutrons = 107 – 32 = 65

12. (a) (i) Beta particle (β – particle)

(ii) A force is to the center of the circle implying negatively charged (Fleming's L HR (etc)

(b) (i) Alpha particle (particle)

(ii) X- 88

Y – 228

(c) (i) Increase in thickness

(ii) Increase in thickness reduces the number of radiations reaching the Geiger tube.

(iii) Increase roller pressure

(iv) Increase in roller pressure squeezes/ presses/ compresses metal sheet more reducing thickness of the foil coming out of them.

(v) Alpha particles have low penetration power and so will not pass/ very few will pass though sheet.

(vi) If a half life is short, decay rate reduces very fast with time and so this sudden change may be mistaken a shaving resulted from increase in thickness OR would be detecting as change in thickness of foil, so longer half- life is more suitable

a= 234

b= 82

13. (a) $^{23}/_{9}\, X \rightarrow 8\, (^{8}/_{2}\, \alpha) + 10\, (^{4}/_{1}\, \beta) + Y$

(b) (i) Gamma rays- not charges

(ii) Alpha particles: mass number decreases by 4 and atomic number decreases by 2

(iii) Beta particles: easily deflected because they are light and carries little charge.

14. The substance takes 57 days to reduce its remaining mass by half.

15. (i) Alpha particles are weak in penetrating solid. So it has to be thin to allow enough alpha particles to enter for ionization to take place.

(ii) It causes ionization of the gas inside. The +ve ions move to the –ve plate and –ve ions move to the +ve terminal. This causes a flow of charge which is amplified and then fed to the counter.

(iii) It controls the extent of ionization without causing avalanche flow of charge.

16. $${}^{24}_{11}Na \rightarrow {}^{24}_{12}Y + {}^{0}_{-1}e$$

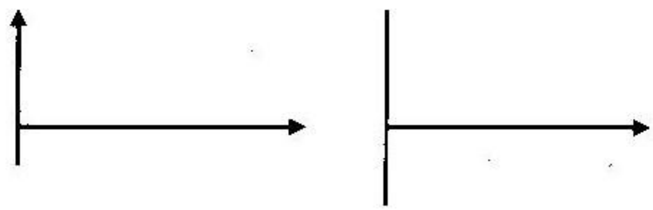
17.

Year	Amount
0	5
5	2.5
10	1.25
15	0.625

The mass will be 0.625g

10. ELECTRONICS

1.



If it doesn't conduct at all or it gives equal deflections when reversed, then it is spoiled. It should give deflection when connected in one way and not the other.

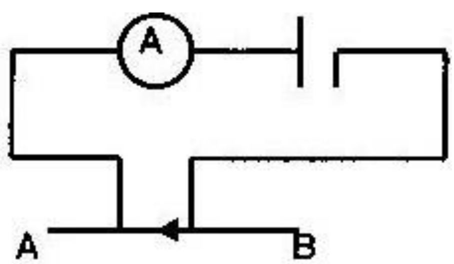
2. (a) (i) Semi- conductor- conducting is by holes

Conductors- Conducting is by electrons.

(ii) Semi conductors - silicon

Conductor – copper, tin, iron

3.

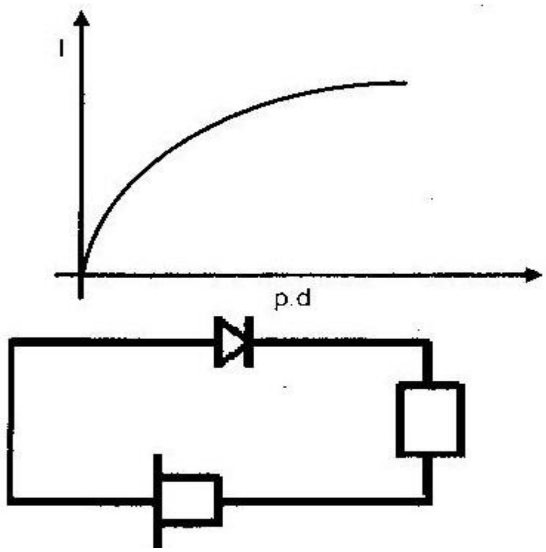


Connect diode and check whether current flows reverse terminals of diode and check again.

4. (i) Introducing group III or V (impurities to group 4 elements to improve their conduction

(ii) The group V elements form covalent bonds with the semiconductor atoms using 4 electrons each. Thus an electron is left free for conduction.

5.



6.

7. (i) Semiconductors are from group 4 while conductors are from group 1,2 or 3. Semiconductors poor conductors at low temp and improves conduction as temp increases. The conductors are good conductors at low temp and increases resistance with increase in temp.

   (ii) Semi- conductors- Germanium, silicon

   Conductor – copper, silver, aluminum, etc.

8. Positive holes

9. (i) It means introduction of impurities to a semi conductor

   (ii) Atom 25 doping has 5 valence electrons

   Doper atom has 5 valence electrons (pent valence) Extra electrons unpaired and is available for conduction. n- type because the majority carriers are electrons.

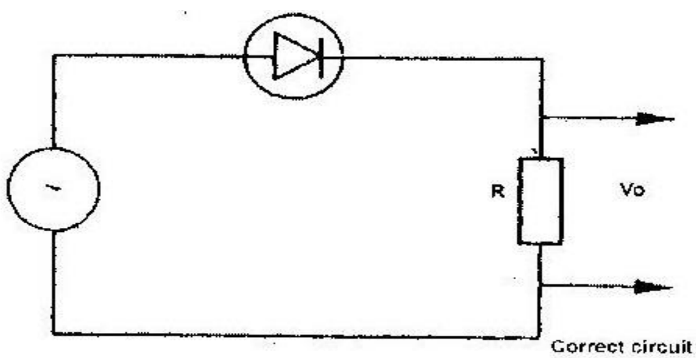
10.

- Diode is forward – biased: current flows
- Diode- reverse- biased; no current flows.

11.

12. Is the atom introduced into the semiconductor (doping) to provide an extra electron for conduction

13. :

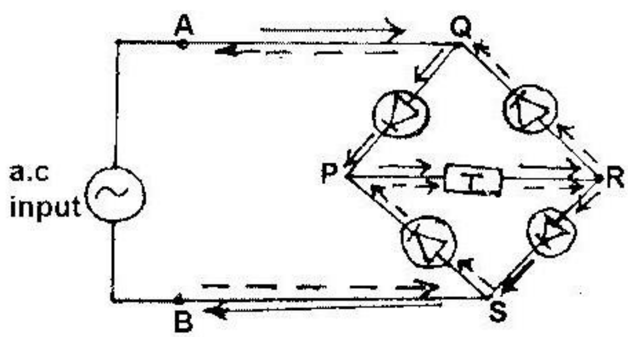


14. No answer

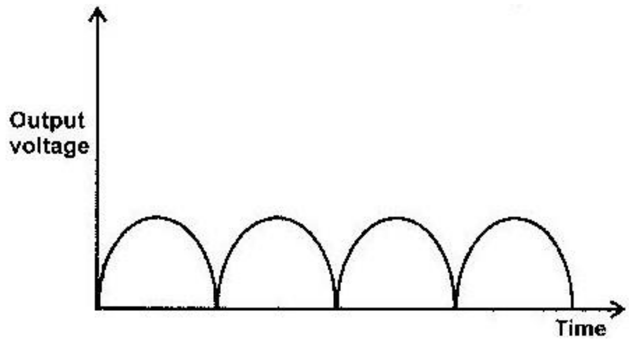
15. Intrinsic semiconductors are pure materials which conduct electricity under suitable conditions like increase in temperature.

    Extrinsic semiconductors are materials that have been fitted with impurities.

16. (i)



(ii)



PHYSICS K.C.SE. YEAR 2008

PAPER 1

SECTION A (25 MARKS)

Answer all the questions in this section in the spaces provided.

1. A drug manufacturer gives the mass of the active ingredient in a tablet as 5 mg. Express this quantity in kilogramme and in standard form. (1mk)

2. The masses of equal volumes of a certain liquid and of water were found to be m_v and m_w respectively. Given that the density of water is $1gcm^{-3}$, express the density, p, of the liquid in terms of m_v m_w (show your work) (2mks)

3. Fig. 1 shows a brick placed on a plane inclined at an angle θ to the horizontal. The weight, W, of the brick is shown.

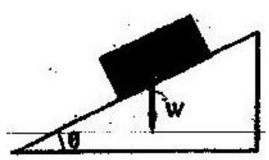


Figure 1

a) On the same diagram show with arrows the other two forces acting on the brick and name them. (1mk)

b) State how each of the two forces named (a) above is affected when the angle θ is reduced. (1mk)

4. Water is known to boil at 100^0C. A student heated some water and noticed that it boiled at 101^0C.

State two possible reasons for this observation. (2mks)

5. Fig: 2 shows a flask filled with water. The flask is fitted with a cork through which a tube is inserted. When the flask is cooled, the water level rises slightly, then falls steadily.

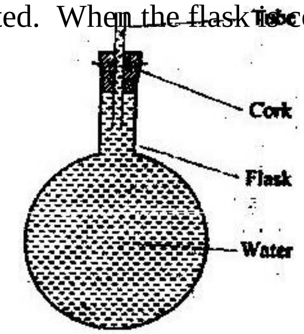


Figure 2

Explain observation. (3mks)

6. Fig. 3 shows a hot water bath with metal rods inserted through one of its sides.

   Some wax is fixed at the end of each rod. Use this information to answer questions 6 and 7.

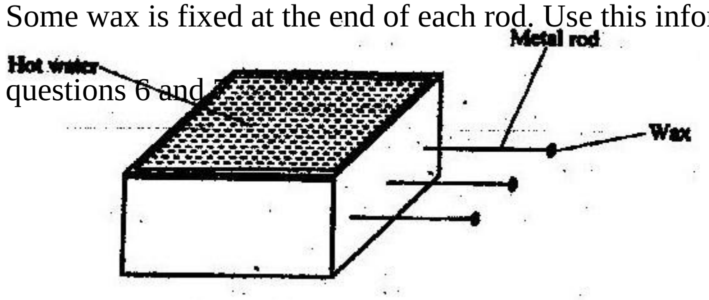


Figure 3

What property of metals could be tested using this set-up? (1mk)

7. Besides the length of the rods that is kept constant, what else should be kept constant when comparing the property for the different metal rods? (1mk)

8. Fig. 4 shows a conical flask 15cm high, filled with a liquid of density $1200kgm^{-3}$. The atmospheric pressure of the surrounding is 8.4×10^4 Pa.

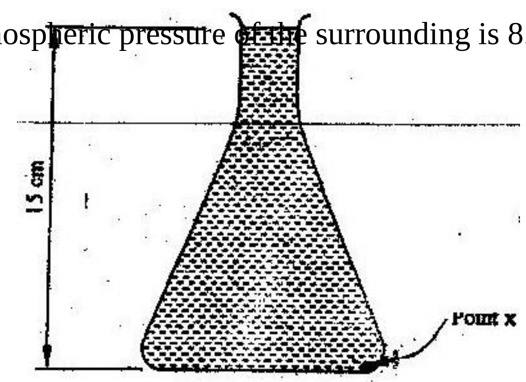


Figure 4

Determine the pressure at the point marked X, at the bottom of the flask. (3mks)

9. Explaining the difference between a liquid and a gas in terms of intermolecular distances and forces. (2mks)

10. Fig. 5 shows a toy resting on top of a closed bottle. Use the information on the figure to answer questions 10 and 11.

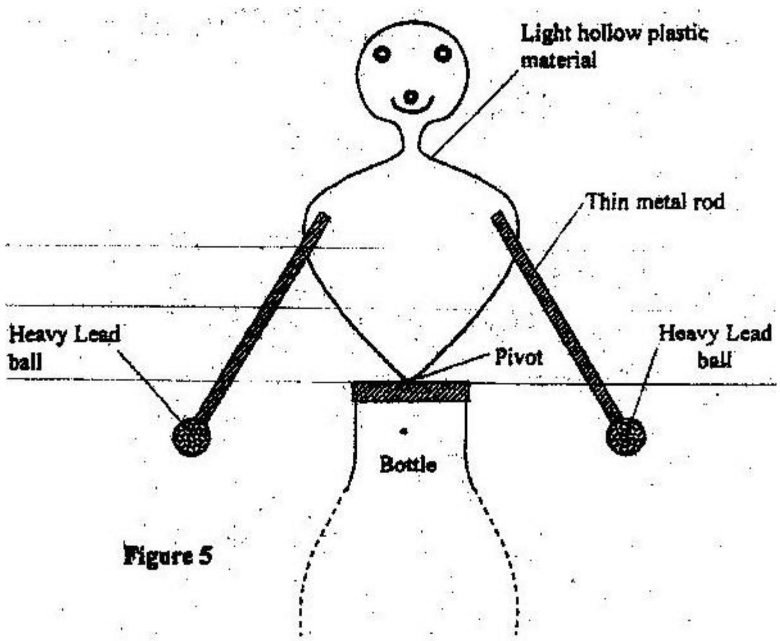


Figure 5

Mark on the diagram, point Q, the approximate centre of gravity of the toy.

