KCSE 1996-2019

PAST PAPERS

PHYSICS

Topically Analysed KCSE past Questions

FORM ONE WORK

INTRODUCTION TO PHYSICS

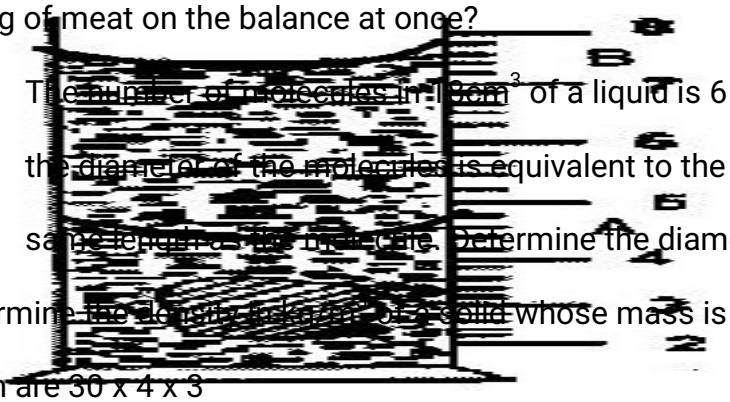
PAST KCSE QUESTIONS ON THE TOPIC

1. State two factors that should be controlled in manufacturing a cylindrical container of uniform thickness, which should normally be in a standing position.

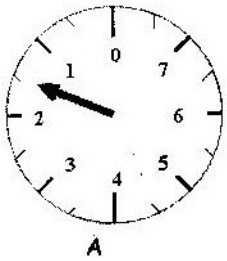
2. The figure shows a measuring cylinder which contains water initially at level A. A solid mass 11g is immersed in the water, the level rises to B.

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

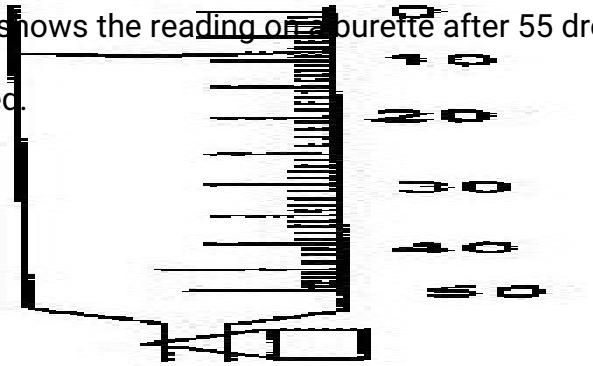
A butcher has a beam balance and masses 0.5 kg and 2 kg. How would he measure 1.5 kg of meat on the balance at once?



3. The number of molecules in 1cm^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.



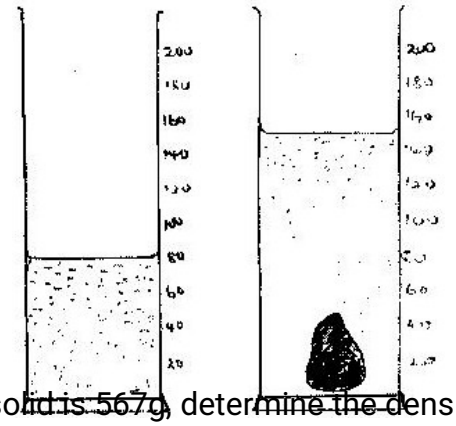
6. Figure 1 shows the reading on a burette after 55 drops of a liquid have been used.



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 x 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 x $10^{-8}m^3$. 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.

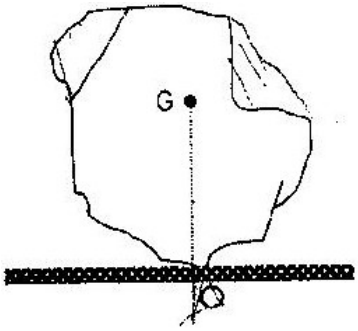
13. 1600 cm^3 of fresh water of density l g/cm^3 are mixed with 1400cm^3 of seawater of density 1.25g/cm^3. Determine the density of the mixture.

TOPIC 2

FORCES

PAST KCSE QUESTIONS ON THE TOPIC

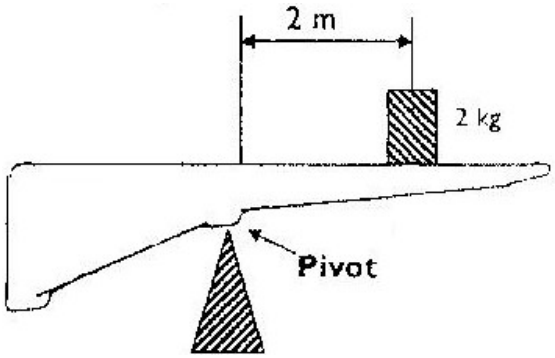
1. A student was heard saying “the mass of a ball on the moon is one sixth its mass on earth”. Give a reason why this statement is wrong.
2. In the study of a free fall, it is assumed that the force *f* acting on a given body of mass *m* is gravitational, given by F= mg. State two other forces that act 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

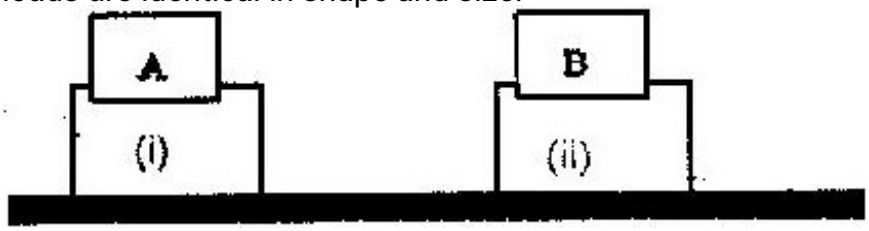
(b) If the portion of the rock represented by the shaded part is chopped off, explain why the rock may topple to the right.

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

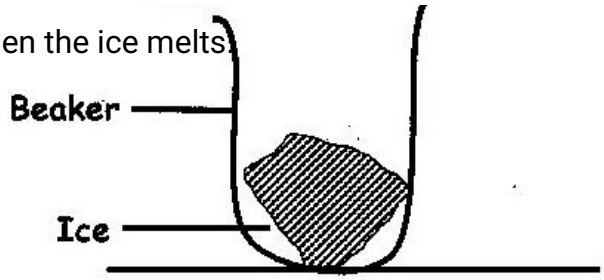
12. 2003: The figure below show two identical trolleys with loads A and B. The loads are identical in shape and size.



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

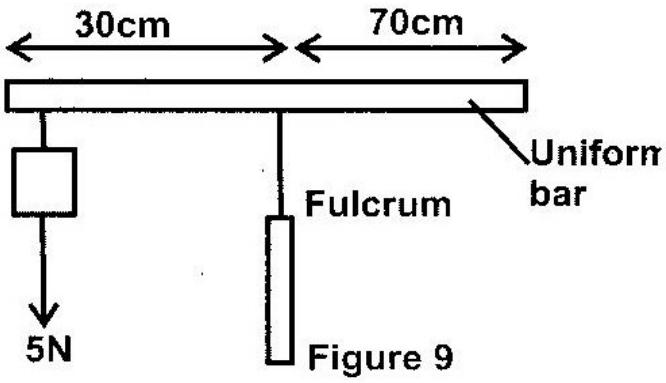


Figure 9

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.

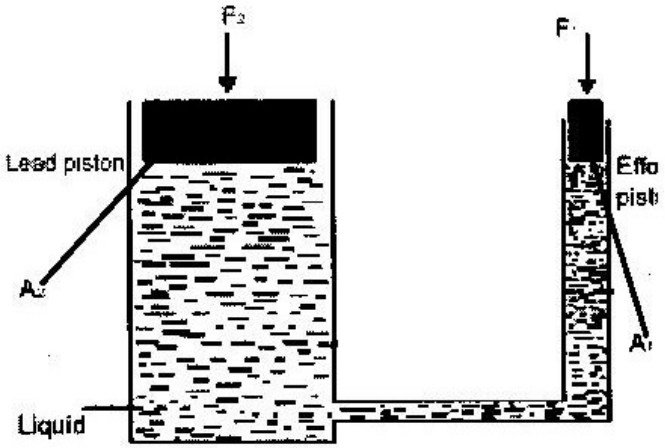


Figure 3

(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.

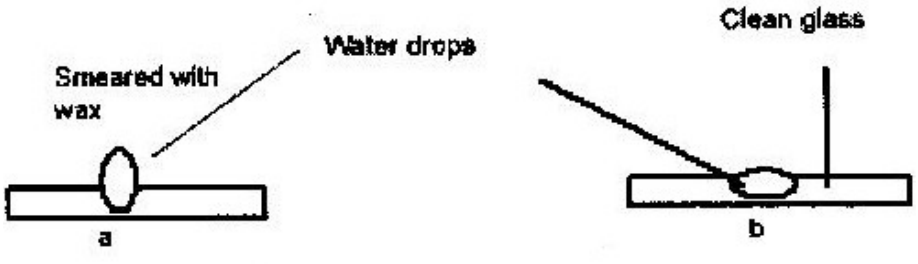


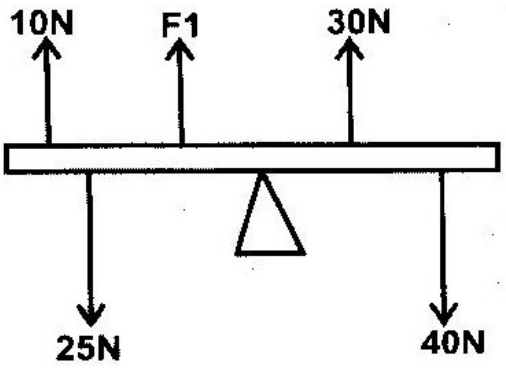
Figure 8

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

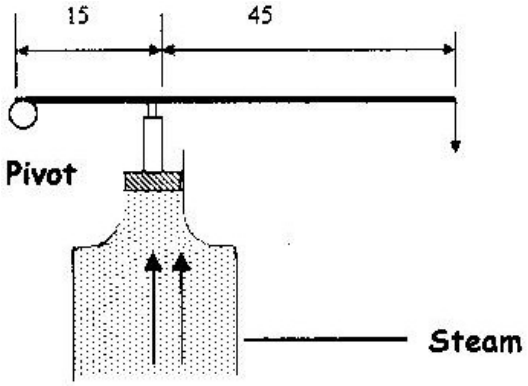
18. A see – saw of length 5 m is pivoted at the centre. A student of mass 50kg sits at one end and is balanced by another student of mass 'm' sitting at a distance of 1m from the other end. Calculate the value of 'm'
19. An astronaut is on the moon. He drops a hammer from a height of 3.2m and it takes 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.

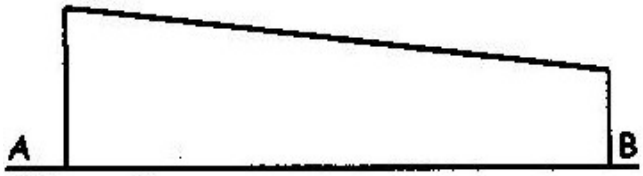


Figure 2

If the rod is 1.8m long find

(i) The position of the centre of gravity

(ii) The weight of the rod

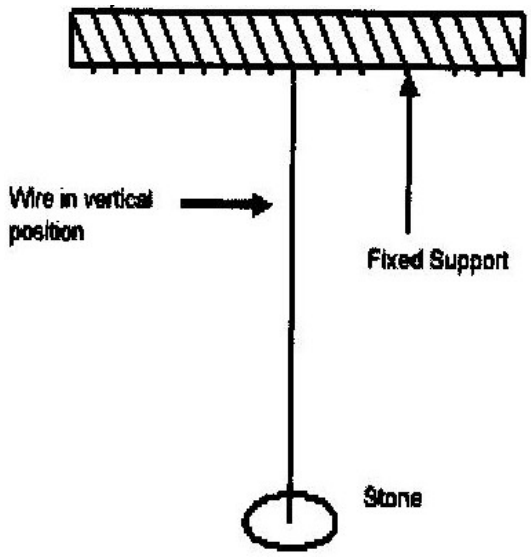
TOPIC 3

PRESSURE

PAST KCSE QUESTIONS ON THE TOPIC

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.

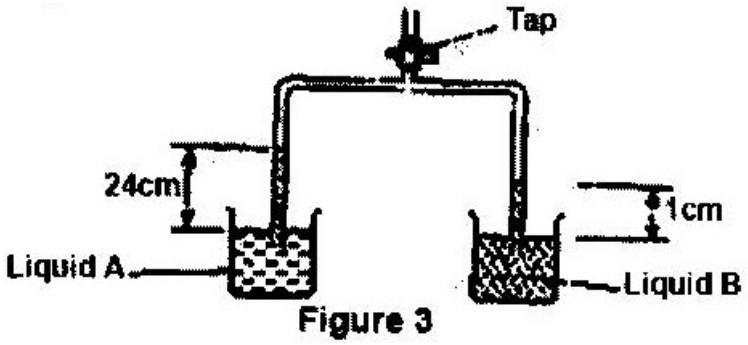


Figure 3

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.

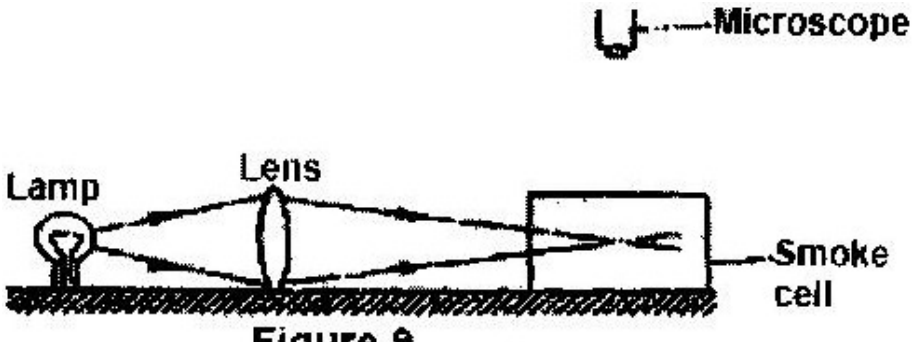


Figure 9

(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)

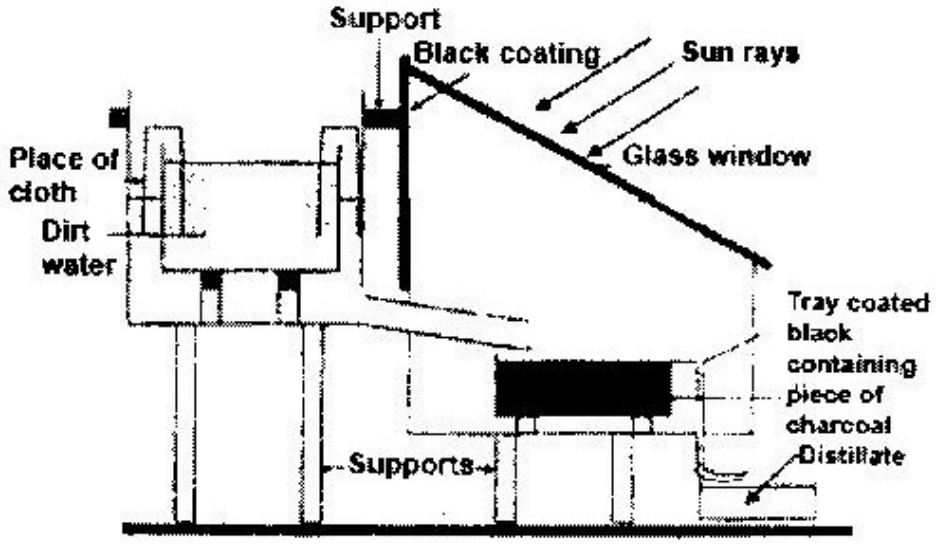
(c) State what will be observed about the motion of the smoke particles if the temperature surrounding the smoke cell is raised slightly. (1 mark)

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.