(1mk)

11. Giving a reason, name the state of equilibrium of the toy. (2mks)

12. Fig. 6 shows a sheet of paper rolled into a tube.

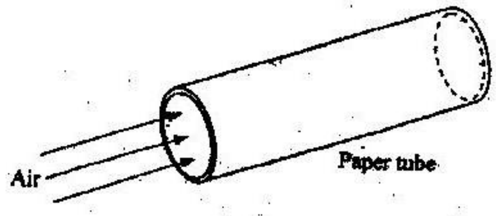


Figure 6

When a fast stream of air is blown into the tube as shown in the diagram the paper tube collapses. Explain the observation. (2mks)

13. The graphs in Fig. 7 represent the relations between extension e and mass m added on two springs x and y.

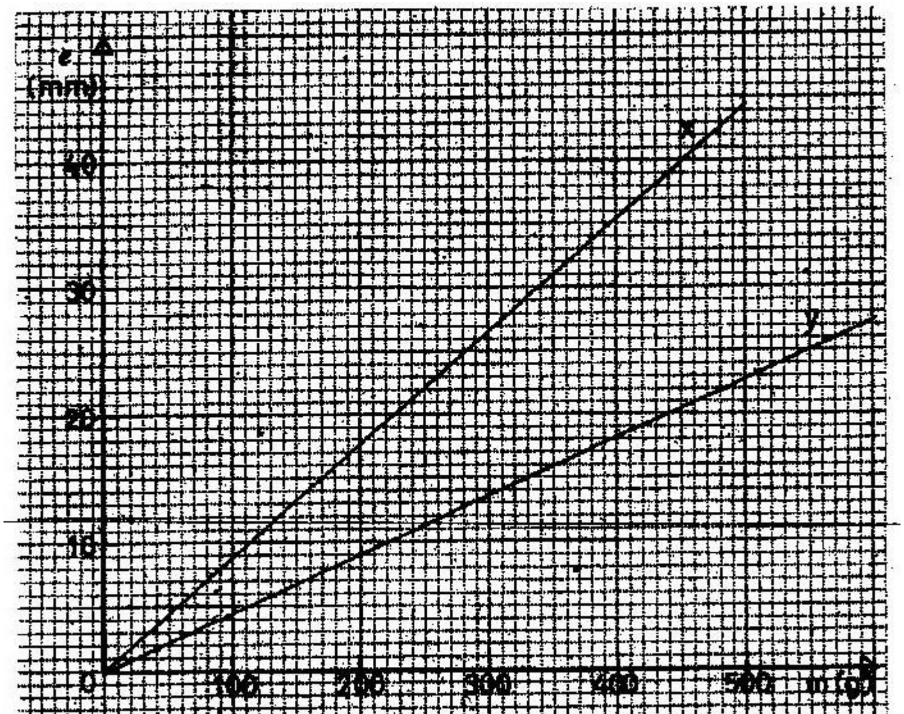


FIG. 7

Given that the two springs are made of same materials, give a reason why the graphs are different. (1mk)

14. The system in Fig. 8 is in equilibrium

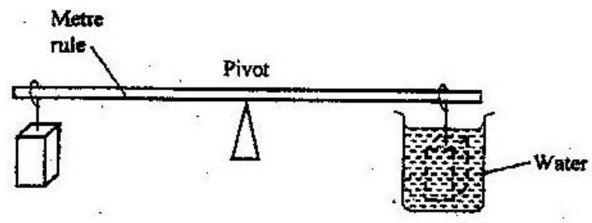


Figure 8

When the temperature of the water is raised the system is observed to tilt to the right, state the reason for this observation. (2mks)

SECTION B (55 MARKS)

Answer all questions in this section in the spaces provided.

15. a) State Newton's second law of motion. (1mk)

b) A matatu starts from rest and accelerates to cover a distance of 49m in 7 seconds.

Determine

(i) Its acceleration; (3mks)

(ii) Its velocity, after 7seconds (2mks)

c) A trolley moving on a horizontal bench of height 1.2m, strikes a barrier at the edge of the bench. The brass mass on the top of the trolley flies off on impact and lands on the ground 2.5m from the edge of the bench.

Determine:

(i) The time taken by the brass mass to reach the ground; (2mks)

(ii) The speed at which the trolley struck the barrier. (2mks)

16. a) Define the term heat capacity. (1mk)

b) You are provided with the apparatus shown in Fig. 9 and a stop watch.

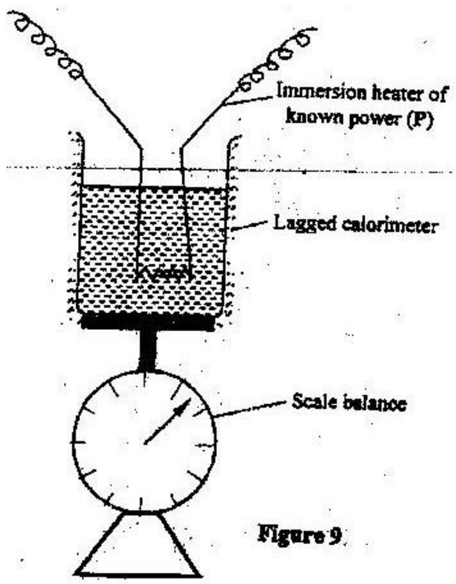


Figure 9

Describe an experiment to determine the specific latent heat of steam, l, using the set up. In your answer clearly explain the measurements to be made and how these measurements could be used to determine l. (6mks)

c) A block of metal of mass 150g at 100^0C is dropped into a lagged calorimeter of heat capacity $40JK^{-1}$ containing 100g of water at 25^0C. The temperature of the resulting mixture is 34^0C. (Specific heat capacity of water=$4200JK^{-1).}$

Determine:

(i) Heat gained by calorimeter; (2mks)

(ii) Heat gained by water; (1mk)

(iii) Heat lost by the metal block; (1mk)

(iv) Specific heat capacity of the metal block (3mks)

17. a) What is meant by absolute zero temperature? (1mk)

Fig. 10 shows a set up to investigate the relationship between temperature and volume for a certain gas.

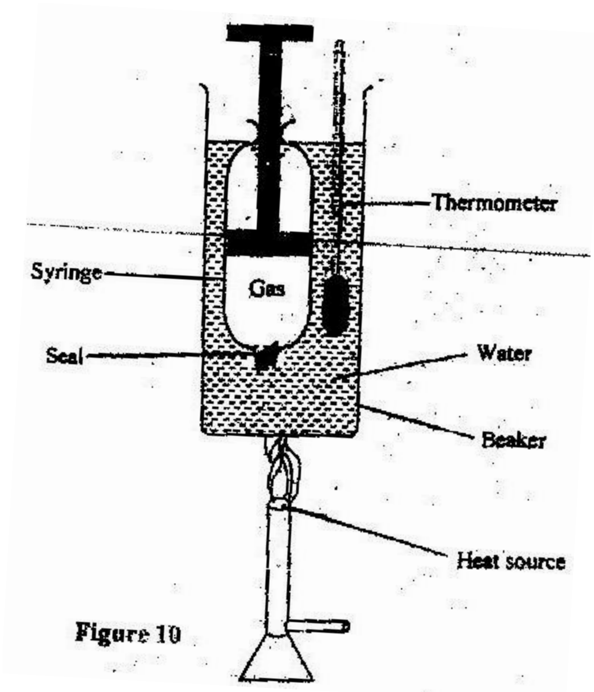
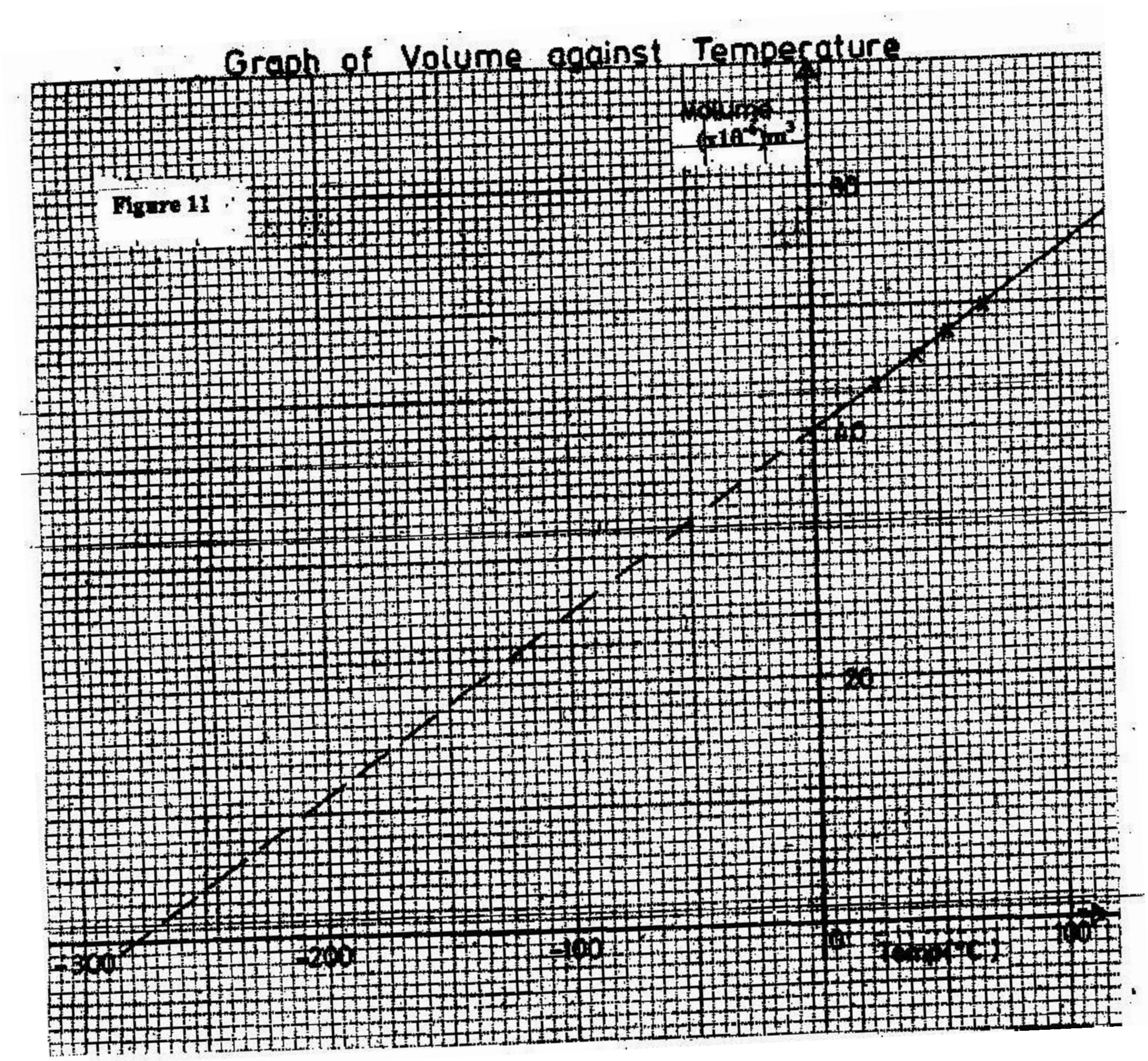


Figure 10

b) State two factors that are kept constant, in order to determine the relationship. (2mks)

c) The graph in Fig. 11 shows the relationship between volume and temperature for the experiment.



(i) What was the volume of the gas at 0^0C? (1mk)

(ii) At what temperature would the volume of the gas be zero? (1mk)

(iii) Explain why the temperature in part (ii) above cannot be achieved. (2mks)

d) A sealed gas cylinder contains $300cm^3$ of certain gas at a temperature of 25^0C, and at a pressure of $9.5x\ 10^4pa$. the gas in the cylinder was then cooled to 10^0C.

Determine the new pressure of the gas in the cylinder. (4mks)

18. (a) Define the term velocity ratio of a machine. (1mk)

(b) Fig. 12 shows part of a hydraulic press. The plunger is the position where effort is applied while the Ram piston is the position where load is applied. The plunger has cross-section area, a m^2 while the Ram piston has cross-section area, a m^2.

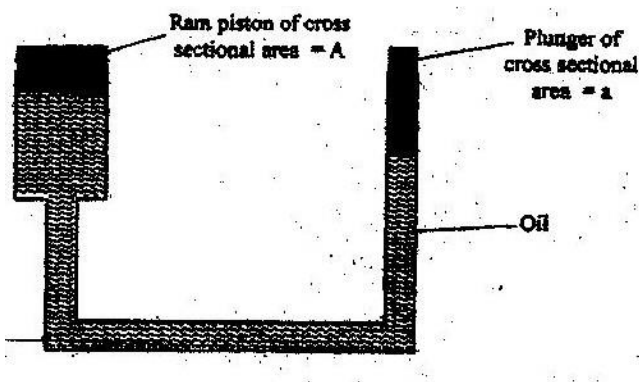


Figure 12

When the plunger moves down a distance d the Ram piston moves up a distance D.

(i) State the property of liquid pressure on which the working of the hydraulic press works. (1mk)

(ii) Derive an impression for the velocity ratio (V.R) in terms of A and a. (4mks)

c) A machine of velocity ratio 45, overcomes a load of 4.5×10^3N when an effort of 135N is applied.

Determine:

(i) The mechanical advantage of the machine; (2mks)

(ii) Efficiency of the machine; (2mks)

(iii) The percentage of the work that goes to waste. (1mk)

19 a) State the principle of moments. (1mk)

b) A uniform metal strip is 3.0cm wide, 0.6cm thick d 100cm long. The density of the metal is 2.7 $g/cm^{3.}$

(i) Determine the weight of the strip. (3mks)

The strip placed n a pivot and kept in equilibrium by forces as shown in fig. 13

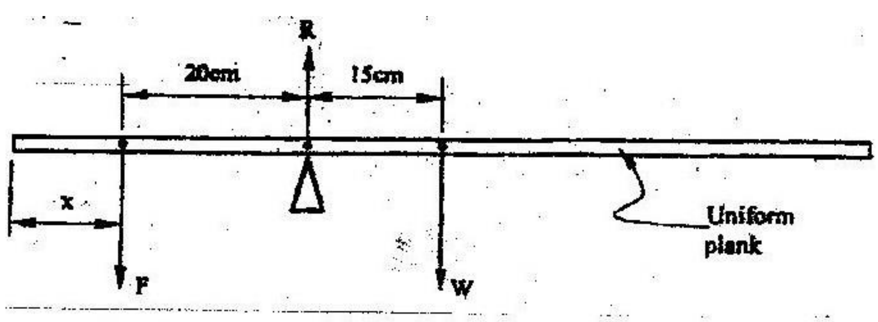


Figure 13

(ii) Determine the value of F and R (3mks)

(iii) X is the distance from the end of the plank to the point of application of force F. Force F is now applied at various points nearer to the pivot so that x increases. Equilibrium is maintained all the time. On the axes provided sketch the relation between force F and x.

(iv) Give a reason for the answer in (iii) above (1mk)

PHYSICS K.C.S.E YEAR 2008

PAPER 2

SECTION A (25 MARKS)

Answer all the questions in this section in the spaces provided.

1. Figure 1 shows three point sources of light with an opaque object placed between them and the screen.

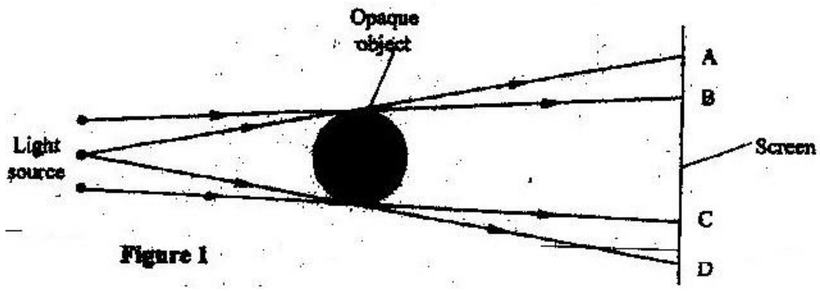


Figure 1

Explain the nature of the shadow formed along B and C. (2mks)

2. A leaf electroscope A is charged and placed on the bench. Another uncharged leaf electroscope B is placed on the same bench and moved close to A until the caps touch. State and explain what is observed on the leaves of A and B.

(2mks)

3. You are provided with the following;

A cell and holder, a switch, a rheostat, an ammeter, a voltmeter and connecting wires. Draw a diagram for a circuit that could be used to investigate the variation of the potential difference across the cell with the current drawn from the cell.

(1mk)

4. An un-magnetized steel rod is clamped facing North-South direction and then hammered repeatedly for some time. When tested, it is found to be magnetized. Explain this observation. (2mks)

5. The diagram in figure 2 shows an object O placed in front of a converging lens. F and F are the principal foci for the lens.

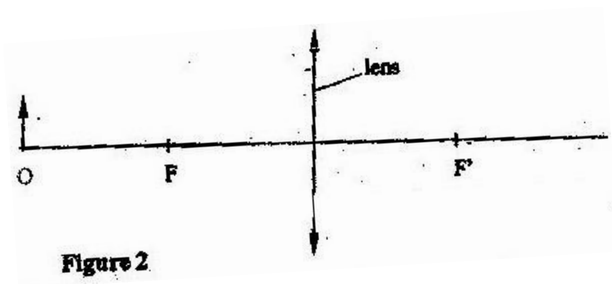


Figure 2

The object is now moved along the principal axis until a virtual image is produced.

On the same diagram:

(i) Draw the object O in the new position along the principal axis;

(ii) Sketch rays to show formation of the virtual image (1mk)

6. Figure 3 shows a flat spring made of iron clamped horizontally on the bench over a solenoid.

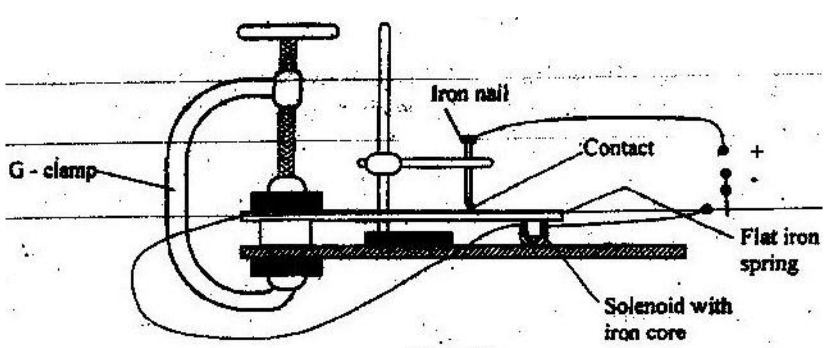


Figure 3

When the switch is closed, the spring vibrates. Explain this observation. (3mks)

7. Figure 4 shows a hack-saw blade clamped horizontally on a bench and the free end is made to vibrate about the rest position.

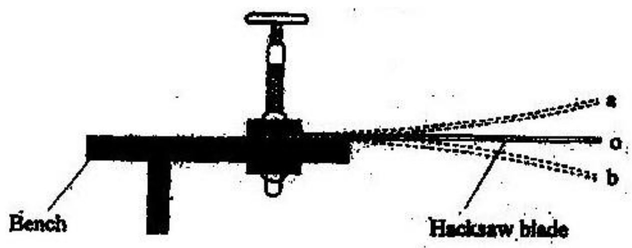


Figure 4

The movement o $\longrightarrow$ a $\longrightarrow$ 0 $\longrightarrow$ b $\longrightarrow$ 0 $\longrightarrow$ a $\longrightarrow$ 0 $\longrightarrow$ b takes 0.7 seconds.

Determine the frequency of vibration of the blade. (2mks)

8. Figure 5 shows wavefronts approaching the boundary between two media.

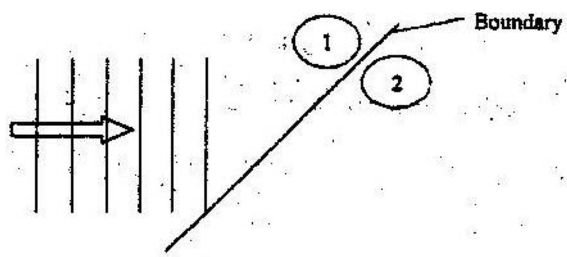


Figure 5

The speed of the waves in medium (2) is higher than that in medium (1). On the same diagram complete the figure to show the wavefronts after crossing the boundary. (2mks)

9. Figure 6 shows a circuit in which a battery of negligible internal resistance, two resistors, a capacitor, a voltmeter and a switch are connected.

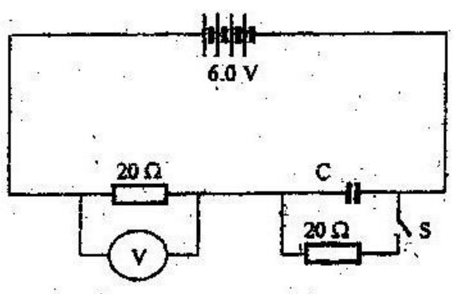


Figure 6

Giving a reason for your answer in each case, state the reading of the voltammeter, V, when the switch is (2mks)

(i) Open

V=…………………………………………………………………..

Reason…………………………………………………………..

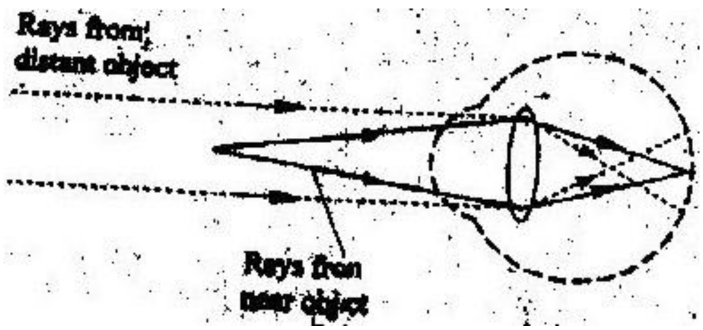
(ii) Closed

V=………………………………………………………………….

Reason………………………………………………………….

10. A heating coil is rated 100W, 240V. At what rate would it dissipate energy if it is connected to a 220V supply? (3mks)

11. Figure 7 shows how rays from a distant and a near object are focused inside a human eye with a certain defect.



Name the defect and state the cause of this defect. (1mk)

Defect…………………………………………………………………………..

Cause of defect…………………………………………………………………

12. A narrow beam of electrons in a cathode ray oscilloscope (CRO) strike the screen producing a spot. State what is observed on the screen if a low frequency a.c source is connected across the y-input of the CRO (1mk)

13. The accelerating potential of a certain X-ray tube is increased. State the change observed on the X-rays produced. (1mk)

14. A radioactive isotope of copper decays to form an isotope of Zinc as shown below

$$^{69}_{29}Cu \longrightarrow {}^{69}_{30}Zn + \text{radiation}$$

(2mks)

Name the radiation emitted and give a reason for your answer

Radiation…………………………………………………………………………

Reason……………………………………………………………………………

SECTION B (55 MARKS)

Answer ALL the questions in this section in the spaces provided.

15. a) State one factor that affects the speed of sound in a solid. (1mk)

b) An observer stands half-way between two vertical cliffs that are L metres apart. He moves directly towards one cliff and after a distance x=10cm from the centre, he strikes a gong and measures the time interval, t, between the echoes heard from the two cliffs. He moves a further 10m and again strikes the gong and measure the time interval between the echoes. The process is repeated several times. The graph in Figure 8 shows the relation between the time interval, t and the distance, x from the centre.

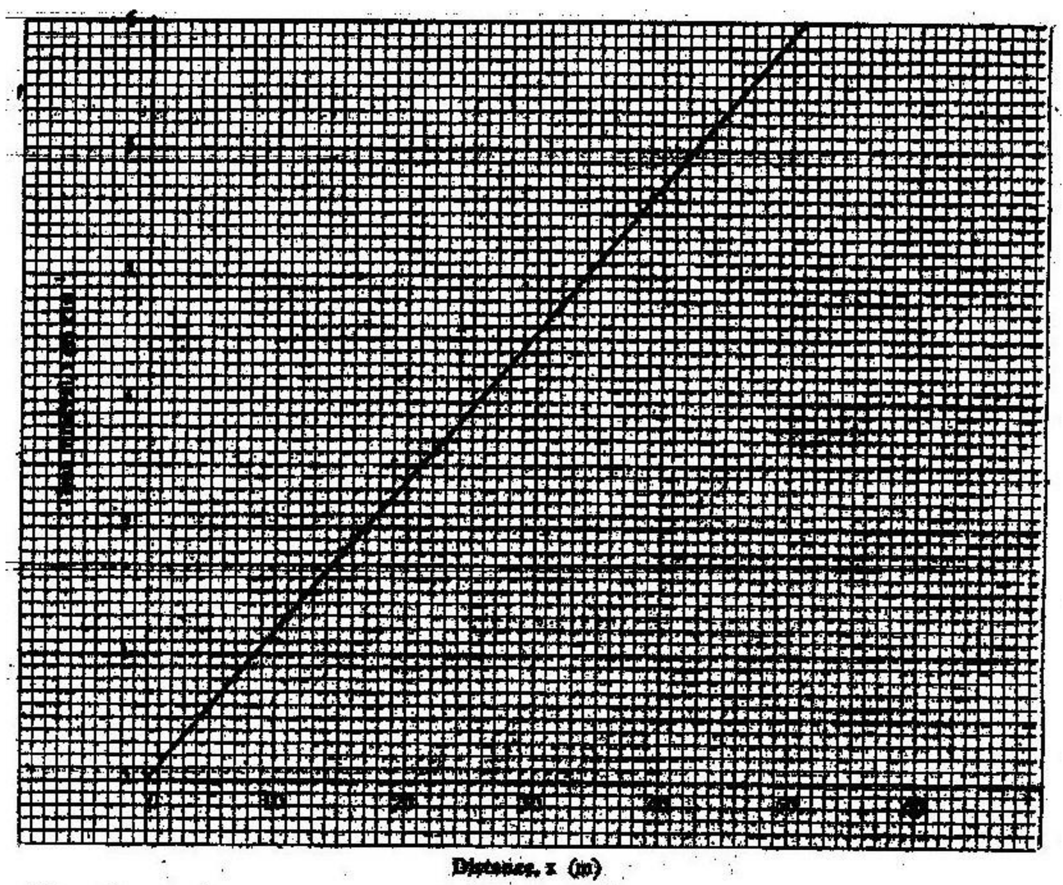


Figure 8

(i) From the graph, determine the value of x for which the time interval was 0.55. (1mk)

(ii) Given that t= $^4/_v x$ where v is the speed of sound in air, determine the value of v from the graph. (3mks)

(iii) If the maximum time measured by the observer was t=4.7s, determine the distance L between the cliffs. (3mks)

(c) A search boat uses a signal of frequency 6.0 x 10^4 H_z to detect a sunken ship directly below. Two reflected signals are received; one after 0.1 seconds from sunken boat and the other after 0.14 seconds from the sea bed. If the sea bed is 98 m below the boat, determine:-

(i) The speed of the signal in water. (3mks)

You may use the value of v from (ii) above.