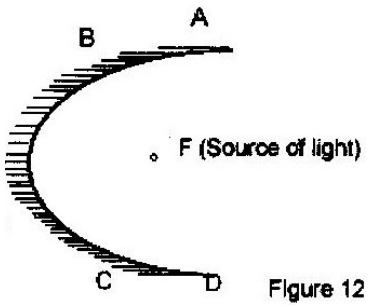


Figure 12

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.

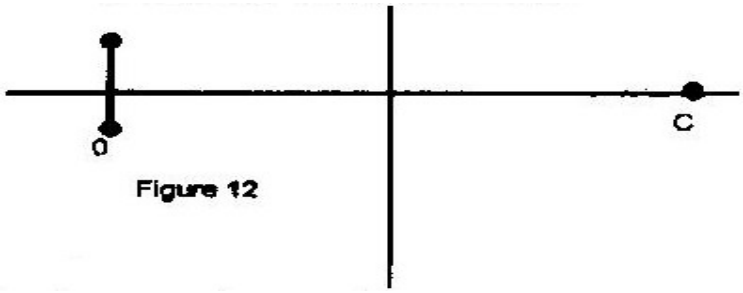


Figure 12

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.

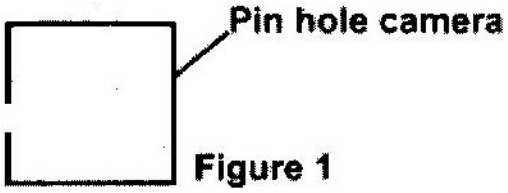


Figure 1

6. Figure 3 shows an object, O in front of a concave mirror and its image, 1 formed after reflection.

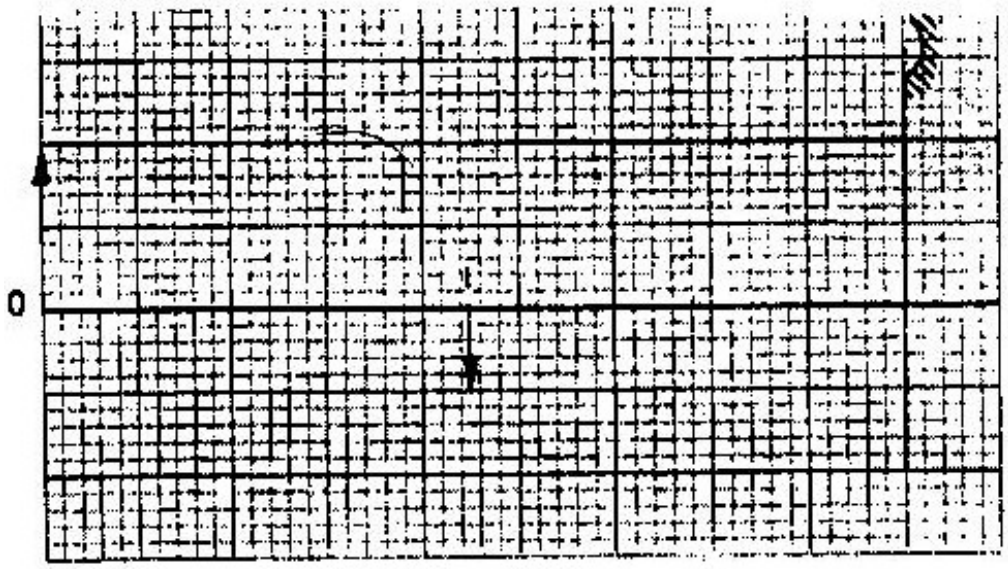
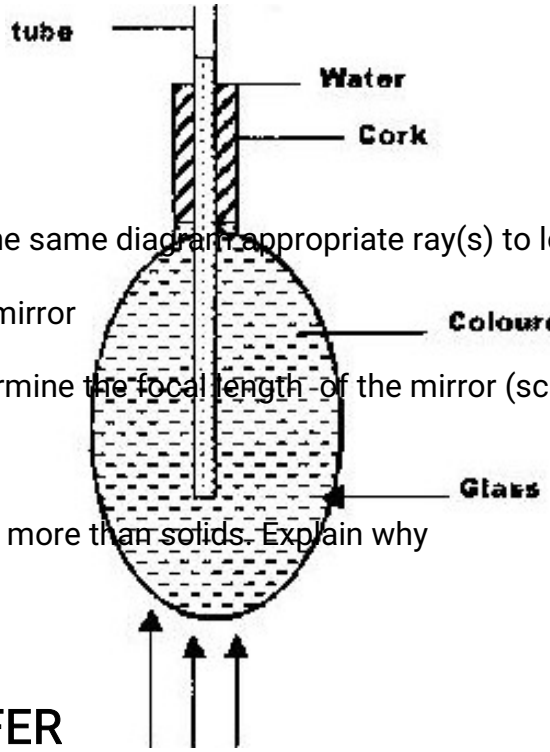


Figure 3



(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

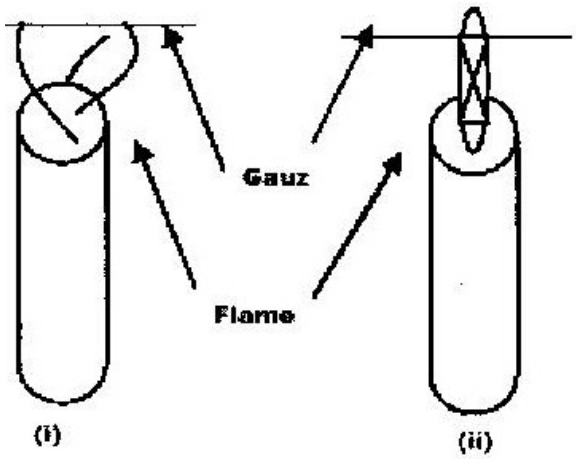
HEAT TRANSFER

PAST KCSE QUESTIONS ON THE TOPIC

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.

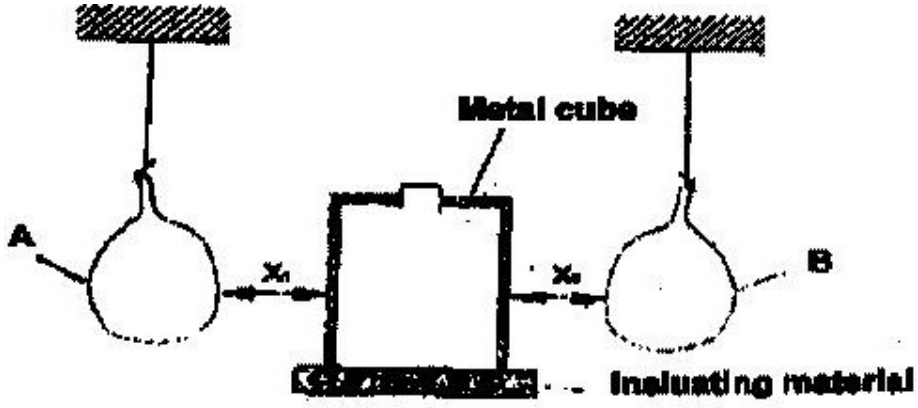


Figure 4

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)

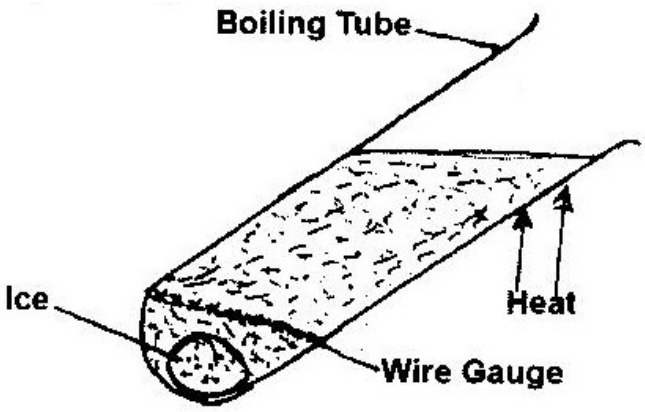
7. Temperature scale in clinical thermometer ranges from 35^0c to 43^0c. Explain.
8. State one application of expansion in gases
9. Why is it that boiling is not used for sterilization of clinical thermometer?
10. Describe ONE advantage and ONE Disadvantage of anomalous behavior of water.
11. (a) Draw 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.

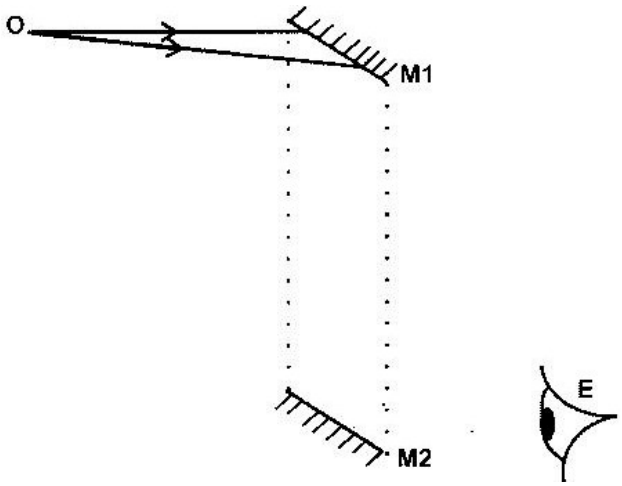


TOPIC 7

RECTILINEAR PROPAGATION OF LIGHT AND REFLECTION AT PLANE SURFACES

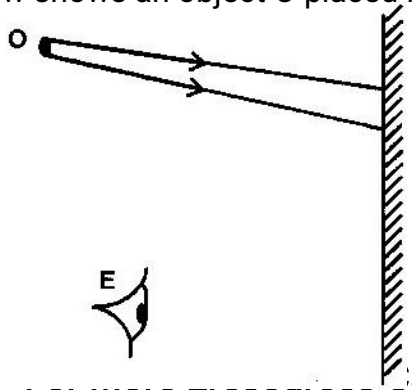
PAST KCSE QUESTIONS ON THE TOPIC

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.



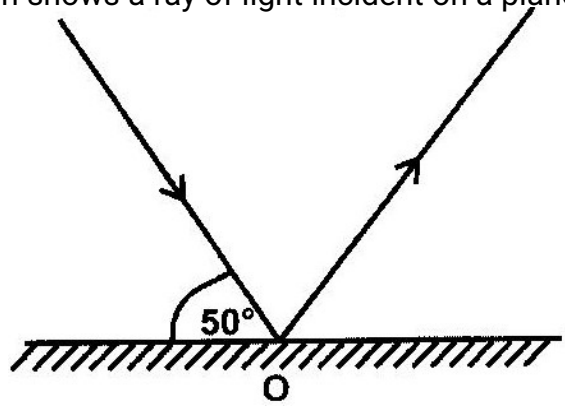
Complete the diagram by sketching rays to show the position of the image as seen by the eye E

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.

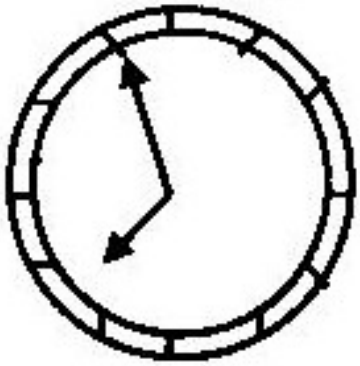


The mirror is rotated clockwise through an angle of 30^0 about an axis perpendicular to the paper. Determine the angle through which the reflected ray rotated.

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)

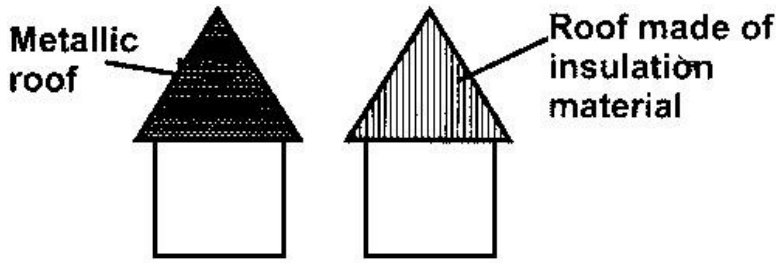
10. A building standing 100m from a pinhole camera produces on the screen of the camera an image 5 cm high 10 cm behind the pinhole. Determine the actual height of the building. (3 marks)

TOPIC 8

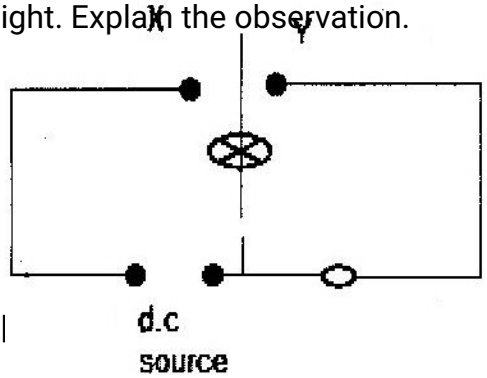
ELECTROSTATICS 1

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.

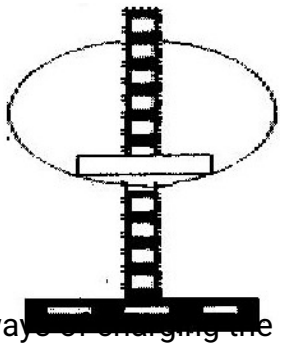


5. In the clothing and textile industries the machines experiences electrostatics forces at certain points. Suggests one method of reducing these forces.
6. State two other factors to be considered in constructing a capacitor other than the surface area of the plates.
7. State the precaution that is 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.



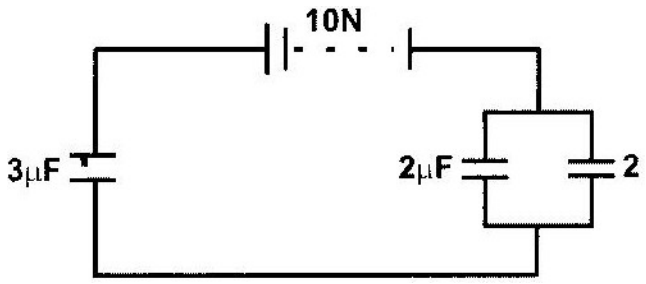
   (d) State two ways of changing the magnitude of the deflection of the leaf of an electroscope.