(ii) The depth of the sunken ship below the boat (2 mks)

16. (a) State two conditions necessary for total internal reflection to occur

(2 mks)

(b) Figure 9 shows a ray of light incident on the boundary between two media 1 and at an angle θ

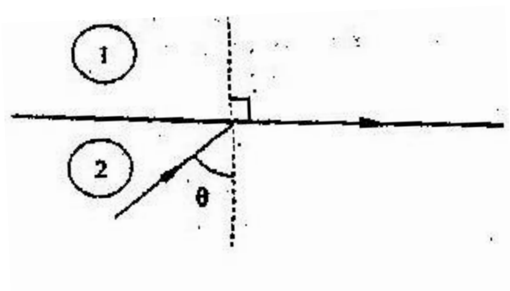


Figure 9

Show that the refractive index for a ray of light traveling from medium 1 to medium 2 is given by:

$$M_2 = \frac{1}{\sin \theta}$$

(2 mks)

(c) Figure 10 shows a ray of light incident on one face of a block of ice of refractive index 1. 31 and totally reflected at the adjacent face

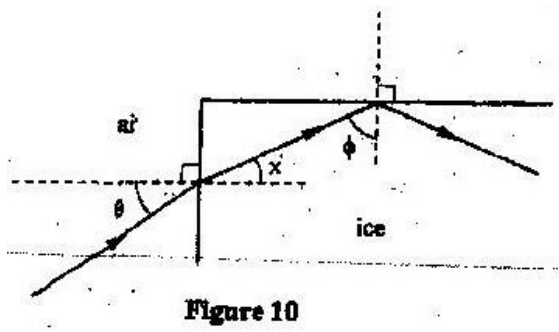


Figure 10

Determine

(i) Angle Φ (2 mks)

(ii) Angle x (1 mk)

(iii) Angle θ, the greatest angle for which the total internal reflection is possible (2 mks)

17. (a) Three resistors of resistance 2.0 Ω, 4.0 Ω and 6.0 Ω are connected together in a circuit.

Draw a circuit diagram to show the arrangement of the resistor which Gives

(i) Effective resistance of 3.0 Ω (1 mk)

(ii) Minimum resistance (1 mk)

(b) In figure 11 the voltmeter reads 2.1 V when the switch is open. When the switch is closed, the voltmeter reads 1.8 V and the ammeter reads 0.1A.

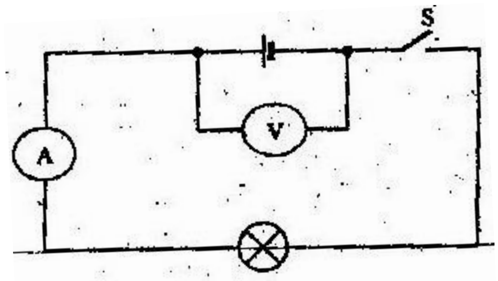


Figure 11

Determine:

(i) The e.m.f of the cell (1 mk)

(ii) The internal resistance of the cell (3 mks)

(iii) The resistance of the lamp (2 mks)

18. (a) Figure 12 shows two circuits close to each other

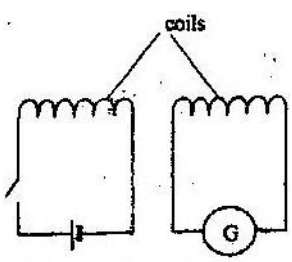


Figure 12

When the switch is closed, the galvanometer shows a reading and then returns to zero. When the switch is then opened, the galvanometer shows a reading in the opposite direction and then returns to zero. Explain these observations. (3 mks)

(b) Explain how energy losses in a transformer are reduced by having:

(i) A soft- iron core (2 mks)

(ii) A laminated core (2 mks)

(c) An ideal transformer has 2000 turns in the primary circuit and 200 turns in the secondary circuit. When the primary circuit is connected to a 400V a.c. source, the power delivered to a resistor in the secondary circuit is found to be 800W. Determine the current in:

(i) The secondary circuit

(ii) The primary circuit

19. (a) X- rays are used for detecting cracks inside metal beams

(i) State the type of the X- rays used (1 mk)

(ii) Give a reason for your answer in (i) above (1 mk)

(b) Figure 13 shows the features of an X- ray tube

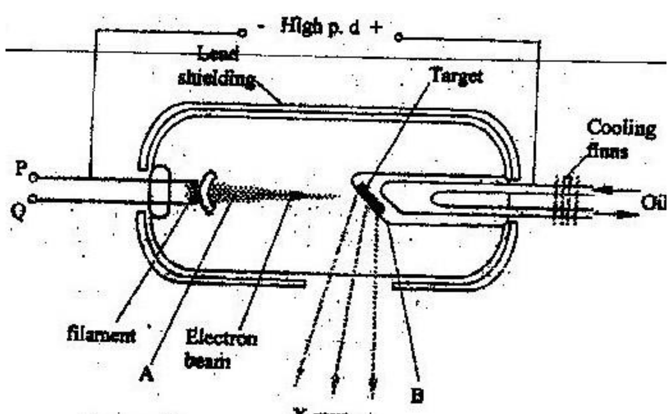


Figure 13

(i) Name the parts labeled A and B (2 mks)

A

B

(ii) Explain how a change in the potential across PQ changes the intensity of the X- rays produced in the tube. (2 mks)

(iii) During the operation of the tube, the target becomes very hot. Explain how this heat is caused (2 mks)

(iv) What property of lead makes it suitable for use as shielding material? (1 mk)

(c) In a certain X- ray tube, the electrons are accelerated by a Pd of 12000V. Assuming all the energy goes to produce X- rays, determine the frequency of the X- rays produced. (Plank's constant h= 6.62×10^{-34} Js and charge on an electron, e = 1.6×10^{-19}C). (4 mks)

ANSWERS TO KCSE PHYSICS 2008

PAPER 1

SECTION A

1. 5.0×10^{-6} kg or 5×10^{-6} kg or 5×10^{-6}

2. since $P = {}^{m}/_{v} = {}^{m}/_{p}$

   For water $V = \frac{Mw}{1}$

   For liquid $V = \frac{M1}{P}$

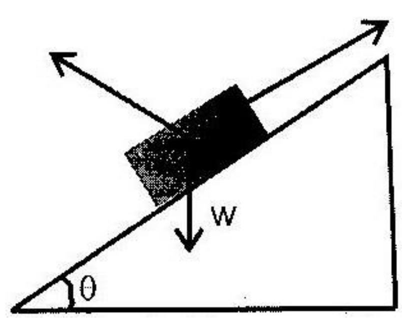
   $\frac{Mw}{1} = \frac{Mv}{p}$

   $\therefore P = \frac{Mv}{Mw}$

   Relative density = $\frac{Mv}{Mw} = \frac{Pv}{1}$

   $\therefore P = \frac{Mv}{Mw}$

3. (a)



(b) R (reaction) increases while F (Friction) reduces or R approaches W while F reduces

4. –Atmospheric pressure is higher than normal/ or pressure is higher than normal atmospheric pressure/ or boiled below sea level.

   - Presences of impurities in water.

5. When flask is cooled it contracts/ volume reduces water due to poor conductivity of glass, subsequently as both cool the contraction of glass is less than that of water or that of water is greater than that of glass.

6. Heat conductivity of rate of (heat) conductivity.

7. Cross – sectional area or diameter or thickness or radious of the metal rods.

8. Pressure in liquids = pgh

   = 1200 x 10 x 15 x `0-2

   = 1800 pa

   Total pressure = (8.4 + 0/18) x 10^4Pa

   = 8.58 x 10^4 Pa

   P= PA + hpg

   = 8.4 x 10^4 + 15 x 10^{-2} x 1200 x 10

   = 8.58 x 104 Pa

9. – Intermolecular distances are greater/ larger/ larger in gases than in liquids

   - Forces of attraction in liquids are higher/ stronger/ larger / greater than in gases.

10.

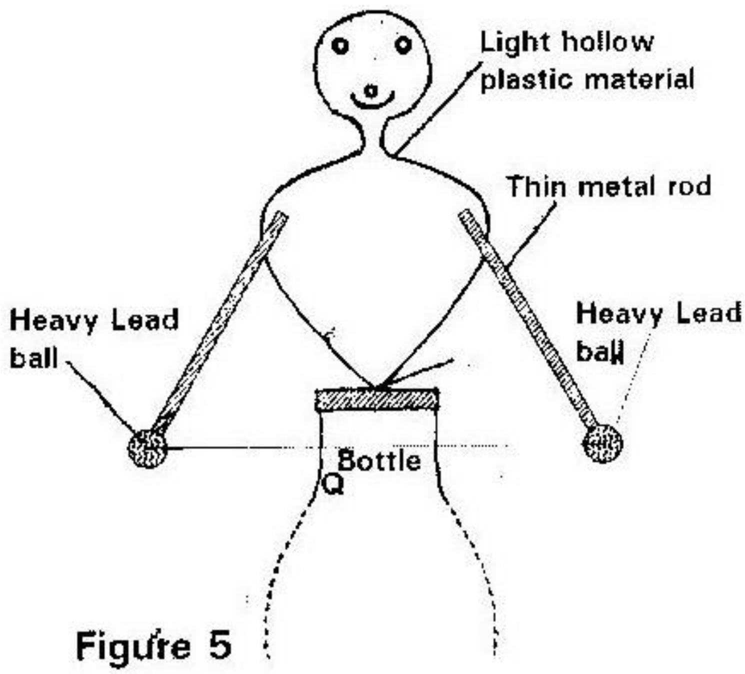


Figure 5

11. – Stable equilibrium

- When it is slightly fitted Q or cog rises or when released it reaches or comes to its original position when fitted.

12. Fast stream of air reduces pressure inside the tube. Pressure from outside is greater than inside hence collapses or pressure differences causes the paper to collapse.

13. Diameter of the coils is different or wires have different thickness or number of turns per unit length is different or length of the springs is different cross-sectional area of the sires.

14. Heated water has lower density; hence lower upthrust.

15. (a) The rate of change of momentum of a body is (directly) proportional to

the (resultants external) force producing the change and takes place in the direction of the force.

(b) (i) $S = ut + ½ at^2$

$49 = 0 + ½ a x 7^2$

$9= 2 m/s^2$

(ii) 1^{st} = average v x time

$= \left(\frac{u+v}{2}\right) t$ or

If $= \left(\frac{0 + v}{2}\right) x 7$

= 14m/s

V = u + at Either

= 0 + 2 x 7

= 14m/s

$V2 = u^2 + 2as$

= 0 + 2 x 49

$V= \sqrt{2 x 2 x 4}9$

= 14m/s

(c) (i) $S= ut + ½ at^2$ Either

$1.2 = 0 + ½ x 10 x t^2$

$t = \sqrt{{}^{1.2}/_{5}} = 0.49$

$V^2 = u2 + 2gs$

$V = u + gt$

$V^2 = 0 + 2 \times 10 \times 1.2 = 24$

$V = \sqrt{24} = 4.899$

$= 0 + 10 \times t$

$t = 0.4899$

(ii) $V = {}^{s}/_{t} = {}^{2.5}/_{0.49} = 5.1$ m/s

16. (a) Heat capacity of a body is the energy required to raise the temperature of the body by degree centigrade/ Celsius or 1 Kelvin.

(b) - Measure initial mass of boiling water + calorimeter = Mi

- Measure final mass of boiling water + calorimeter = mf
- Time taken to evaporate (mi – mf) to steam = mf
- Heat given oral by heater = heat of vaporization or heat absorbed by water to change to steam.

Pt = (mi – mf) L

$L = \frac{pt}{mi - mf}$

<u>Alternative</u>

- Initial mass = mi
- Final mass = mf
- Time taken- t

Heat given = heat gained + heat gained + heat of heat by water by

calorimeter vaporization.

(c) (i) Heat capacity x $\Delta\theta$

= 40 (34 – 25) = 40 x 9

= 360J

(ii) MwCw x $\Delta\theta$

= 100 x 10^3 x 4.2 x 10^3 (34 – 25)

= 3.780J

(iii) = MmCm (100 – 34)

= 0.15cm x 66 = 9.9 cm or

= 360 + 3780

= 4140J

(iv) = 0.15cm x 66 = 4140

= Cm = $^{4140}/_{0.15 \times 66}$ = 418 $Jkg^{-1}K^{-1}$

17. (a) Absolute zero temperature is the lowest temperature (theoretically) possible or is the temperature, at which volume/ pressure/ kinetic energy or velocity of particles (is assumed to be zero).

(b) Mass of the gas

Pressure of the gas

(c) (i) 40 x 10^{-6} m^3 or 4 x 10^{-5} m^3 or 4.0 x 10^{-5} m^3 or 40 cm^3

(ii) 277.5 ± 2.5 i.e (-275 - -280)

(iii) A real gas liquefies and/or solidifies before the temperature is reached.

(d) $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

But $V_1 = V_2$

$P_2 = \frac{P_1}{T_1} \times T_2 = 95 \times 10^3 \times \frac{283}{298}$

$= 90.2 \times 10^3$ pa or 9.0×10^4 Pa

18. (a)

Velocity ratio $= \frac{\text{Distance effort moves}}{\text{Distance load moves}} = \frac{\text{effort distance}}{\text{load distance}}$

(b) (i) Pressure in liquids is transmitted equally throughout the liquid

(ii) Volume of the oil displace by plunger = volume received by ram

$d \times a = A \times D$

${}^{d}/_{D} = {}^{A}/_{9}$

But V.R $= {}^{d}/_{D}$

$\therefore$ V.R $= {}^{A}/_{9}$

Work done on plunger = work done on ram

$P \times 9 \times d = P \times A \times D$

$a \times d = A \times D$

Rearranging to have ratio of effort dist to load dist

V.R $= {}^{d}/_{D} = {}^{A}/_{9}$

(c) (i) M.A $^{Load}/_{Effort}$ or substitution

$= \frac{4.5 \times 10^3}{135}$

$= 33\ ^1/_3$

= 33.3

(i) Efficiency = $\frac{M.A}{V.R} \times 100 = \frac{33.3}{45} \times 100$

= 74%

(ii) Percentage of work going to waste

= 100 – 74 = 26%

% lost = $\frac{\text{input – output}}{\text{Input}} \times 100$

$= \frac{6075 - 4500}{6075} \times 100 = \frac{1575}{6075} = 25.92$

19. (a) When an object is in equilibrium the sum of the anticlockwise moments about any point is equal to the sum of the clockwise moments about the same point or same point.

(b) (i) Volume = 100 x 3 x 0.6 = 180 cm or

Mass = volume x density = 180 x 2.7 = 48

W = mg = $\frac{486}{1000} \times 10 = 4.86N$

W = mg but M = PV

$\therefore$ W = Pvf

= $\frac{\underline{A\ 2.7 \times 3 \times 0.6 \times 100}}{1000} \times 10$

= 4.86 N

(ii) Taking moment about R

20F = 15 x 4.86

F= 15 x 4.86 = 3.645N

R= F + W

= 3.645 + 4.86 = 8.51 N

Taking moment about F

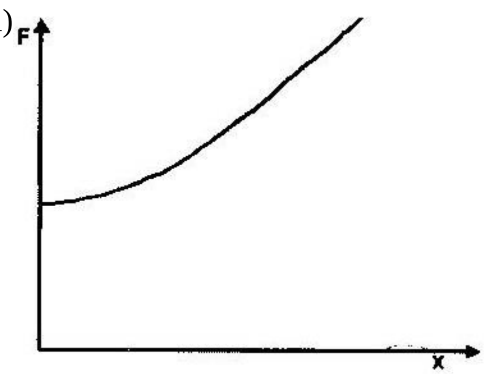
20R = 4.86 x 35 = 8.505N

$\therefore$ F = R – W

= 8.505 – 4.86

= 3.645N

(iii)



(iv) As X increases the distance between F and pivot reduces so F has to increase to maintain equilibrium.

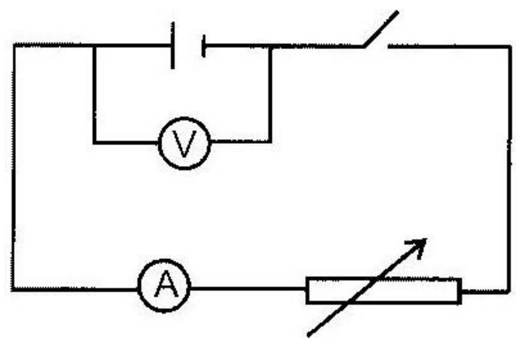
PAPER 2

1. -Umbra, total absence of light, total darkness, completely.

   -Rays of light are completely blocked from the region or no light reaches this region

2. –The leaf in A falls some distance while the leaf in B rises a little distance

   - The two leaf electroscopes share charge acquiring same charges

3. 

4. Hammering causes the domains (dipoles) in the rod to vibrate, when settling some of the domains align themselves in the N- S direction due to the earths magnetic field causing magnetization.

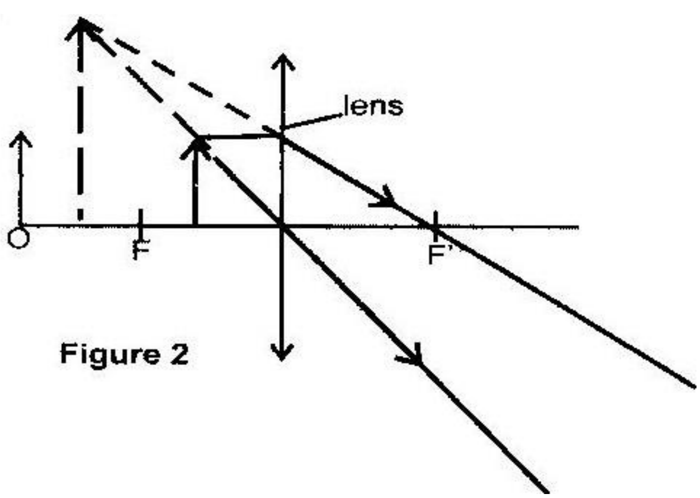
5. (i) 

Figure 2

6. When the switch is closed so that current flows the inner core in the solenoid is magnetized attracting the flat spring, this causes a break in contact disconnecting the current so that magnetism is lost releasing the spring and repeating the process.

7. – Movement equals 1. 75 oscillations/ cycles

   - So that period $T = \frac{0.7}{1.75} = 0.4$ seconds

   $f = {}^{1}/_{T} = {}^{1}/_{0.4} = 2.5Hz$

8.

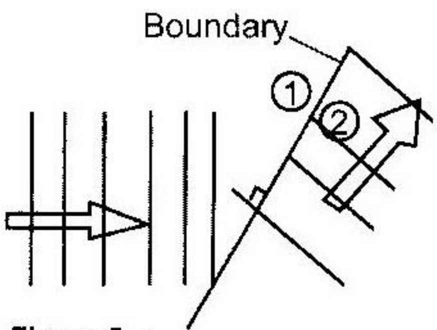


Figure 5

9. (i) V = 0V

   Reason No current

   (ii) V = 3v

   Reason current flows in the resistor

10. $P = \frac{V^2}{R}$ $R = \frac{240^2}{100}$

11. Defect- short sightedness (myopia) ½

Cause of defect. Extended eyeball ½ lens, has short focal length lens is too powerful, lens has high refractive power.

12. The spot moves up and down

13. The frequency of x- rays increases. Accept – becomes hard, wavelength shorten (decreases) penetrating power increases, high frequency

14. Radiation – Beta

Reason- Gain of an electron

- Neutron changes into a proton and an e- is emitted.

- Mass number remains the same, atomic no increases by one.

15. (a) Temperature, density

(b) (i) 46.5m

(ii) $V = \frac{4x}{t}$

$^{x}/_{t}$ = slope x 10^{-1} = $\frac{(0.51)^{-1}}{43}$

$V = \frac{43}{0.51} \times 4 = 337$m/s

(iii) For maximum internal, observer is at one end so distance = 2L

337 x 4.7 = 2L

L= 792m

(c) (i) Distance moved by sound to and from sea bed.

Distance = 98 x 2m

$V = \frac{98 \times 2}{}$ $\left(\frac{98}{}\right)$

0.14 0.4

= 1400m/s

(ii) Distance = v x t

= 1400 x $\frac{0.10}{2}$

= 70m

16. (a) -Light must travel from denser to less dense medium

-Angle of incidence must be greater than critical angle.

(b) $_1\eta_2 = \frac{\text{Sin } i}{\text{Sin } r}$

Since i = 90, r = θ

$_1\eta_2 = \frac{\text{Sin } 90}{\text{Sin } \theta}$

$_1\eta_2 = {}^1/_{\text{Sin } \theta}$

Alternative

$_1\eta_2 = \frac{\text{Sin } i}{\text{Sin } r} = \frac{\text{Sin } \theta}{\text{Sin } 90} = \text{Sin } \theta$

$_1\eta_2 = \frac{1}{_1\eta_2} = \frac{1}{\text{Sin } \theta}$

(c) (i) $\text{Sin } \theta = \text{Sin } c = \frac{1}{n} = \frac{1}{1.31} = 0.763$

$\theta = 49.8^0$ (49.76^0)

(ii) $X = 90 - \theta$

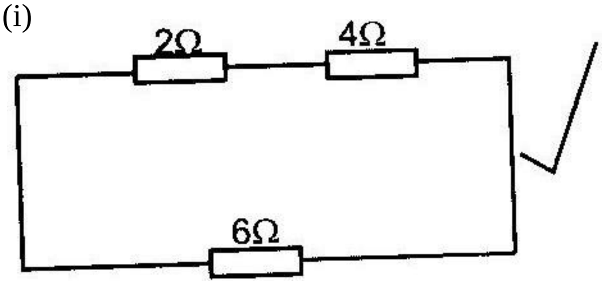
$= 40.24^0$

(iii) $\frac{\text{Sin } \theta}{\text{Sin } x} = \eta = 1.31$

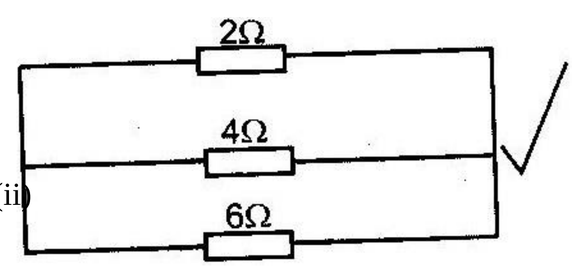
$\text{Sin } \theta = 1.31 \times \text{Sin } 40.24 = 0.846$

$\theta = 57.8$

17. (a) (i)



(ii)



(b) (i) 2.1V

(ii) The difference in reading is the p.d across the internal resistance

r.2.1 V – 1.8 V = 1r = 0.1r

0.1r = 0.3V

$r = \frac{0.3}{0.1} = 3\Omega$

(iii) When current is being drawn from the cell the p.d across the external circuit is the one measured.

0.1 x R = 1.8V

$R = \frac{1.8}{0.1} = 18\ \Omega$

18\. (a) When the switch is closed , flux in the coil on LHS grows and links the other coil inducing e.m.f

When the I is steady No. flux change and hence no. when the switch is opened, the flux collapses even in the boil on RHS inducing current in opposite director.

(b) (i) Soft iron reduces losses due to hysterisis.

This is because the domains in soft iron respond quickly to changes in magnetic (or have low reluctance) or easily magnetism demagnetized.

(ii) Laminated core reduces losses due to eddy currents, this is because laminating cuts- off the loops of eddy currents reducing them (resistance) considerably.

(c)

$\frac{V_p}{V_s} = \frac{N_p}{N_s}$

$\frac{N_p}{N_s} = 400V \qquad V_s = ?$

$N_p = 2000 \; N_s = 200$

$\frac{2000}{200} = \frac{400}{V_s}$

$\frac{2000}{200} = \frac{V_s}{400} \qquad V_s = 40V$

Power = $I_S V_S = 800W$

$I_s = \frac{800W}{40V}$

$= 20A$

(ii) $P_p = P_s$

$800w = 400 \times I_p$

$I_p = 24$

19. (a) -Hard x- rays

-They are more penetrating (energetic)

(b) (i)

A: Cathode rays, electron (s), electron beam

B: Anode (copper anode)

(ii) Change in p.d across PQ changes the filament current

No. of electrons (Intensity of e^-s) (Temperature of cathode)

This changes the no. of e^-s released by cathode hence intensity of

x- rays

(iii) Most of the energy of e^- s hitting target is converted into heat.