   (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

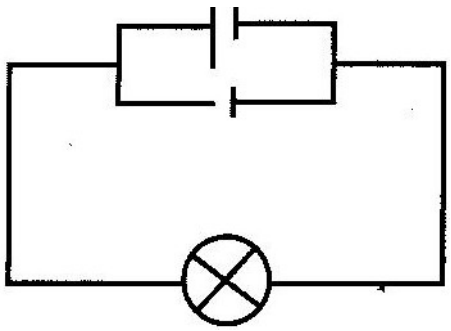
CELLS AND SIMPLE CIRCUITS

PAST KCSE 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. 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)

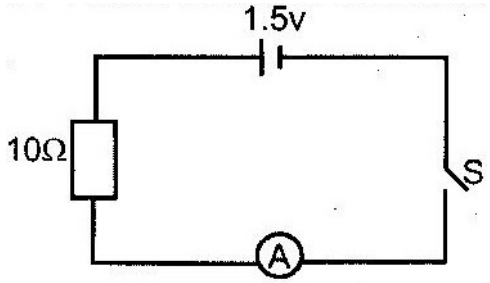


Figure 7

(a) State Ohm's law

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

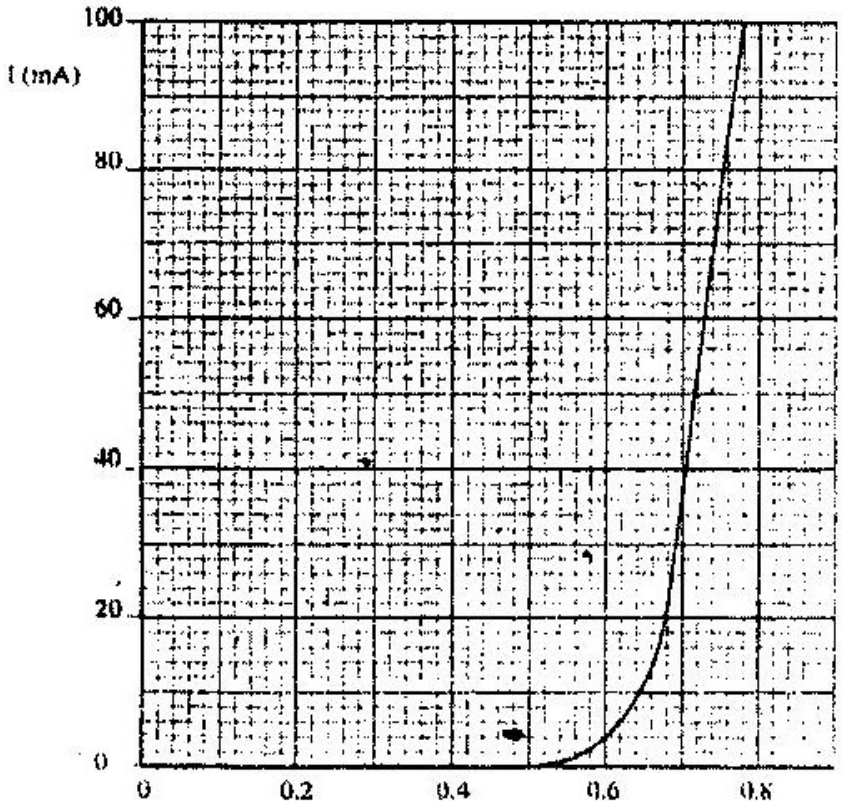
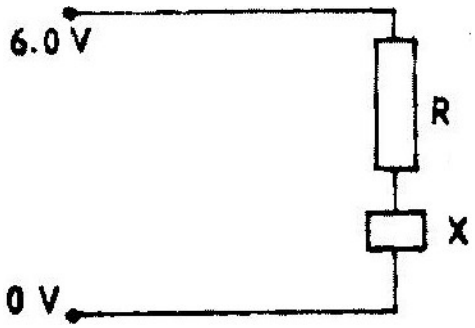


Figure 9

(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.

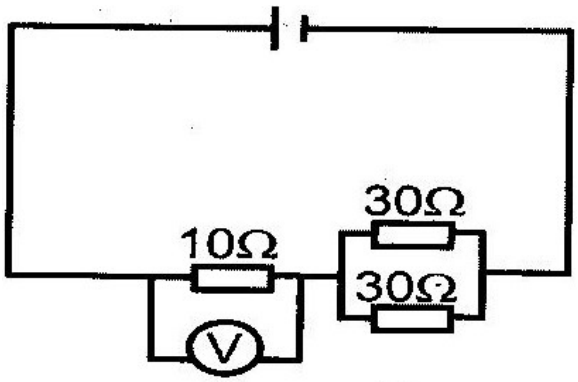


Figure 10

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

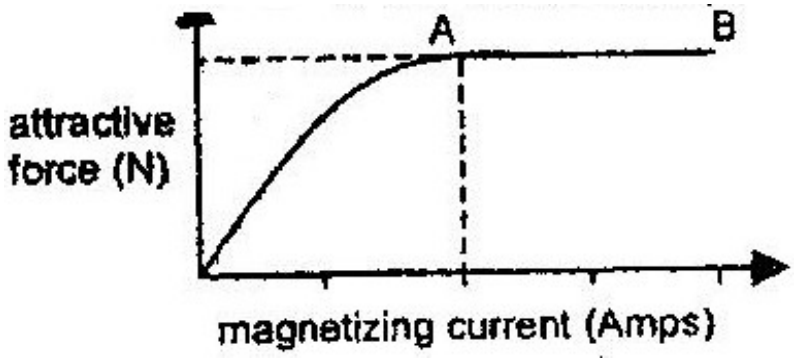
FORM 2 WORK

TOPIC 1

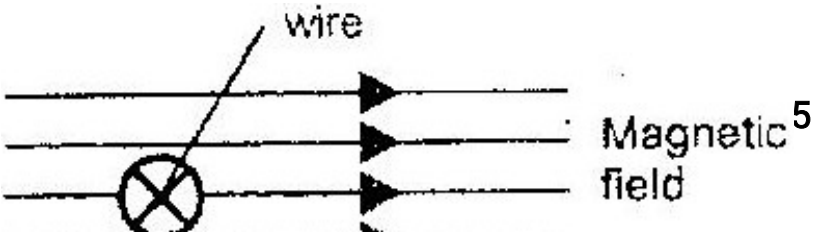
MAGNETISM AND ELECTROMAGNETISM

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.



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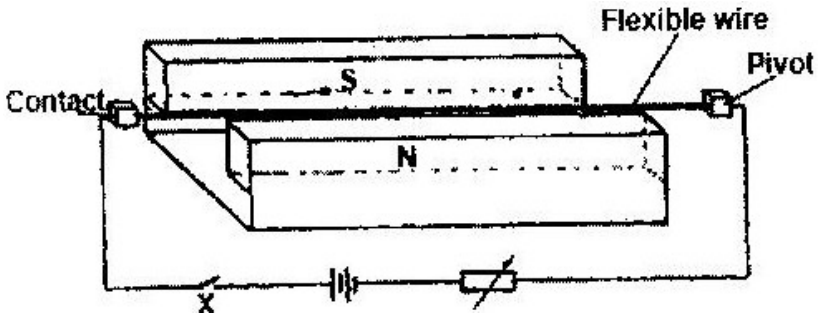
3. The diagram in the figure below shows a flexible wire in a magnetic field.



(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?

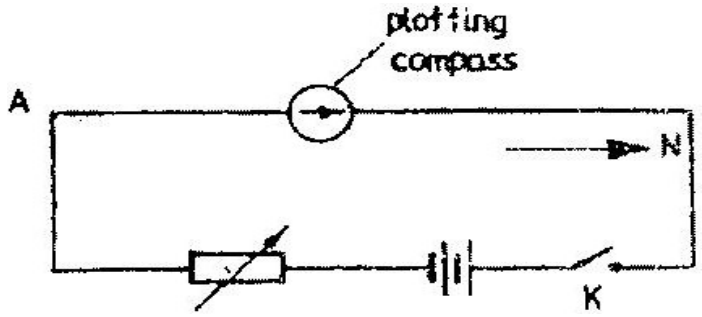
4. You are provided with two iron bars, X and Y, one is magnetized and the other is not. Explain how you would identify the magnetized bar without using a magnet.

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?

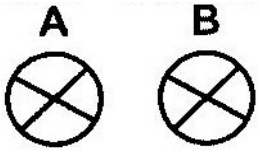
6. Give two reasons why soft irons is used as a core of the coil of an electric

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

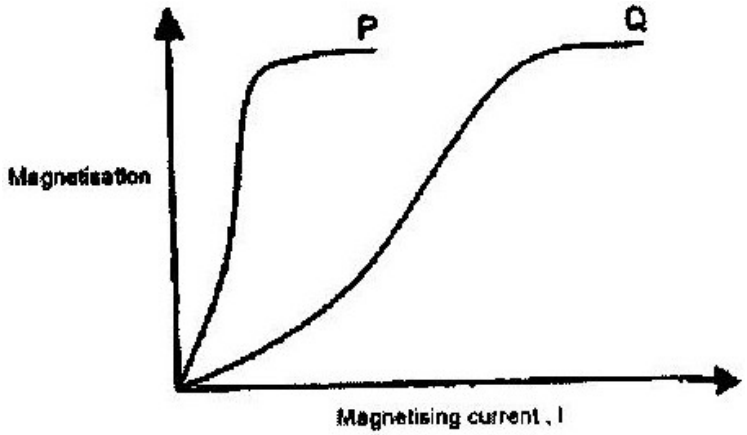
(ii) indicate the force F due to the current on each conductor

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.



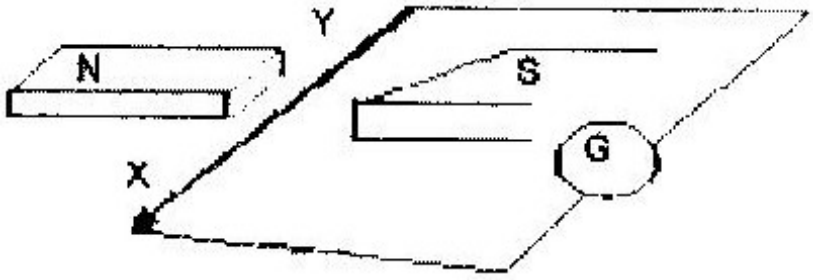
13. Distinguish between soft and hard magnetic material

14. Explain how hammering demagnetizes a magnet.

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

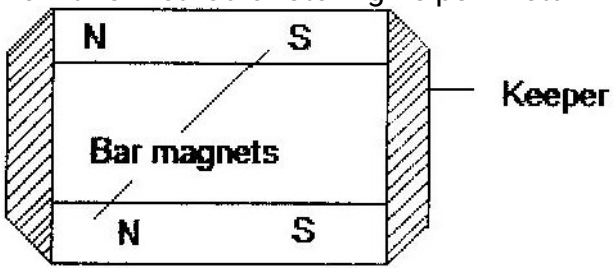
16. Figure 11 shows a wire XY at right angles to a magnetic field. XY is part of a circuit containing a galvanometer. When XY is moved, the current flows in

the direction shown. State the direction in which XY is moved.



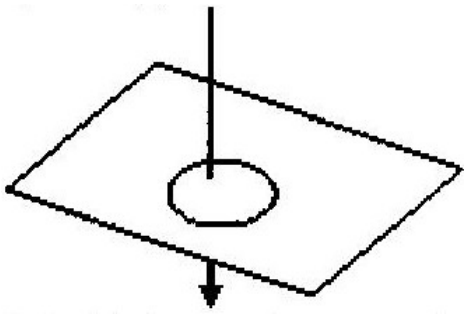
17. Fig 12 shows how magnets are stored in pairs with keepers at the end.

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

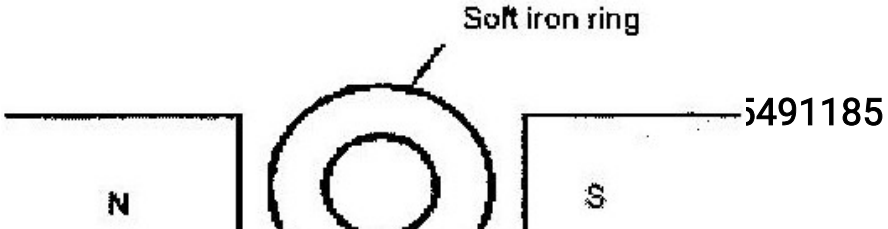


(2 marks)

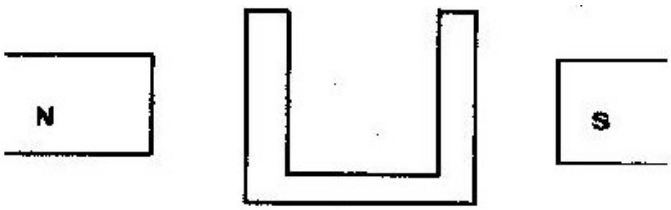
18. In figure 13 the arrow indicates the direction of the current in the conductor. Sketch on the diagram the magnetic field pattern (1)



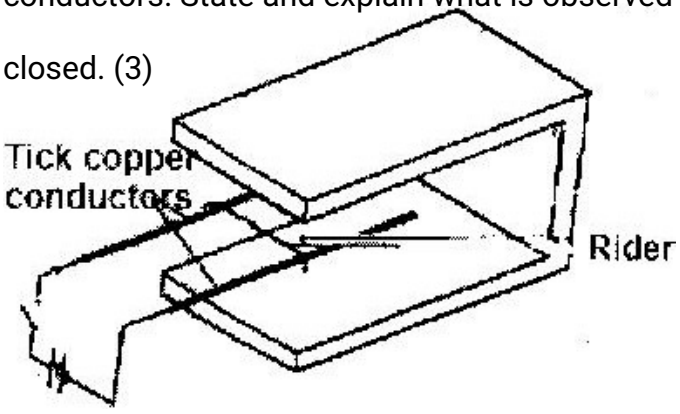
19. Fig 14 shows a soft iron ring placed between the poles of magnet. Copy the diagram and sketch the magnetic field pattern. (1)



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.

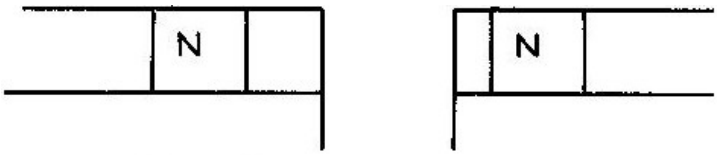


Figure 7

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.