(iv) High density.

(c) Energy of e^- s = ev = QV

Energy of x- rays = hf (ev = hf)

$= 6.62 \times 10^{-34}$ Js x f

$= 6.62 \times 10^{-34} \times f = 1.6 \times 10-19 \times 12000$

$f = 2.9 \times 10^{18}$ H_Z

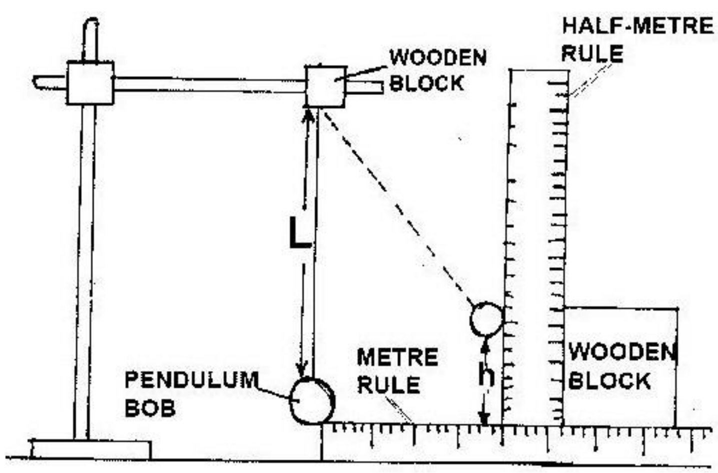
PRACTICALS

EXPERIMENT 1

You are provided with

- A pendulum bols with a piece of thread attached
- Two wooden blocks
- Retort stand, clamp and boss
- Metre rule
- ½ metre rule attached to wooden block
- Cello tape (2 pieces of about 10cm long)
- Stop watch

(a) Fix the thread between the two wooden blocks and fasten in the clamp. Adjust the thread so that length L shown the figure below is 50cm. Fix the metre rule horizontally to the bench using the cello tape provided. Adjust the clamps so that the marble is next to the end of the metre rule as shown.



(i) Displace the pendulum bob by a horizontal distance x = 10cm and measure the corresponding vertical displacement, h

(ii) Repeat the experiment to find h for each of the following values. X = 25 cm, 10cm, 35cm, 10cm, and 45cm. Complete the table below

X (cm)	H (cm)	X^2 (cm^2)	X^2/h cm
20	400		
25	625		
30	900		
35	1225		
40	1600		
45	2025		

(iii) Plot the graph of X^2/h cm against h starting the X^2/h axis scale from 50cm and h-axis scale from zero. Draw the best line through the points.

(iv) Determine the slopes of the graph (2 mks)

(v) From the graph find the value of X^2 /h when h = 0 (1 mrk)

(b) Raise the clamp slightly without changing the length I so the pendulum bob is free to swing. Displace the bob through a horizontal distance of about 10cm and let it free to swing.

(i) Determine the periodic, T for one complete oscillation by timing twenty oscillations.

Time for 20 oscillations = (1 mark)

Period T (1 mark)

(ii) Calculate the value of P from the following equation

$T= 2x\sqrt{(^{P}/_{g})}$ where $g = 10ms^{-2}$ (4 marks)

EXPERIMENT 2

You are provided with the following apparatus

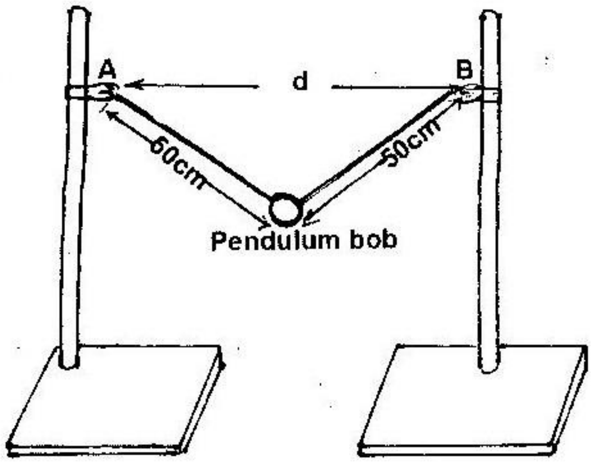
- Two retort stands
- Two bosses
- A metre rule
- A pendulum bob
- Piece of thread
- Stop watch or clock

Proceed as follows

a) Tie the thread provided to the pendulum bob securely so that it is the centre of the thread (put the thread through the hole or loop of the bob up to the centre and then make a knot).

b) Use your pen to mark on the loose ends of the thread, point A and B 50 cm from the point where the bob is tied.

c) Fix the bosses on the stands at points 60 cm above the bench. Suspend the bob between the two stands by tying the loose ends of the thread to the bosses at the points marked in (b) above. See below (A and B are the marked points).



d) Adjust the position of one of the stands (by moving it closer to the other) So that the distance d is 50cm. Give the bob a small displacement perpendicular to the plane containing the two portions of the thread and then release it. Measure t_1 the time for 10 oscillations Repeat the measurement and record in table below.

e) Repeat the procedure in (d) for other values of d shown in the table and complete the table.

Distance (cm)	50	55	60	65	70	75	80	85	90
Time t for 10 oscillations in sec									
Periodic time T (s)									
T_4 (S_4)									
d^2 (sm^2)									

f) On the provided grid plot the graph of T^4 (y- axis) against d^2

g) The relationship between T and d is given by the equation

$T^4 = pd^4 + q$

Where p and q are constants. Use your graph to determine

I. p and q (5 marks)

II. The length I of the thread (3 marks)

EXPERIMENT 3

You are provided with the following

- Metre rule
- Retort stand, clamp and boss
- 500ml beaker ¾ full of water
- 100g mass
- 50g mass
- Three pieces of thread

Proceed as follows:

(a) Balance the metre rule horizontal by suspending it from the stand and clamp with one of the threads

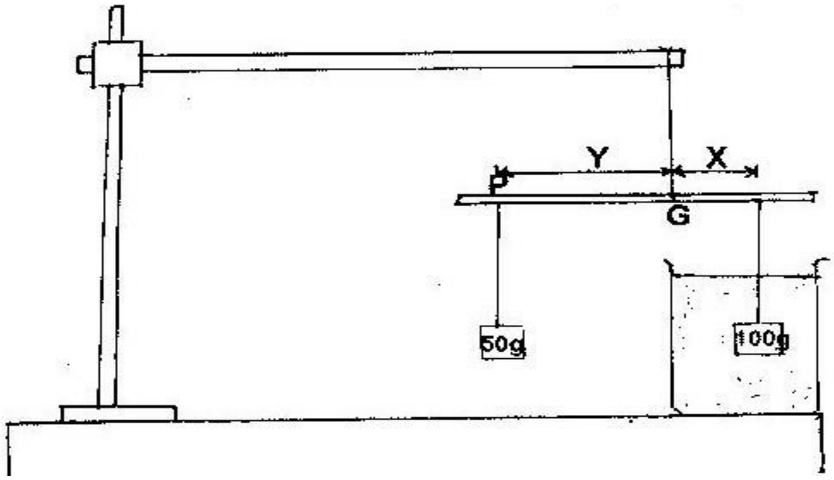
Record the balance point G

G = _______cm (1 mark)

(b) Suspend the 100g mass from the metre rule at a point such that x=5 cm from point G. With 100g mass completely immersed in water in the beaker hang the 50g mass from the metre rule and adjust its position until the system is in equilibrium as shown in the diagram below

Note the point of suspension P of the mass P.

P=_______ (1 mark)



Repeat the procedure for values of x= 5cm, 10cm, 15cm, 25 cm…….. record the values of y in the table below

NOTE: ensure that during each case the position of the thread through G does not change.

X (cm)	Position of 50g mass	Y (cm)
5		
10		
15		
20		
25		

(c) (i) On the grid provided plot a graph of y against x. (5 marks)

(ii) Determine the slope of the graph (3 marks)

(d) Find the density d of the liquid given that (4 marks)

$$\frac{Y}{X} = \frac{(0.68 - 12 \times 10^{-5})^{d}}{0.32}$$

EXPERIMENT 4

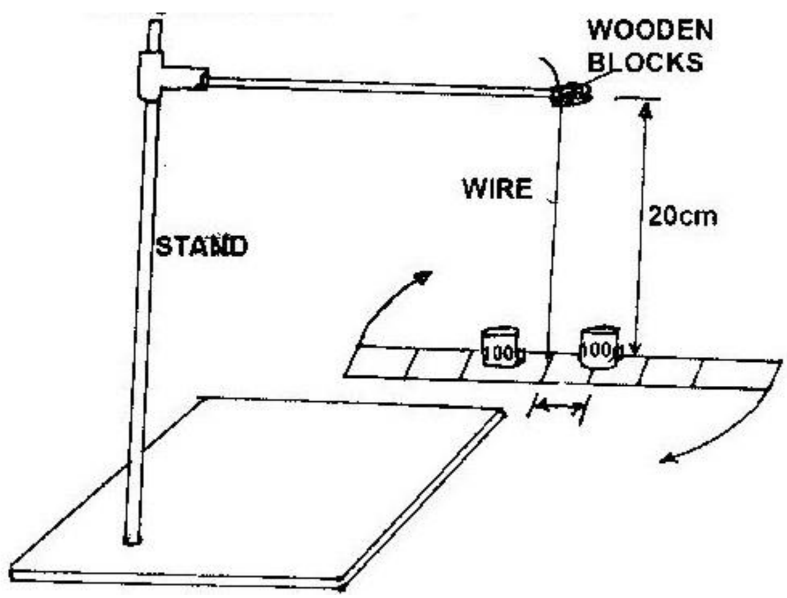
You are provided with the following

- A wire soldered to a metallic bar M
- One clamp, stand and boss
- Two masses
- A stopwatch or clock
- One metre rule or half metre rule
- Two wooden blocks

Procedure

(a) Suspend the bar by the wire such that the length of the wire between the clamp and the bar is 20cm.

Note: ensure that the wire is tightly clamped using the pieces of wood provided and that the metal bar lies horizontally by straightening the wire.



(b) Place the masses on the first mark (r=2cm) on either side of the centre of the bar.

Note: That the distance between the mark is 2 cm

(c) Displace the bar slightly as shown in the figure so that it performs oscillations about a vertical axis through the wire.

This may be achieved by turning the bar about the centre and then releasing it.

(d) Measure and record in the table provided the time t for 10 oscillations. Determine the period T.

(e) Repeat b, c and d above for other values of r shown on the table. Complete the table.

R(cm)	2.0	4.0	6.0	8.0	10.0	12.0
R (m)						
R^2 (m^2)						
Time for 10 osci. (s)						
Periodic time T (s)						
T^2 (S^2)						

(f) (i) Plot a graph of T^2 (y- axis) against r^2

(ii) Determine the gradient and intercept of the graph.