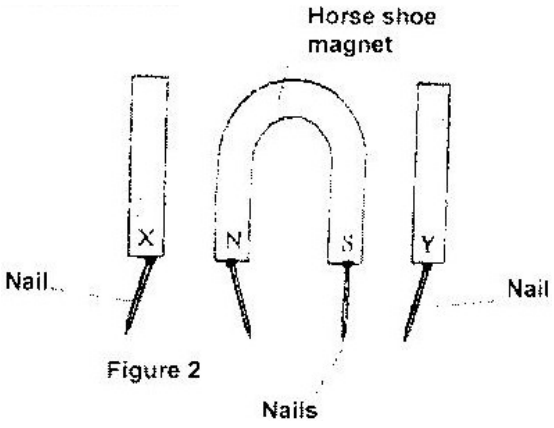
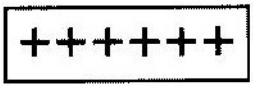


Figure 2

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.

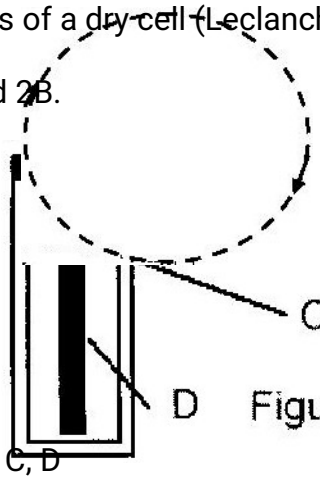
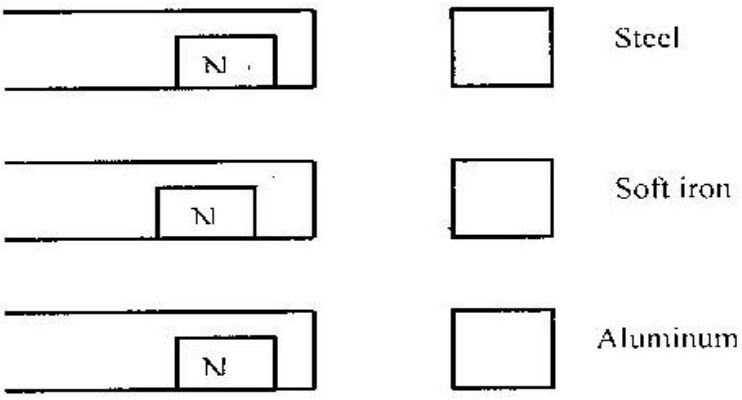


Figure 7

(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

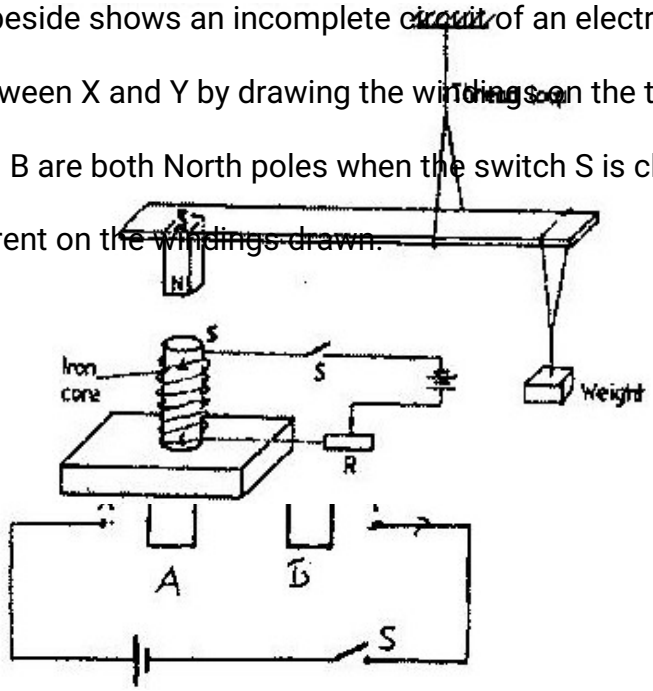
A and C sometime attract one another and sometimes repel one another. What conclusion can you draw about?

(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.

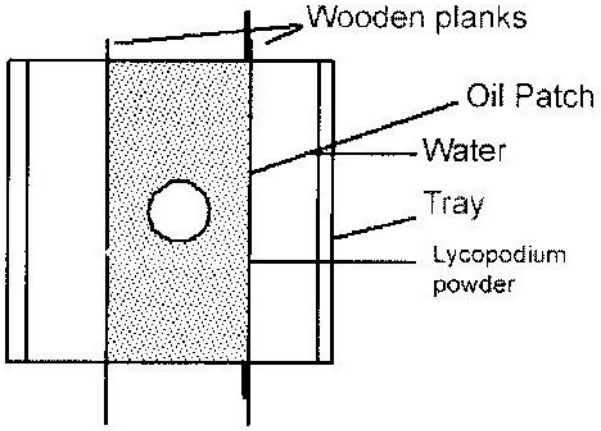
(b) Using a labeled diagram, explain the working of a simple relay.

TOPIC 2

MEASUREMENTS II

PAST KCSE QUESTIONS ON THE TOPIC

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)

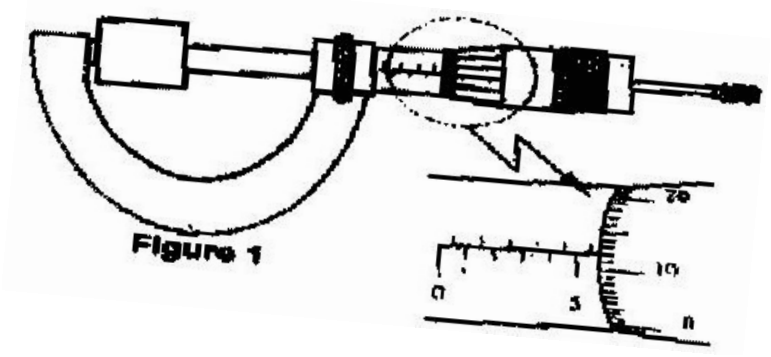
4. An oil drop of average diameter 0.7mm spreading out into a roughly circular patch of diameter 75mm on the surface of water in a trough.

(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?

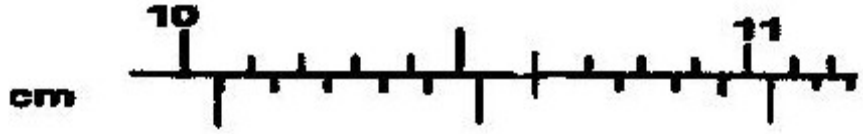
7. Determine the density of the metal cube giving your answer correct to three significant figures.

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 of a blind hole nearly

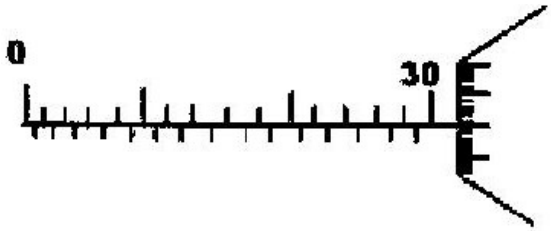
900mm deep.

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?

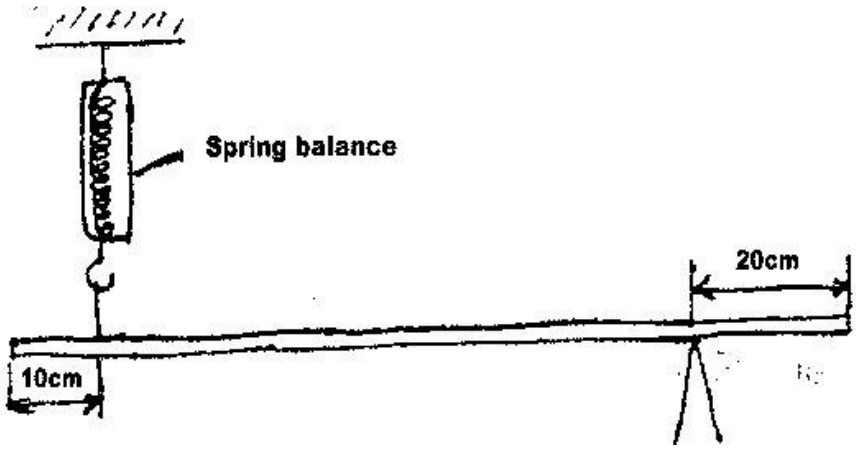
Estimate the assumption (s) made in this experiment

TOPIC 3

TURNING EFFECT OF A FORCE

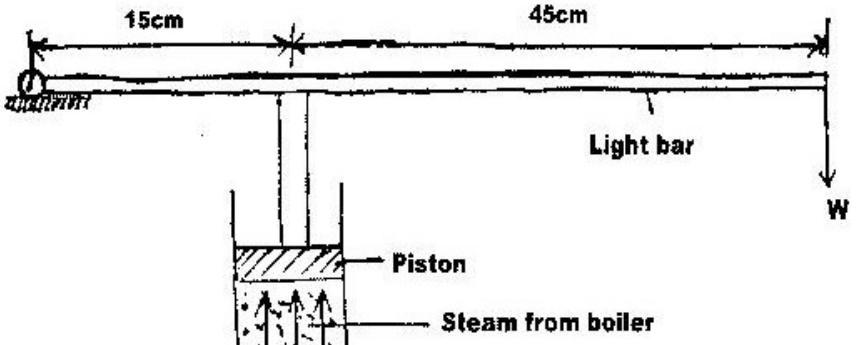
PAST KCSE QUESTIONS FROM THE TOPIC

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.

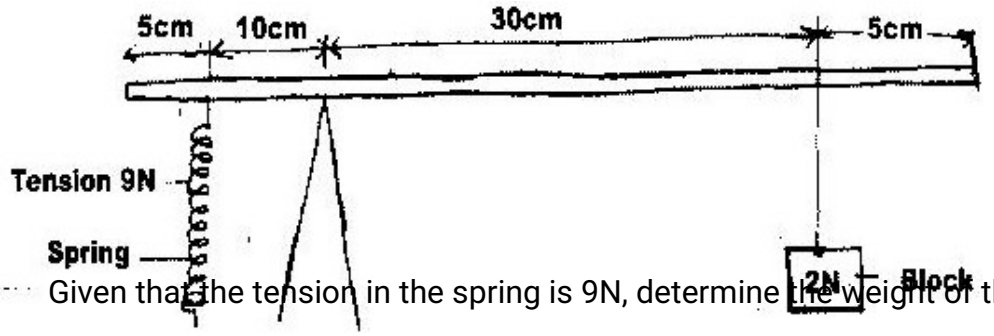
   (b) Two men P and Q carried a uniform ladder 3.6 m long weighing 1200N. P held the ladder from one end while Q supported the ladder at a point 0.4m from the other end.

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

      (ii) Calculate the load supported by each man.

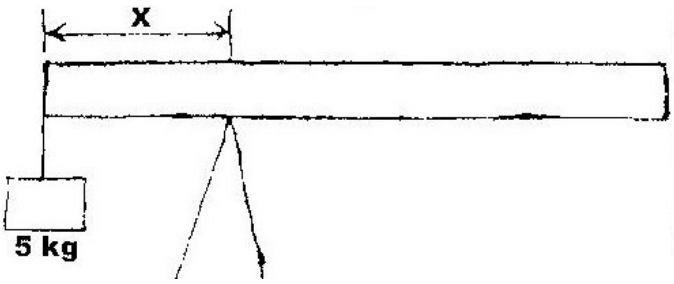
5. The figure shows a uniform half metre rod that is balanced over a pivot using a block

of weight 2N and a spring.

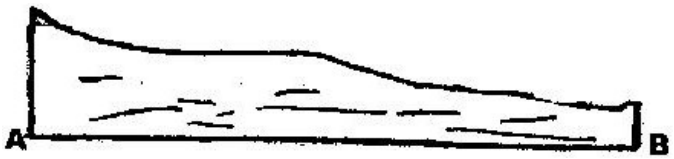


Given that the tension in the spring is 9N, determine the weight of the rod.

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



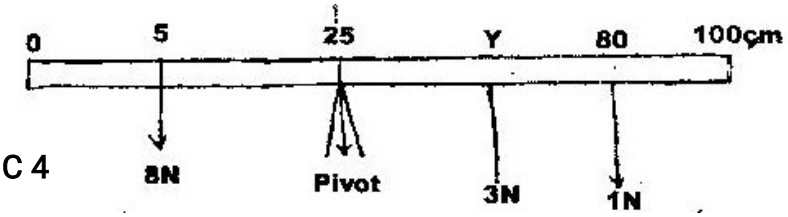
7. State the principle of moments
8. Name four activities which produce a turning effect
9. Why is it very difficult to open a door from a point too close to hinges
10. Why are people who are maimed or have lost one leg provided with crutches?
11. A uniform half- metre rod is balanced by a weight of 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

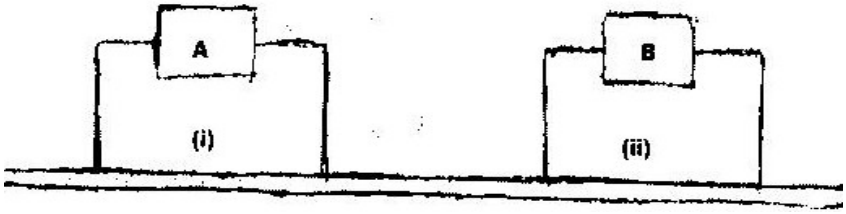


TOPIC 4

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.

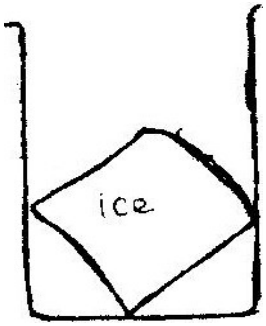


Given that the density of A is greater than that of B, explain why the trolley in (ii) is more stable.

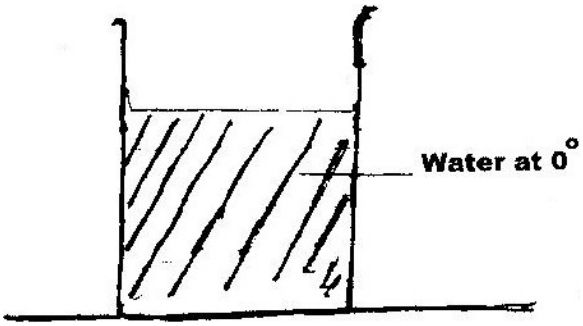
2. Figure 2 shows a solid cylinder standing on a horizontal surface. The cylinder is in stable equilibrium.

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.