Gradient (3 marks)

Intercept (1 mark)

(iii) Given that the slope $S = \frac{4x^2}{5c}$

Determine the constant C (2 marks)

(iv) Given that the T^2 intercepts is given by $4x^2/c\ I_0$ where I_0 is a constant, determine the value of I_0. (2 marks)

ANSWERS TO PRACTICAL QUESTIONS

EXPERIMENT 1

(a) (i) h = 3.5 – 6cm (1 mark)

X (cm)	h (cm)	X^2 (cm^2)	X^2/hcm
20	3.5 - 6	400	114-66.7
25	6 - 8	625	104- 78.1
30	9-11	900	100-81.8
35	13-15	1225	94.2 -81.8
40	18-20	1600	88.9-80.0
45	24-26	2025	84.4 – 77.9

(6 marks)

(iii) - Suitable scale

- Labeling

- Plotting

- Straight line

(iv) - Reading values from graph

- Evaluating of gradient

(v) Correct intercept of X2/ h

(b) (i) t= 28 – 29 sec

T= 1.4 – 1.45 sec

(ii) - Substitution

- Removal of square root

- P the subject

- Evaluation of P

EXPERIMENT 2

(a)

Distance d (cm)	50	55	60	65	70	75	80	85	90
Time t for 10 oscillations	13.6	13.44	13.06	12.77	12.38	12.0	11.65	10.84	10.09
Periodic time(s)	1.36	1.344	1.306	1.277	1.238	1.2	1.165	1.084	1.009
$T^4(S^4)$	3.42	3.26	2.91	2.66	2.35	2.07	1.84	1.38	1.03
D^2 (sm^2)	2500	3025	3610	4225	4900	5625	6400	7225	8100

(b) Graph of T^4 (y- axis) against d^2

- Axes labeled with units (1 mark)
- 6 points correctly plotted (2 marks)
- Scale consistent and accommodates values (1 mark)
- Straight line passing through at least point (1 mark)

(c) q= y – intercept = $4.5s^4$

$$P = \text{gradient } \frac{\Delta T^4}{\Delta d^2}$$

$$= \frac{3.42 - 2.07}{2500 - 5625}$$

= 1.35

-3125

= 4.32×10^{-4} S^4/cm^2

EXPERIMENT 3

(a) G = 50 ± 0.5cm

(b) P = 58.6cm

X (cm)	Position of 50g mass	Y (cm)
5	58.6	8.6
10	67.3	17.3
15	75.8	25.8
20	84.6	84.6
25	93.1	43.1

(c) (i) Gradient of y against x

- Well labeled axes with units (1 mark)
- At least 4 points correctly plotted (1 mark)
- Consistent scale accommodating all values (1 mark)
- Straight line through plotted points (1 mark)
- Title of graph (1 mark)

(ii) Slope = $\underline{\Delta Y}$

ΔX

$= \underline{34.6 - 8.6}$ $= 1.73$

20-5

Uses values from plotted points

(d) $^{y}/_{x} = \underline{(0.68 - 12 \times 10^{5})d}$

0.32

$1.73 = \underline{(0.68 - 12 \times 10^{-5})d}$

0.32

D= 0.8g/cm^3

EXPERIMENT 4

R(CM)	2.0	4.0	6.0	8.0	10.0	12.0
R(M)	0.02	0.04	0.06	0.08	0.10	0.12
R^2 (m^2)	0.0004	0.0016	0.0036	0.0064	0.01	0.0144
Time for 10 osci. (s)	19.0	20.7	23.51	27.0	30.9	35.0
Periodic time	1.9	2.07	2.35	2.70	3.09	3.50
T^2 (S^2)	3.61	4.3	5.52	7.29	9.6	12.25

(b) (i) Graph of T^2 (y- axis) against r^2

- Well labeled axes with units
- At least 5 correctly plotted points

- Consistent scale accommodating all values
- Straight line through plotted points

(ii) Gradient = $\frac{12.25 - 7.29}{0.0144 - 0.0064}$

$= \frac{4.96}{0.0008}$

$= 620 S^2/m^2$

Intercept = 3.4 s^2

N.B line should be extrapolated

(iii) Given slope s = $\frac{4x^2}{5c}$

$C = \frac{4x\ (3.142)^2}{5 \times 620}$

$= 1.274 \times 10^{-2}\ m^2/s^2$

$I_0 = \frac{3.4 \times 1.274 \times 10^{-2}}{4 \times (3.14^2)^2}$

$= 1.097 \times 10^{-2} m^2$

PAST KCSE PRACTICAL PAPERS

2007 PRACTICAL PAPER (232/3)

1. You are provided with the following

- A metre rule
- An optical pin fixed to a piece of cork
- Two retort stands, two bosses and two clamps
- Two wooden blocks
- A stop watch
- Some thread tied to a mass

Proceed as follows

Set up the apparatus as shown in figure 1

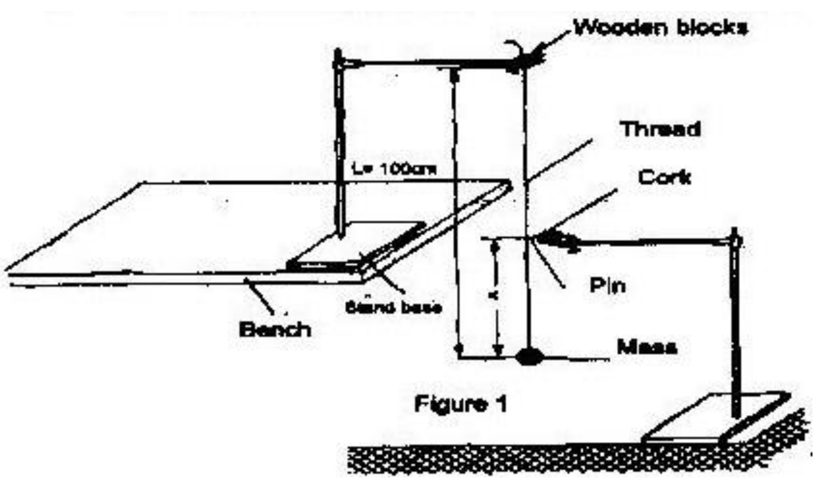


Figure 1

The thread tied to the mass should be held firmly between the two blocks of wood and clamped to the upper end of the stand so that the mass hangs freely. The distance L between the point of support and the centre of the mass is 100cm. Ensure that L remains constant throughout the experiment. Adjust the lower clamp so that the optical pin touches the thread when the hanging mass is at rest.

(a) Adjust the position of the lower clamp so that the pin is at the distance X= 35cm above the centre of the mass. Displace the mass slightly to one side and release it so that it swings in a plane perpendicular to the pin and the thread hits the pin as shown in figure 2.

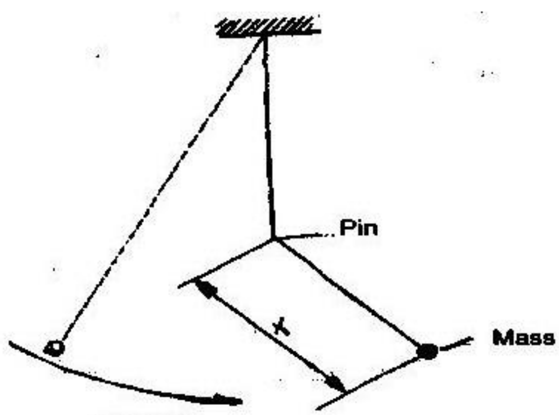


Figure 2

Measure and record in table 1 the time, t, for 20 oscillations.

(b) Repeat the procedure in (b) for other values of X shown in table 1.

On the grid provided

Table 1

Distance x (cm)	35	40	45	50	55	60
Time t for osc (S)						
T = T/20 = (s)						

(c) Plot the graph of T (y – axis) against X (5 marks)

(d) Determine the slope S of the graph at a point X = 52 cm (3 marks)

(e) Determine the constant n given that $n = 52S^2$ (2 marks)

(f) Determine the constant P given that $P = \prod^2/4n$ (2 marks)

2. You are provided with the following

- A Voltemeter
- Two cells and a cell holder
- A switch
- A set of six resistors each of resistance 1000 Ω

Proceed as follows

Set the apparatus as shown in the circuit diagram in figure 3

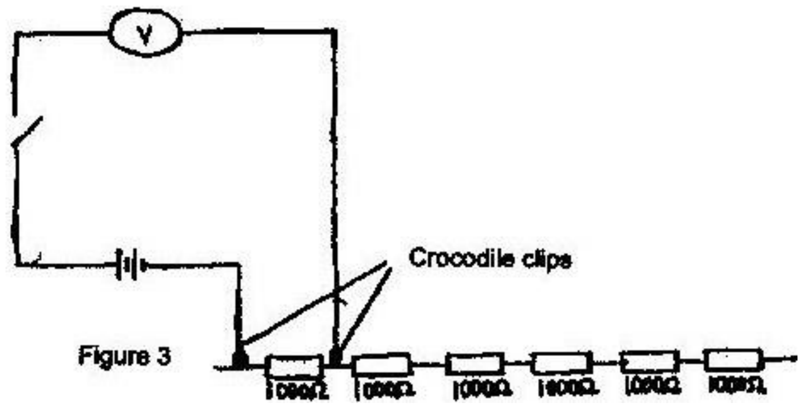


Figure 3

(a) (i) Record the voltemeter reading E, when the crocodile clips are connected together (R=0)

E = ___________ volts

Open the switch and separate the crocodile clips. Indicate by ticking below, the range of the voltmeter used.

0- 3V□ 0-5V □ 0-15V □

(ii) Now connect the crocodile clips across resistance R= 1000Ω. Close the switch and record in table 2 the voltemetre reading V. Open the switch

(b) Repeat the procedure in (b) (ii) for other values of resistance R shown in the table.

Table 2

Resistance R	1000	2000	3000	4000	5000	6000
V(v)						
$\frac{I}{V}$ (v^{-1})						

(c) On the grid provided plot the graph of R (y-axis) against I/V (5 marks)

Hint: Draw your axes to include point (0, 0) half way up the page i.e the I/V axis to run across the middle of the page.

(d) Determine the slope S of the graph

(e) Determine the constant G given that G = S/E

(f) From the graph determine

(i) V_0, the value of V when R-0 (1 mark)

(ii) R_g the value of R when I/V = 0

(iii) Determine G/R_8

2008 PRACTICAL PAPER

232/3 PRACTICAL

Question 1

This questions consists of two parts A and B attempt both parts

PART A

You are provided with the following:

- Copper wire
- A retort stand, boss and clamp
- An optical pin mounted on a cork
- A stop watch
- Wire cutters (to be shared)
- A metre rule or half metre rule

(a) Clamp the cork so that the optical pin is horizontal. Hang the copper wire from the pin by the loop as shown in figure 1. Ensure the wire is straight and the length X between the lower tip and the optical pin is 32 cm. If the length exceeds 32 cm reduce by cutting at the lower tip using the wire cutters provided.

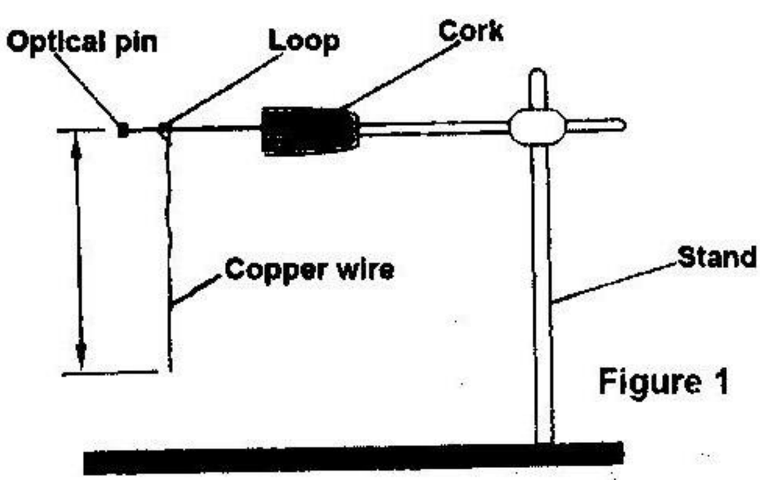


Figure 1

(b) Displace the lower tip of the wire slightly in a plane perpendicular to the optical pin and then release it. Measure the time t for 20 oscillations of the wire and record the value in table.

(c) Repeat the procedure in (b) above for other values of X shown in the table. (Note that each length X is obtained by cutting off an appropriate length from the lower tip of the wire. For example to get X= 28cm cut off 4 cm from the lower end). Complete the table.

Length X (cm)	32	28	24	20	16	12
Time t for 20 oscillations (S)						
Period (T = $^{t}/_{20}$(S)						
T^2 (S^2)						

(d) Plot a graph of T^2 (y- axis) against x

(e) (i) Determine the slope, S, of the graph (3 marks)

(ii) Obtain the value of k in the equation (2 marks)

$$S = \frac{8\pi}{3k}$$

PART B

You are provided with the following:

- A cylindrical container
- Some water
- A stop watch
- A metre ruler of half–metre rule

- A boiling tube
- Some sand
- A rubber band

Proceed as follows:

(f) Tie the rubber band round the boiling tube so that it is at a distance L= 12 cm from the bottom of the tube (see fig 21). Pour water into cylindrical container until the level is about 2.0 cm from the top of the beaker. Float the boiling tube in the water in the container. Add sand gradually into the boiling tube until the tube sinks to the 12 cm mark. See figure 2 (b).

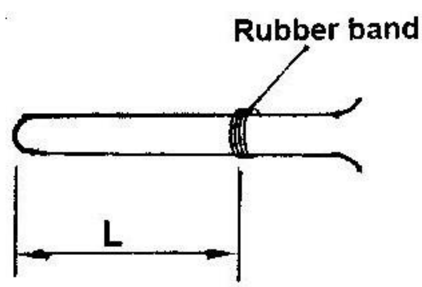


Figure 2(a)

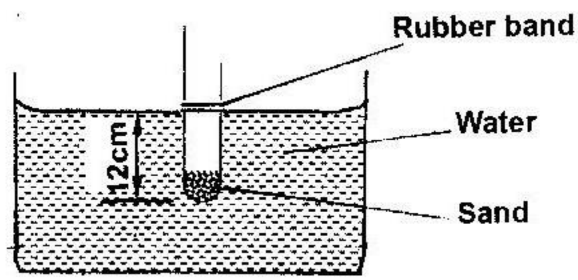


Figure 2(b)

(g) Depress the boiling tube slightly and release so that is oscillates vertically without touching the sides of the container. Measure and record in table 2 the time t_1, for five oscillations of the boiling tube, Repeat the procedure two more times to obtain t_2, and t_3 and record the values in table 2. Complete the table.