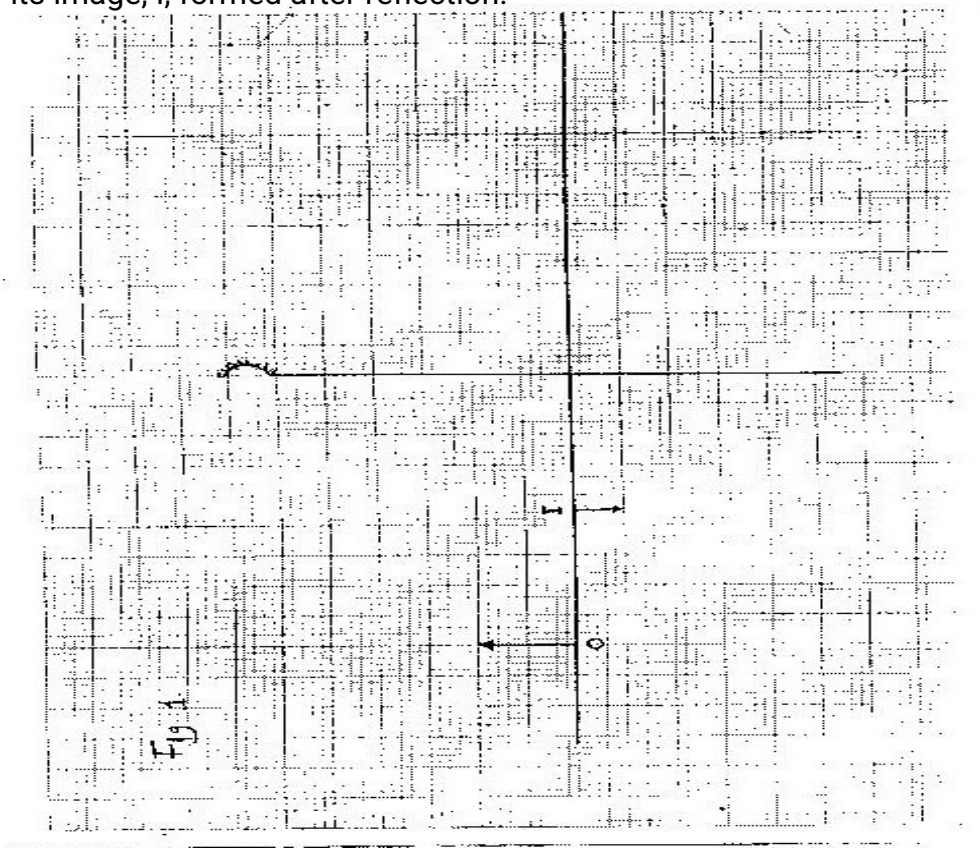
State and explain the changes in stability of beaker when water freezes

TOPIC 5

REFLECTION AT CURVED SURFACES

PAST KCSE QUESTIONS ON THE TOPIC

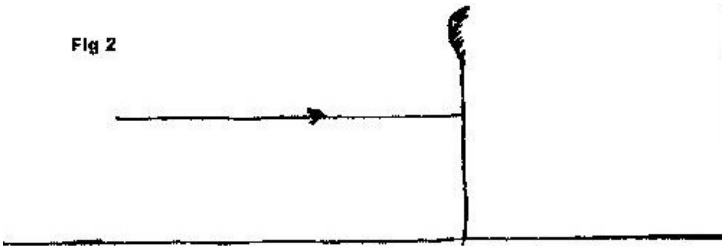
1. The figure (fig 1) on the grid shows an object O in front of a concave mirror and its image, I, formed after reflection.



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

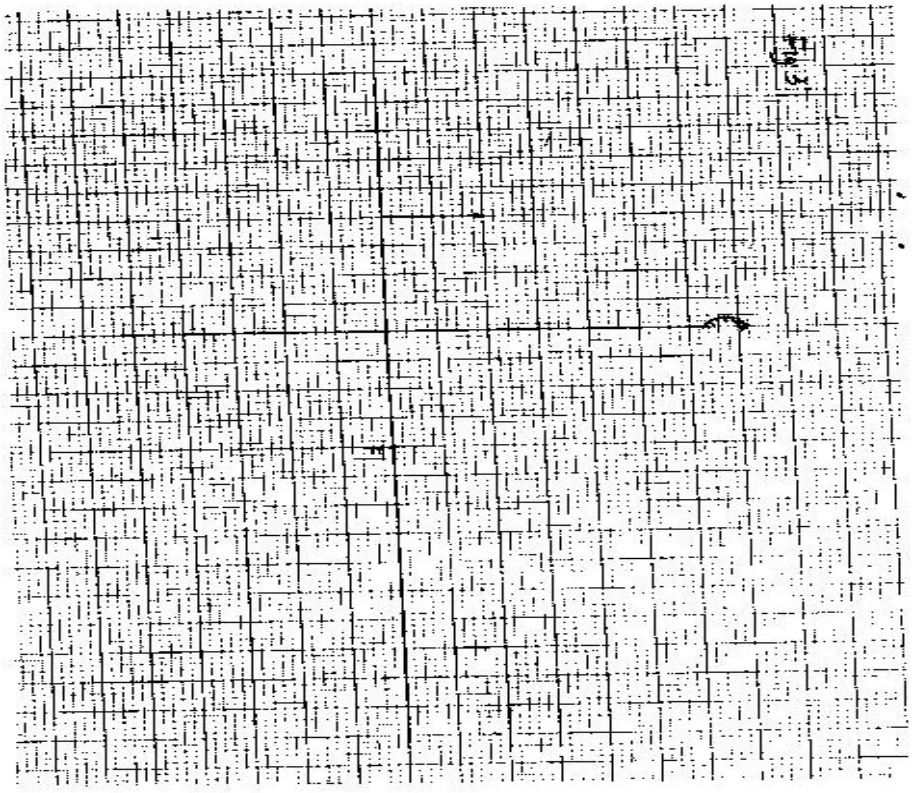
(b) Determine the focal length, f of the mirror, (scale 1.5)

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



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.

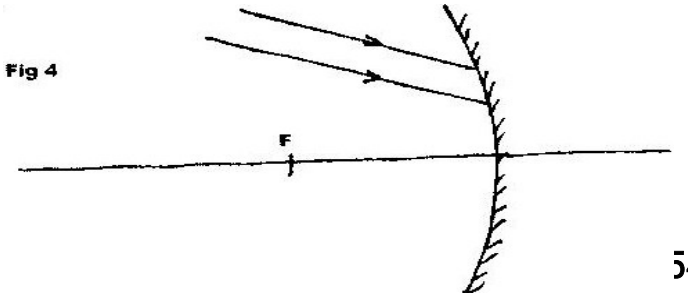
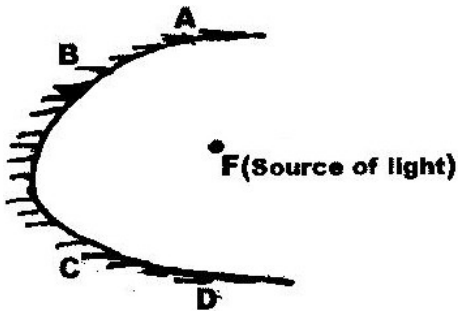


Fig 4

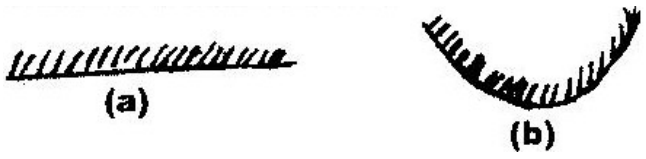
On the same diagram sketch the path of the rays after striking the mirror

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.

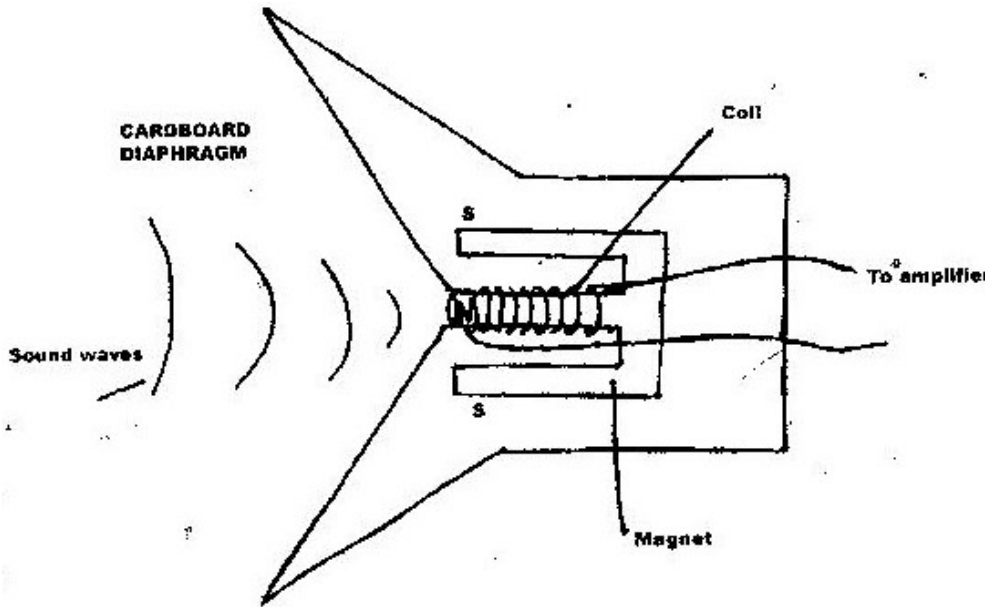
8. Distinguish between a real and a virtual image.
9. State ONE application of each of the following
    (i) Convex mirrors
    (ii) Parabolic mirrors
    (iii) Concave mirrors
10. State the advantages a diverging mirror has over a plane mirror when used as a rear-view in vehicles.
11. State characteristics 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

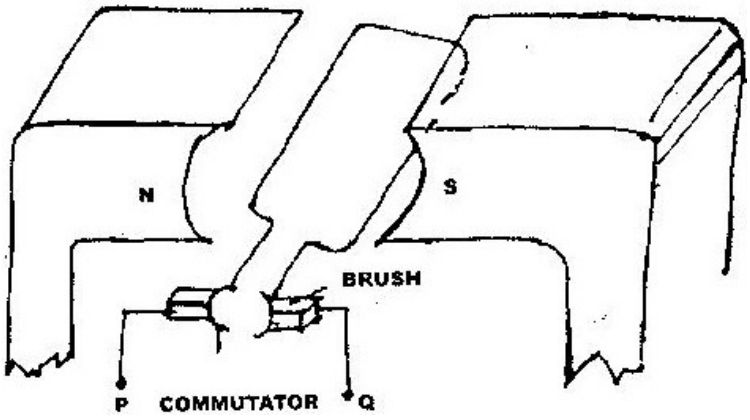
1. Fig 4 shows a simple microphone in which sound waves from the person talking causes the cardboard diaphragm to vibrate.



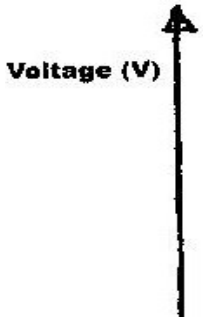
(a) Explain how a varying current is induced in the coil when the diaphragm vibrates

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

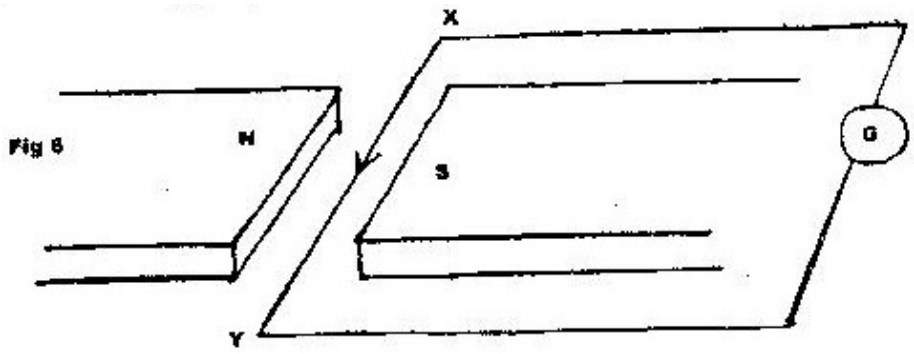
2. Fig 5 shows an electric generator. The points P and Q are connected to a Cathode Ray Oscilloscope (CRO).



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.



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.

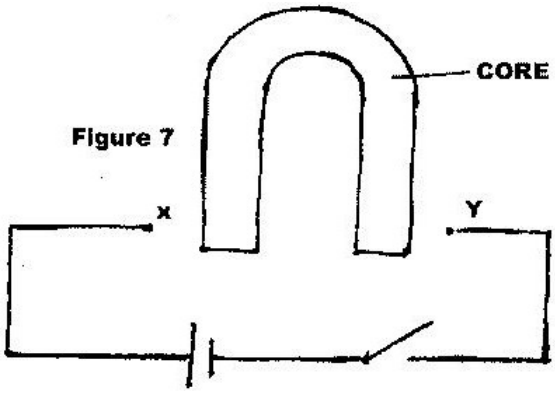
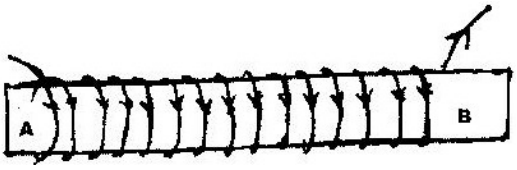


Figure 7

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.

Figure 2

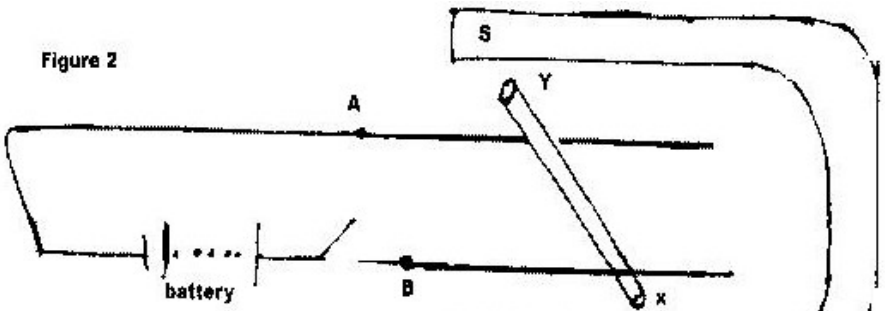
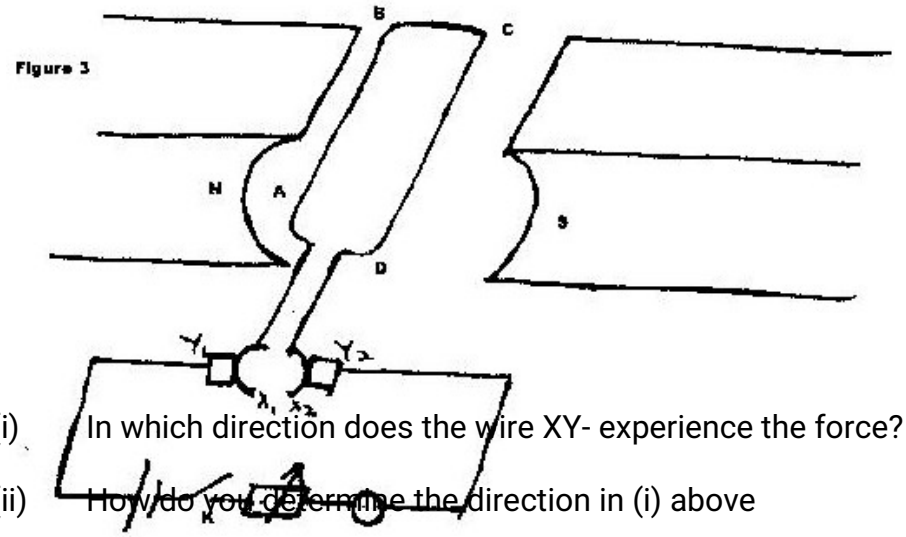


Figure 3



(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

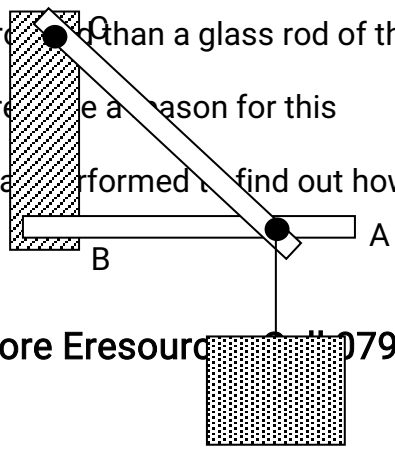
HOOKES LAW

PAST KCSE QUESTIONS ON THE TOPIC

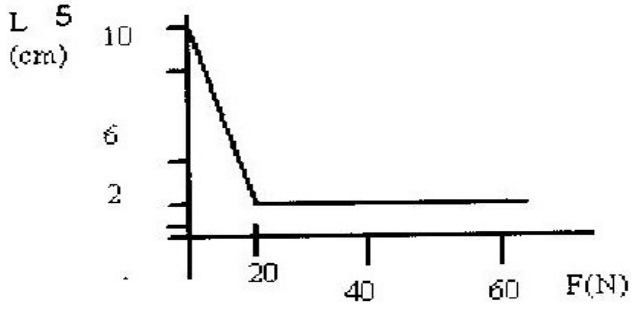
1. 1990: Distinguish between ductile and brittle material
2. 1990: Identify the girders in the structure that can be replaced by a string

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.

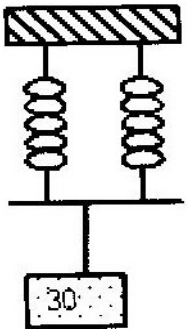


(i) Draw a diagram of a possible set up of the apparatus

(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.

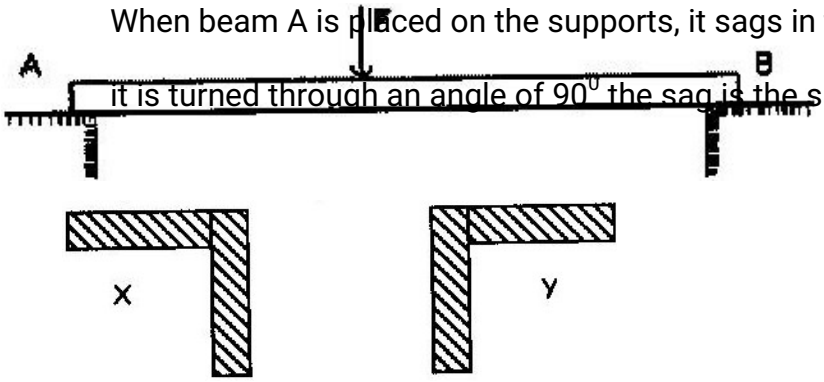


(c) State two factors that govern the strengths of a spiral of given material

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.



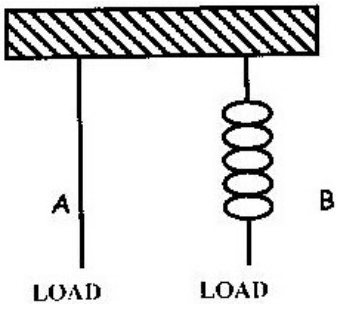
(i) Suggest the possible shapes of the beams A and B.

(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.)

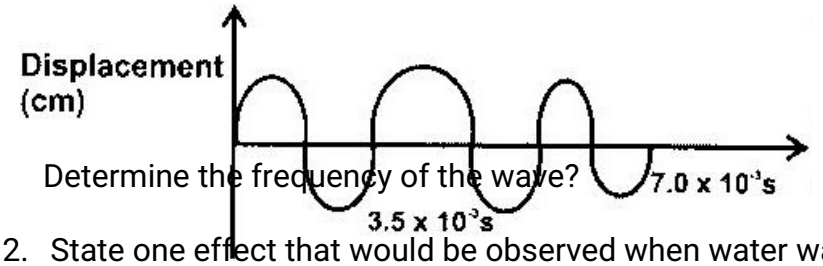
8. State Hooke's Law
9. A spiral spring stretches by 0.6 cm when a mass of 300g is suspended on it. What is the spring constant?

TOPIC 8

WAVES 1

PAST KCSE QUESTIONS ON THE TOPIC

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.

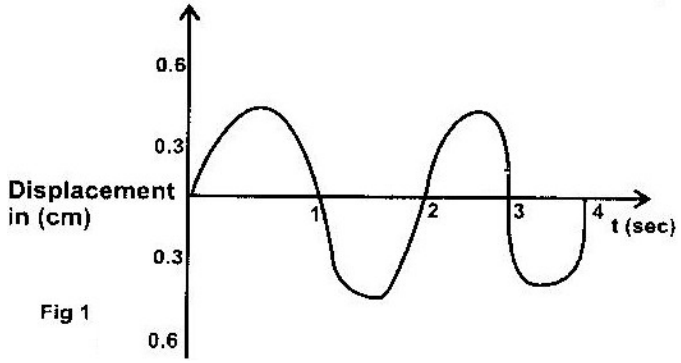


Fig 1

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.

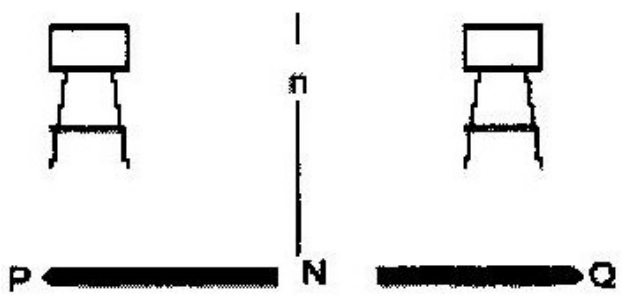
10. Give an example which show that speed of a wave depends on the medium in which it travels.
11. Give an example to demonstrate that waves carry energy
12. Best FM station broadcasts on a frequency of 250 KHz and the wavelength of its signals is 1200m.
    (i) The speed of radio waves in m/s
    (ii) 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



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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

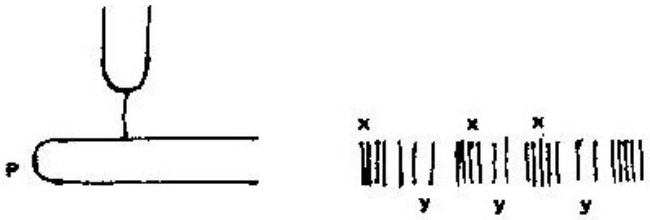
b. The value d

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.

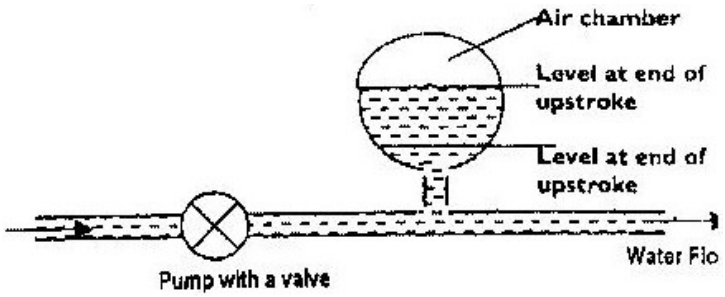
14. Sound is very faint in high altitudes than at sea level. Why?
15. Distinguish between the following terms
    (i) Intensity and loudness
    (ii) Frequency and pitch
16. State two factors that affect the frequency of the note produced by a vibrating string

TOPIC 10

FLUID FLOW

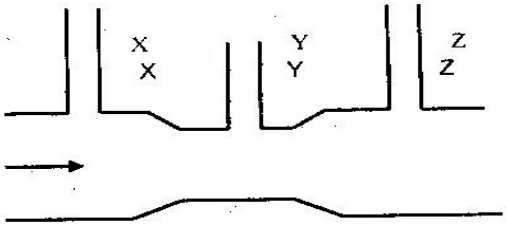
PAST KCSE QUESTIONS ON THE TOPIC

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.

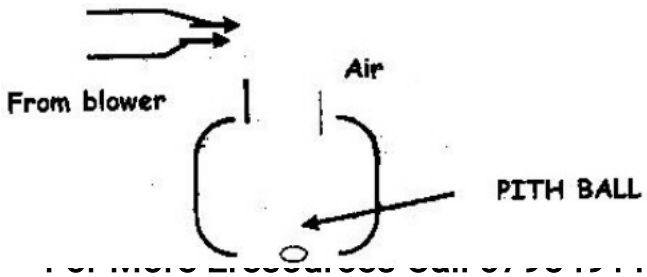


Explain how the continuous flow of water is maintained.

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.



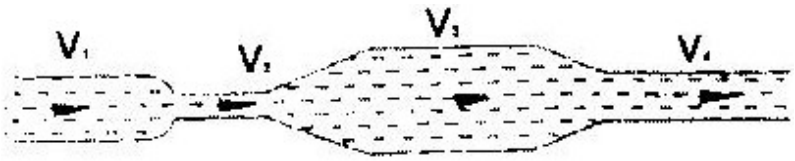
6. State how the pressure in a moving fluid varies with speed of the water is steadily increased from low to high value.
7. Water flows in a horizontal smooth pipe. State the changes that would be observed in the nature of the flow if the speed of the water is steadily increased from low to high value?
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.

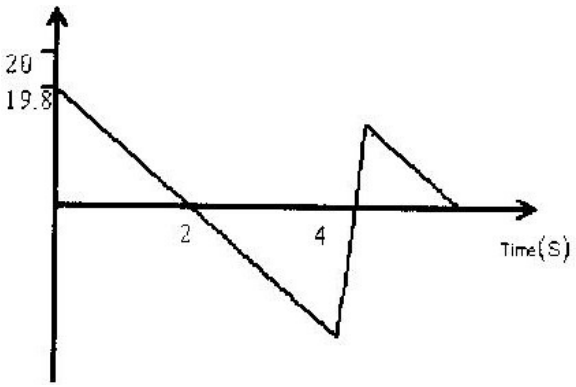
FORM THREE WORK

TOPIC 1

LINEAR MOTION

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

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.

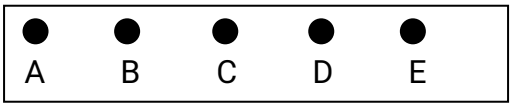
ii) From the graph, calculate the acceleration due to gravity.

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?

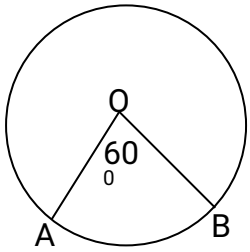
5.An object is projected vertically upwards at a speed of 15m/s. How long will it take to return to the same level of projection?

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

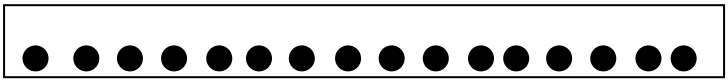
a) The horizontal distance from the table at which the block hits the floor.

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) $s= ut + ½ at^2$ 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.

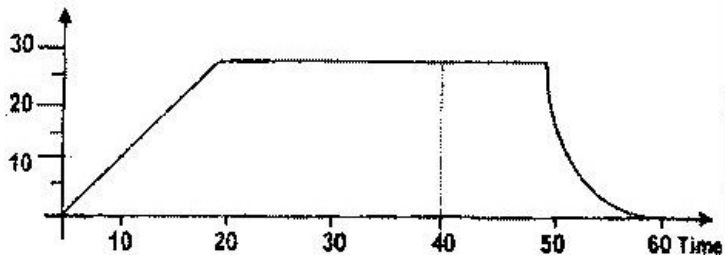
13.: a) A stone is thrown vertically upwards from the edge of a platform eventually the stone lands without bouncing on the ground below the platform. Taking the upward velocity to be positive, sketch the velocity-time graph of the motion of the stone.

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.

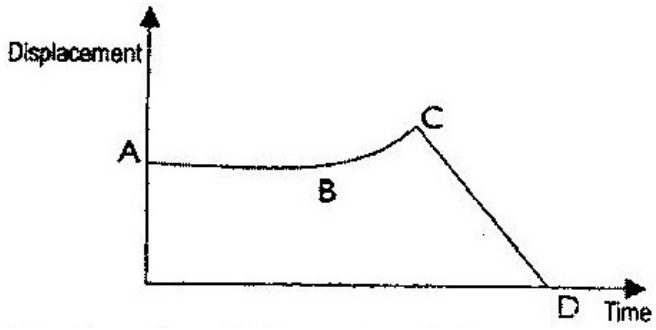


Determine the distance the car travels in the first 40 seconds

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

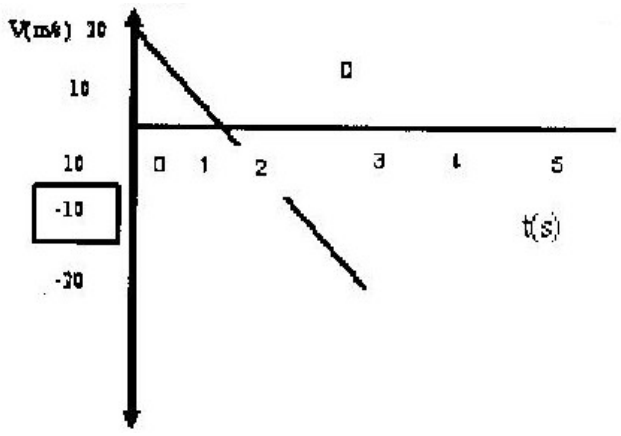
b) A ball is thrown horizontally from the top of a vertical tower and strikes the ground at a point 50m from the bottom of the tower. Given that the height of the tower is 45m, determine the;-

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.