Table 2

T_1 (S)	T_2 (S)	T_3 (S)	Average t (S) $T = \frac{(t_1 + t_2 + t_3)}{3}$	$T = \frac{t}{5}$ (S)

(3 marks)

(h) Evaluate P=40L given that L is the length of the tube up to the rubber band in (f) and T is the value obtained in (g) above. (2 marks)

P__________

Questions 2

This question consists of two parts A and B attempt both parts.

PART A

You are provided with the following:

- A triangular glass prism
- A piece of soft board

- Four (4) optical pins
- A sheet of plain paper

Proceed as follows

(a) Place the plain sheet of paper on the soft board. Trace the triangular outline of the prism on the sheet of paper. Remove the prism and use a ruler to extend the three sides of the outline. See figure 3 (a).

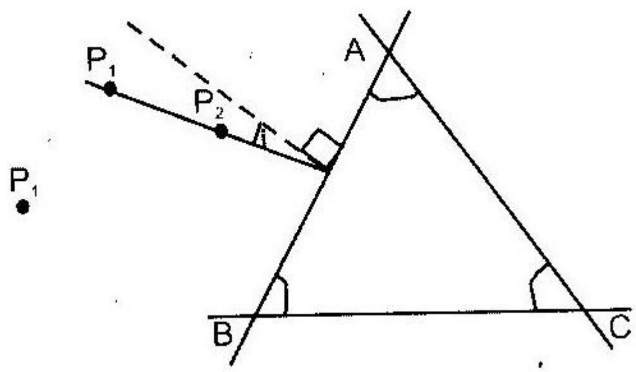


Figure 3(a)

Use a protractor to measure the refracting angle R of the prism

(b) On the side AB of the triangular outline, draw a normal at a point half-way between A and B. This normal will be used for the rest of this experiment.

(c) Draw a line at an angle I = 30^0 to the normal. Stick two pins P_1 and p_2 vertically on this line. See figure 3 (a)

(d) Place the prism accurately on the outline. By viewing through the prism from side AC stick two other P_3 and P_4 vertically such that they are in line with the images of pins P_1 P_2. Remove the prism and the pins. Draw a line joining marks made by P_3 and P_4. Extended this line to meet AC. (see figure 3 (b). Measure and record in table 3 the value of angle θ.

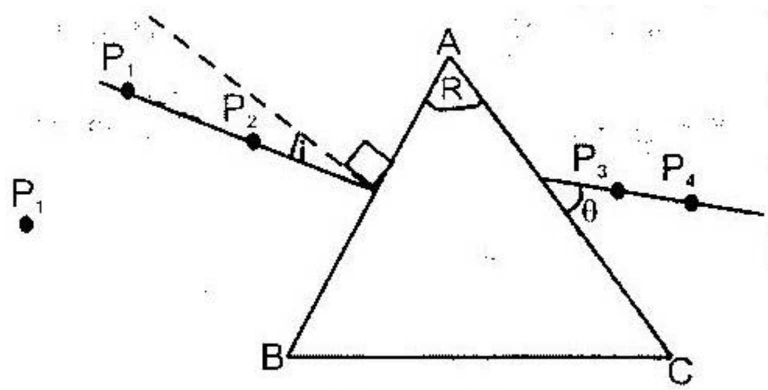


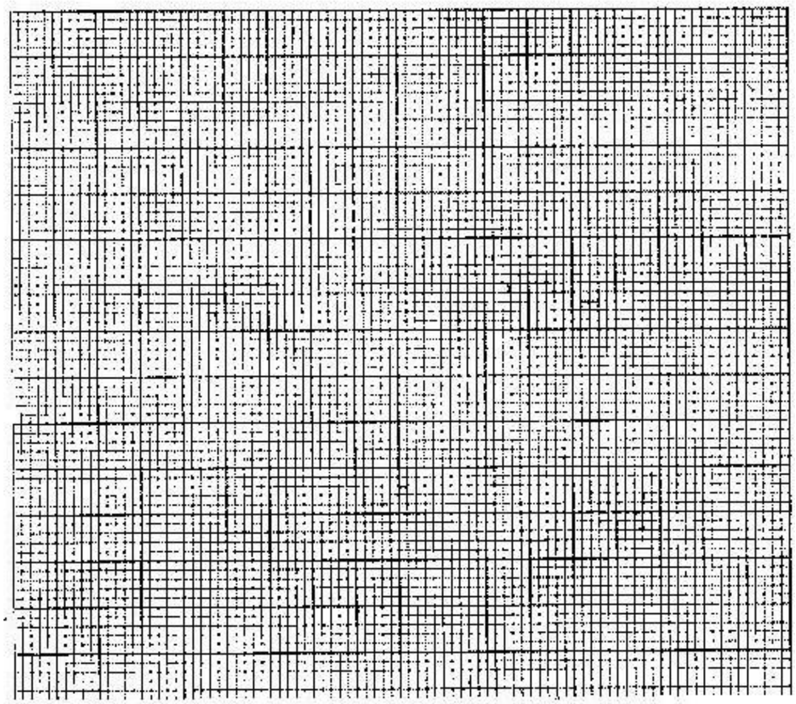
Figure 3(b)

(e) Repeat the procedures in (c) and (d) above for other values of I shown in table 3.

Complete the table.

Angle of incidence I (degree)	30	35	40	45	50	55	60
Angle θ (deg)							
Angle of emergence							

(f) (i) On the grid provided plot the graph of the angle of emergence E (y- axis) against the angle of incidence I (5 marks)



(ii) Use the graph to find i_0 the angle of incidence at which I = E (1 mark)

(iii) Evaluate

(I) $y = 2i_0 – R$

(II) $b= 2 \sin i_0$

PART B

You are provided with the following:

- A lens and a lens holder
- A screen with cross-wires
- A candle
- A metre rule

(g) Arrange the lightened candle, the lens and the screen as shown in figure 4. Adjust the position of the screen until a sharp inverted image of the candle is formed on the screen.

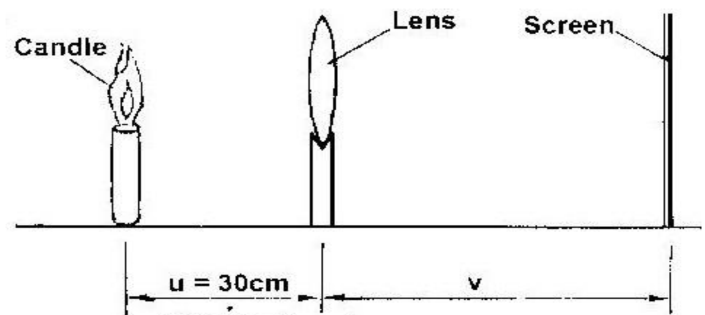


Figure 4

(i) Measure the image distance V

V= _____cm

(ii) Determine the focal length of the lens using the formula $f = \frac{uv}{u+v}$ (1 mk)

(h) Now arrange the lightened candle, the screen with cross wires and the lens as shown in figure 5. Ensure that the centre of the lens, the cross-wires and the

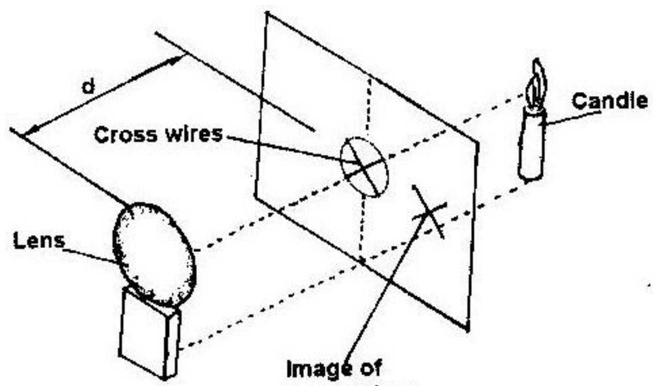


Figure 5

candle flame lie on the same horizontal line. The candle flames should be placed close to the cross-wires for better illumination.

(i) Adjust the position of the lens until a sharp image of the cross-wire is formed on the screen next to the cross-wires. *(Hint you have to rotate the lens slightly about a vertical axis so that the image of the cross-wires falls on the screen next to the cross-wires and not on the cross-wires).*

Measure the distanced between the lens and the screen.

D ________ cm (1 mark)

(ii) Evaluate:

(I) $L = \frac{df}{f-d}$ (1 mark)

(II) $X = \frac{L}{2f} + 1$ (1 mark)

ANSWERS TO KCSE PRACTICAL PAPERS

2007 PRACTICAL PAPER 3

1. (c)

Table 1

Distance X (cm)	35	40	45	50	55	60
Time t for 20 osc (s)	31.5	33.3	34.5	35.4	36.2	36.6
$T = \frac{t}{20}$ (s)	29.5 – 33.5	31.3 – 35.3	32.5 – 36.5	33.4 – 37.4	34.2-38.2	34.6

(d)

(a) Slope tangent at X = 51- 53 shown (1 mark)

With correct shape and direction, correct interval (1 mark)

(b) Correct substitution (1 mark)

Correct evaluation to 4 s. figures or 2 decimal places in standard form

(1 mark)

(c) Substitution of n

Correct evaluation to nearest whole number OR check 2 decimal places in std form (Decimal form) (1 mark)

2. (b) (i)

E = 3.0 + 0.2 volts 2.8 – 3.2 V (2 cells)

OR E = 1.5 + 0.1V = 1.4 – 1.6V (1 cell)

2008 PRACTICAL PAPER 3

1. (c)

Length X (cm)	32	28	24	20	16	12
Time t for 20 oscillations (S)	18.50	17.40	16.10	14.60	13.30	11.20
Period ($T = {}^{t}/_{20}$(S)	0.925	0.870	0.808	0.738	0.665	0.560
T^2 (S^2)	0.856	0.757	0.652	0.544	0.442	0.314

(d) Graph

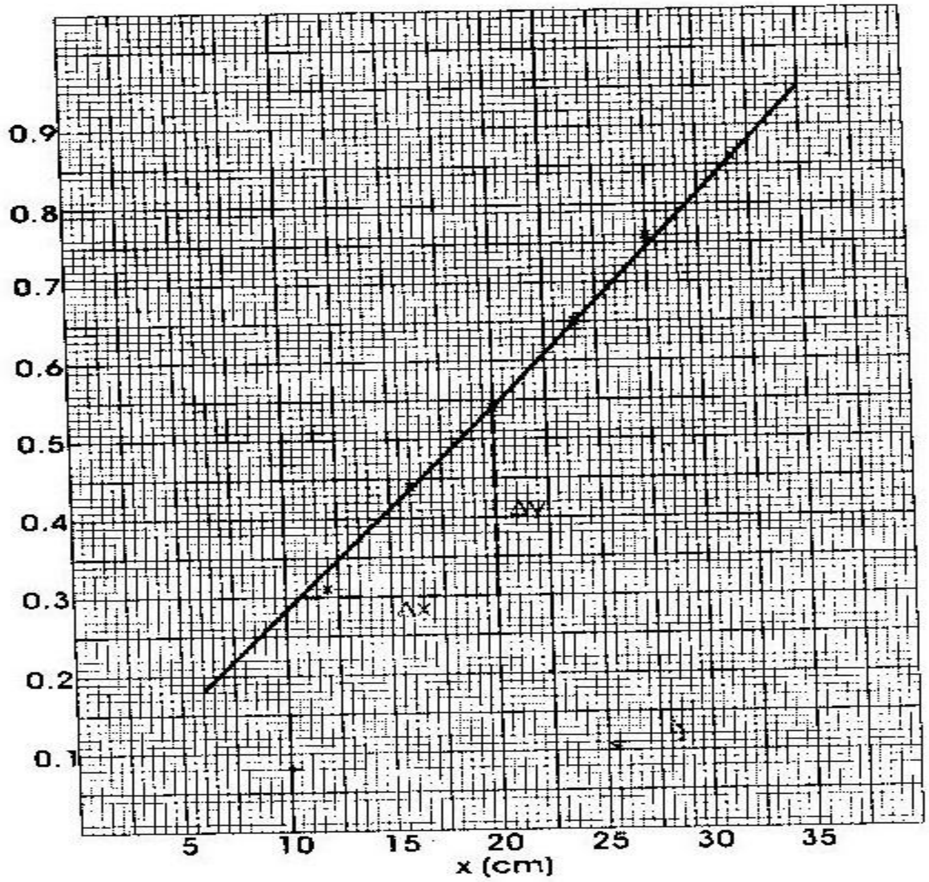
(e) (i) Slope = $\frac{0.54 - 0.30}{20-11}$

$= \frac{0.24}{9} = 0.0267 \frac{s^2}{cm}$

(ii) $S = \frac{8\pi^2}{3k}$ $\quad 0.0267 = \frac{8\pi^2}{3k}$

$\therefore k = \frac{8\pi}{3x\ 0.0267}$

= 313. 767



0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Δy
Δx
5
10
15
20
25
30
35
x (cm)

(f)