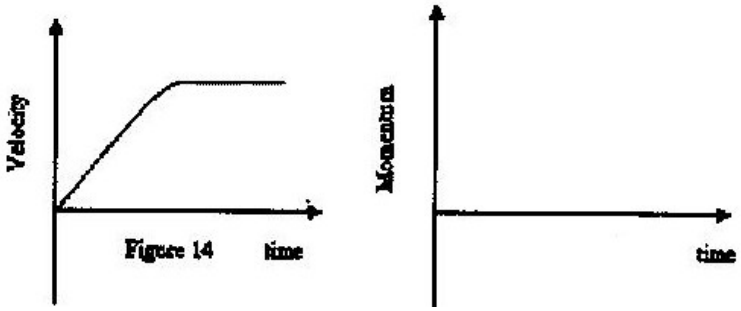
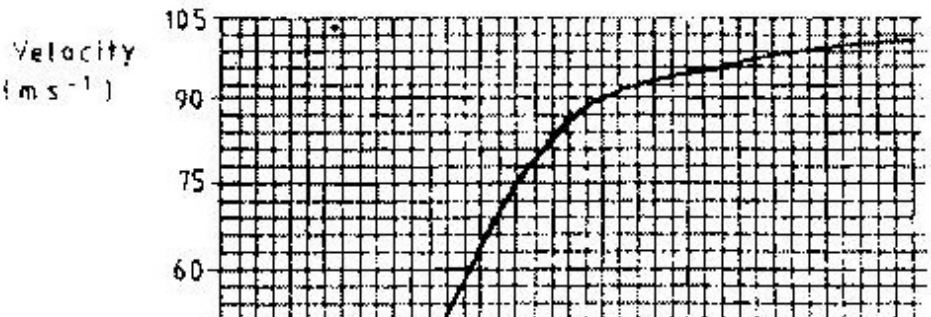


Figure 14

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.



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.

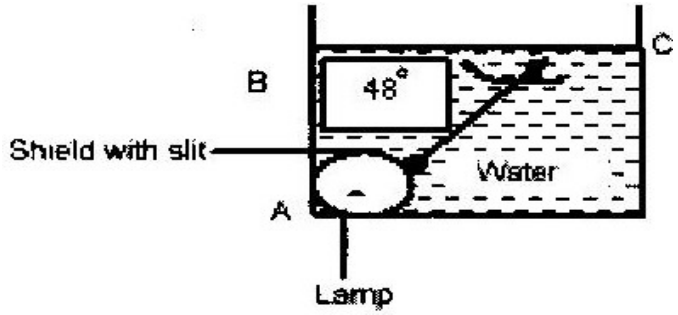
26. A stone is thrown horizontally from a building that is 50 m high above a horizontal ground. The stone hits the ground at a point, which is 65m from the foot of the building. Calculate the initial of the stone.

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



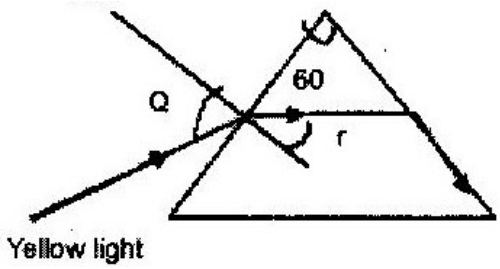
a) i) Determine the angle of refraction for the ray shown in the diagram.

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 x 10^8 ms^{-1})

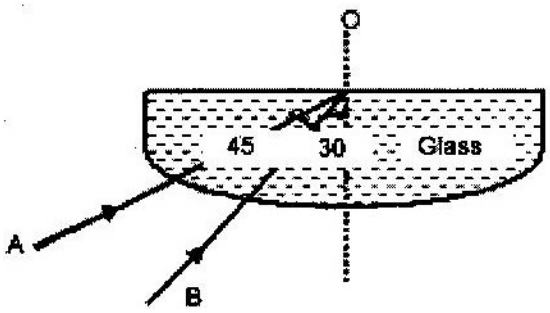
b) Show on the figure the critical angle C and determine the value.

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.

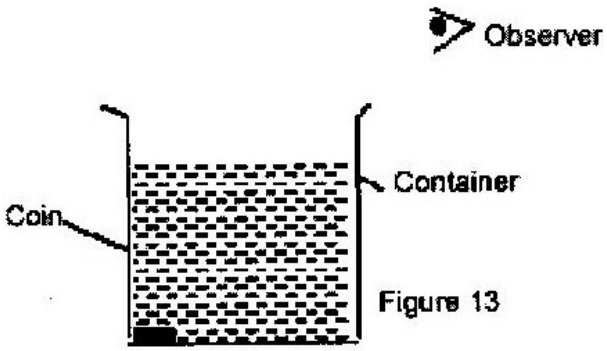


Figure 13

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.

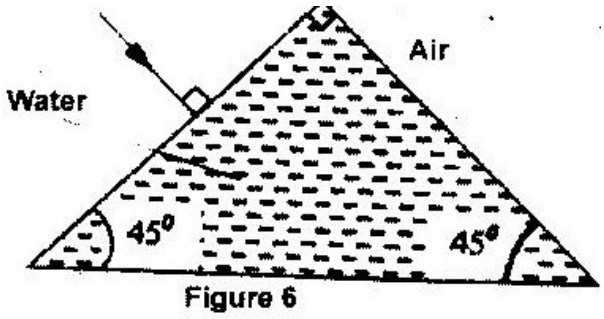


Figure 6

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

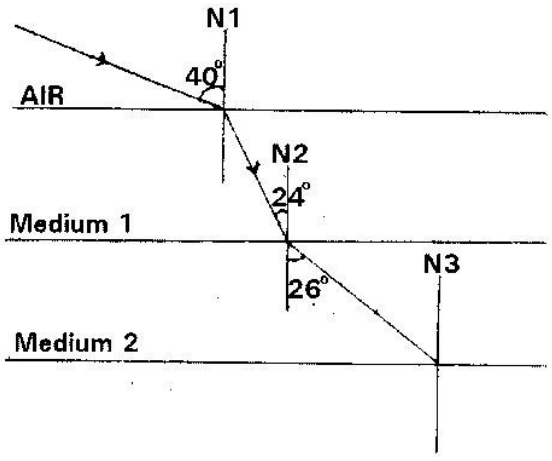
i) Plot a graph of the real depth (y-axis) against apparent depth.

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

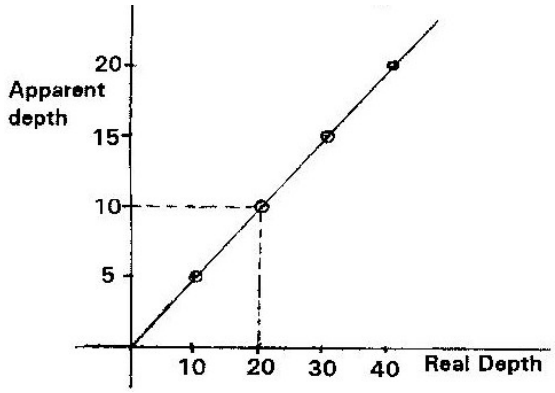
iii) The refractive index of medium 2 relative to medium ($_1n_2$)

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.

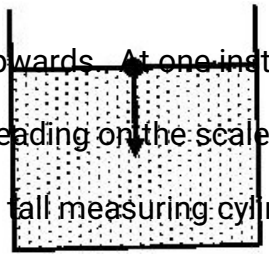
ii) Calculate the acceleration of the masses.

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.

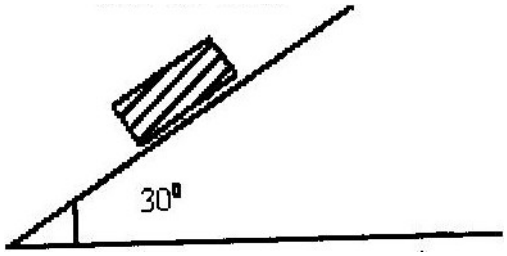
ii) A car of mass 800 kg is initially moving at 25 m/s. Calculate the force needed to bring the car to the rest over a distance of 20 m.

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.

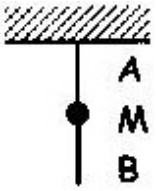
ii) Determine from the graph.

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.

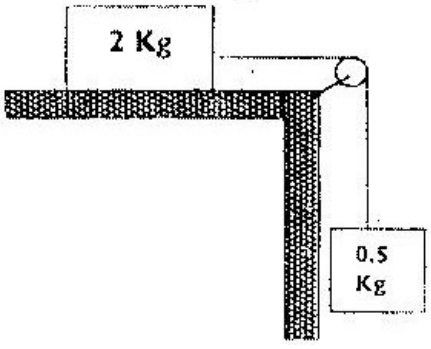
ii) The impulse of the force.

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.



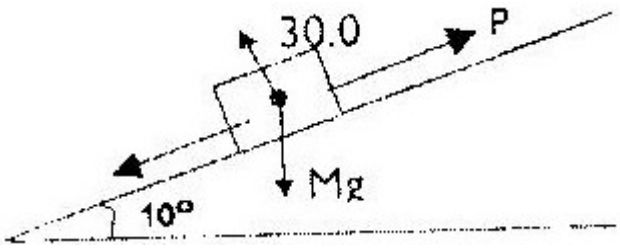
10. 1994: The fig. shows a 2 kg block attached to 0.5 kg mass by a light inextensible string which passes over a pulley. The force of friction between the horizontal bench and block is 3N. The block is released from rest so that both masses move through a distance of 0.6m. Calculate the velocity of the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

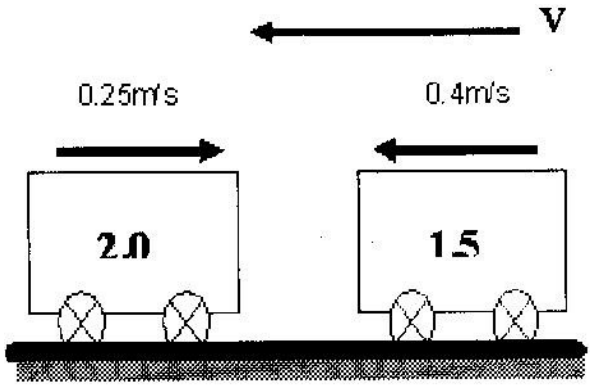
ii) Determine the acceleration of the block down slope.

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

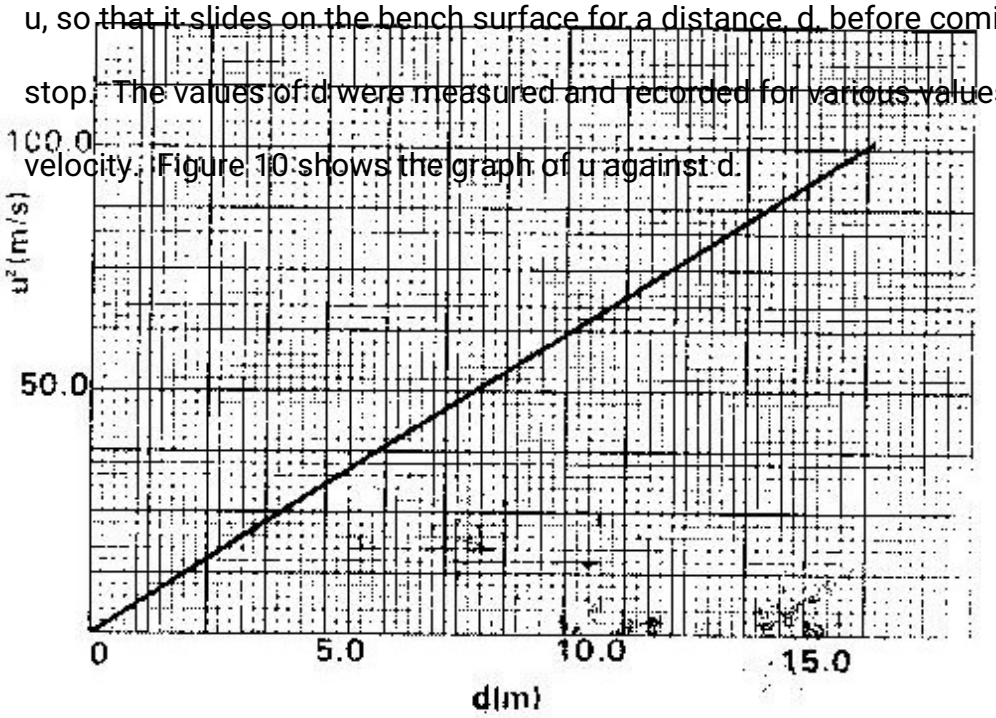
appropriately.

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.

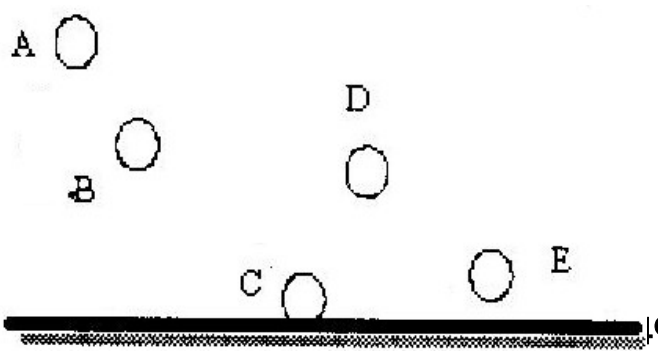
26. A helicopter of mass 3000 kg rises vertically at a constant speed of 25 ms^{-1} if the acceleration due to gravity is 10 ms^{-2}; determine the resultant force working on the helicopter.

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?

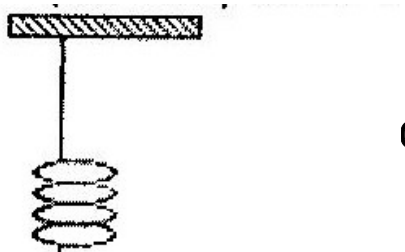
ii) If the pump is 40% efficient, what mass of this mixture is needed to raise the water? (1g of alcohol = 7000J, of petrol= 48000J)

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.

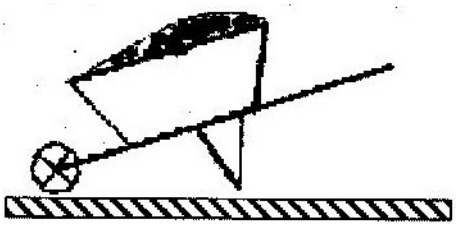
10. A body has 16 Joules of kinetic energy. What would be its kinetic energy

    if its velocity was double?

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

100%

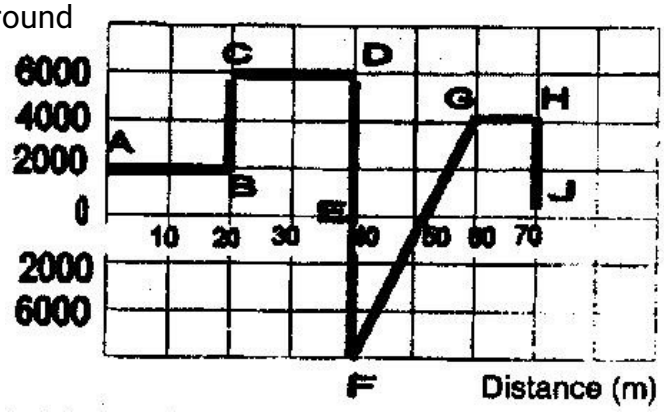
12. a) The fig shows a loaded wheelbarrow. Indicate and label on the diagram three forces acting on the wheelbarrow when a worker is just about to lift the handle.



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

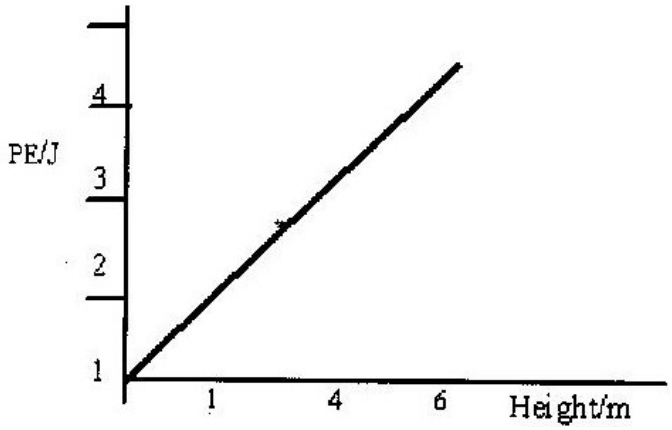


a) Calculate the total work done

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 3.0×10^5 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 6

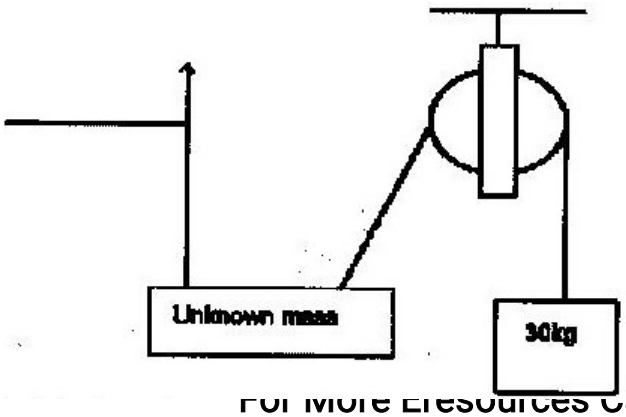
Given that the reading of the spring balance is 0.6N. Determine the weight of the bar.

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.

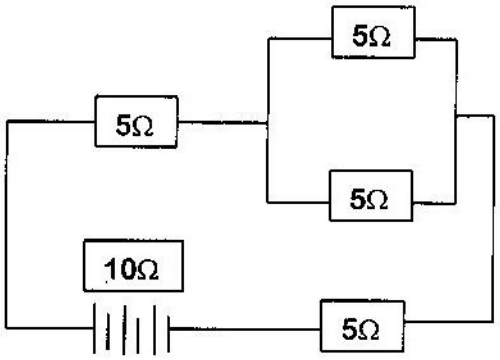
ii) Describe how you would use the circuit in (a) (i) above to determine the resistance per unit length of x.

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.

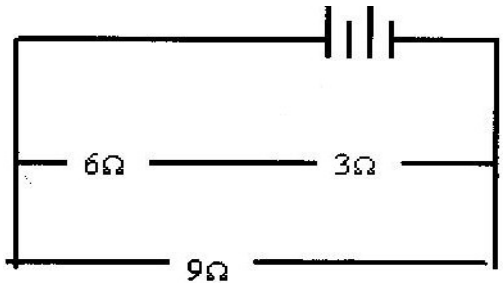


Calculate;-

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.



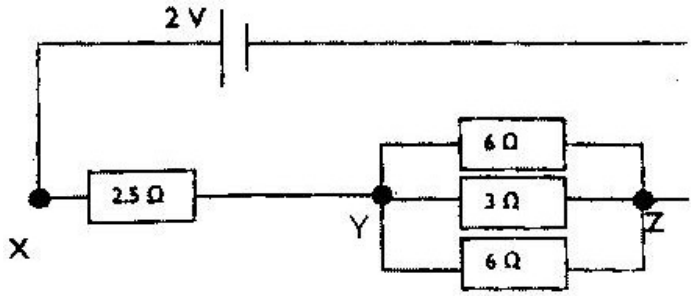
4. State two conditions that are necessary for a conductor to obey Ohm's law.
5. a) State Ohm's law.
   b) Describe with aid of a diagram an experiment to verify Ohm's law
   c) Two resistors R_1 and R_2 are connected in series to a 10V battery. The current flowing then is 0.5A. When R_1 only is connected 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.

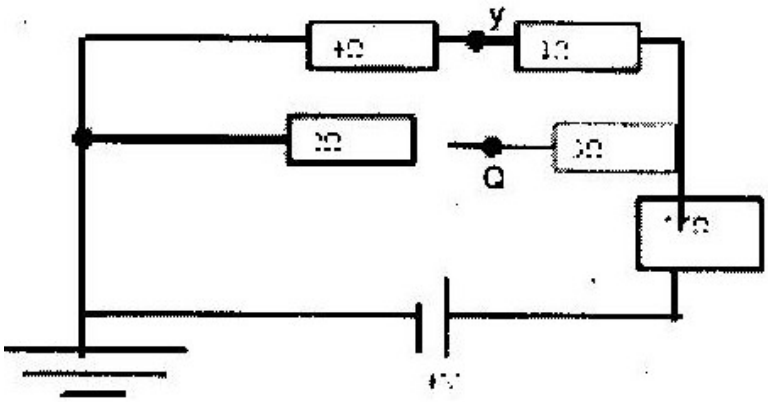
   d) Recharging is one of the practices of maintenance of accumulators. State two measurements, which need to be taken to help you decide when an accumulator is due for charging.
6. A current of 0.08A passes in circuit for 2.5 minutes. How much charge passes through a point in the circuit?
7. An ammeter, 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.

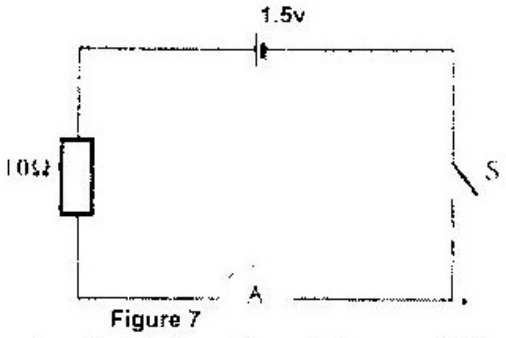


Figure 7

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.

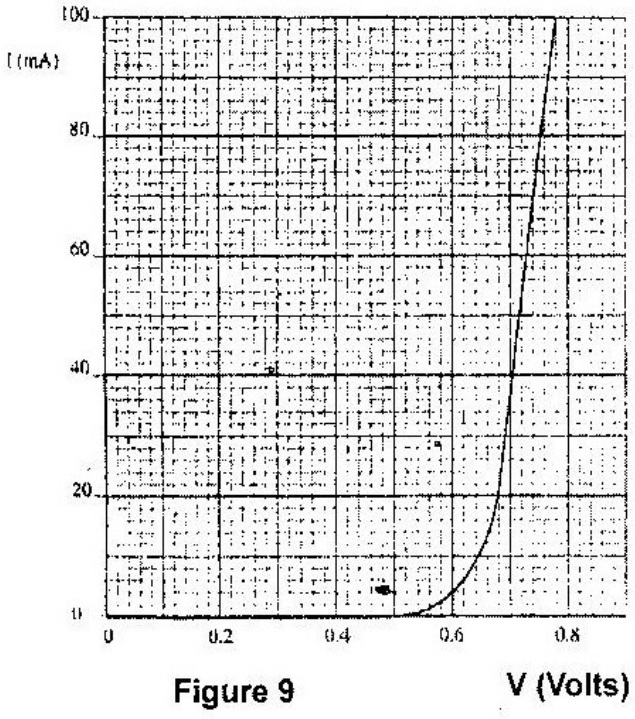
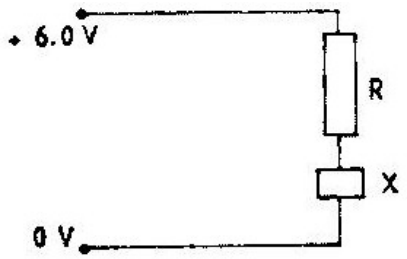


Figure 9

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.

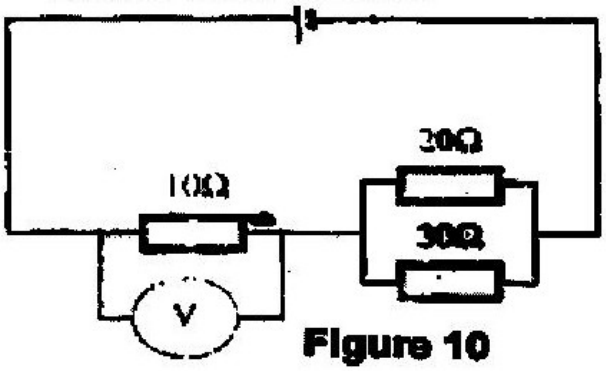


Figure 10

Determine the

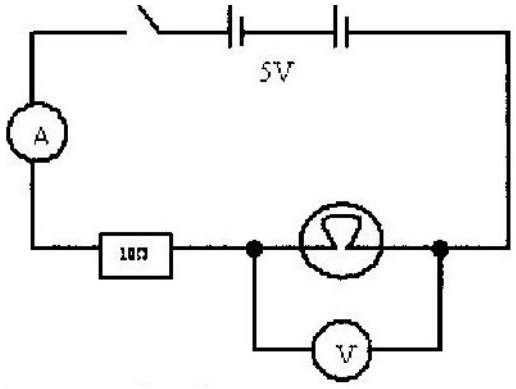
i) Total resistance in the circuit.

ii) Current in the circuit

iii) Reading on the voltmeter

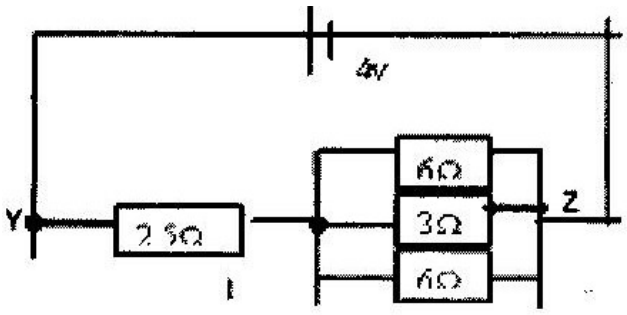
14. The diagram below shows an electrc circuit. When the switch is close the ammeter

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

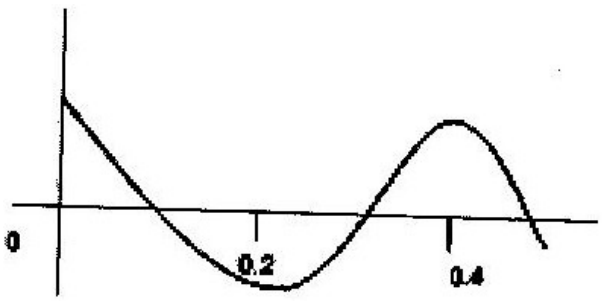
iii) Calculate the resistance of resistor x.

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 x 10^8 m/s).

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

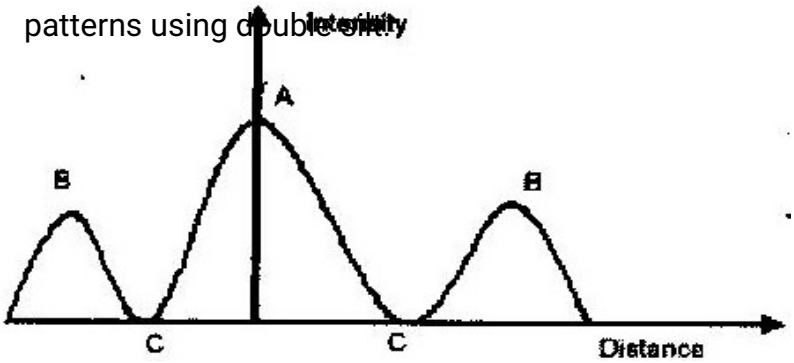
11. In an experiment using a ripple tank the frequency, f of the electric pulse generator was reduced to one third of its original value. How does the new wave length compare with the initial wavelength? Explain your answer.

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.



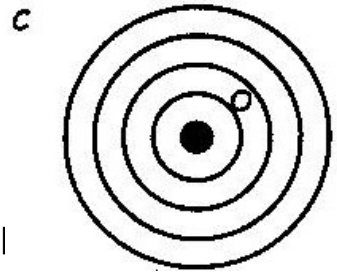
i) Sketch an experimental set up that may be used to obtain such a pattern.

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.

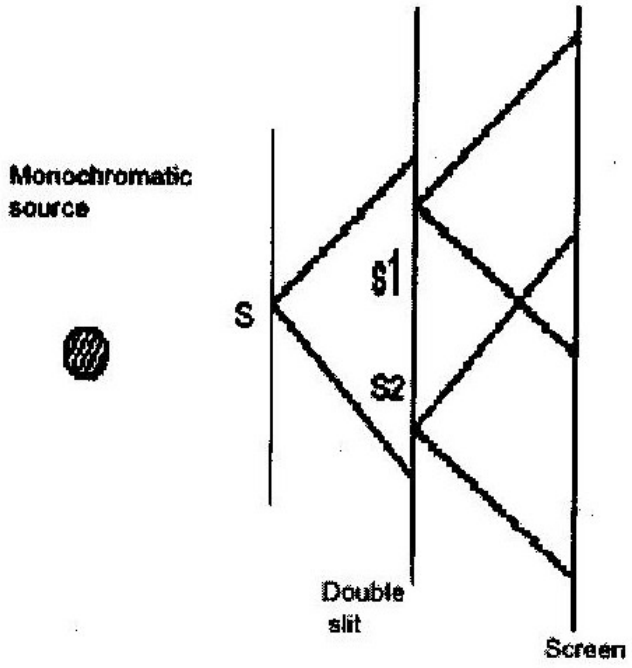
    iii) State what is observed on the screen when

        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:-

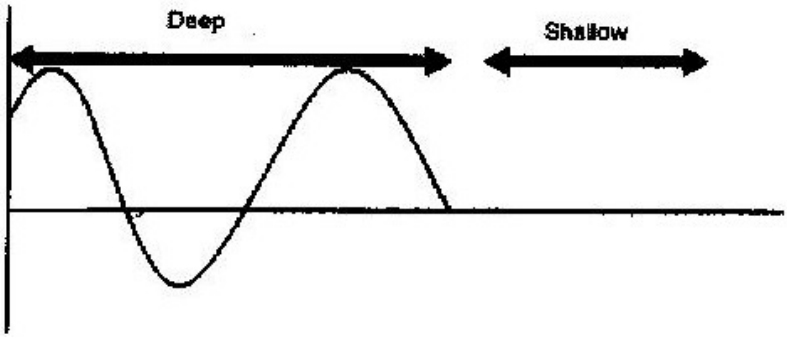


i) Monochromatic (ii) White light

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.

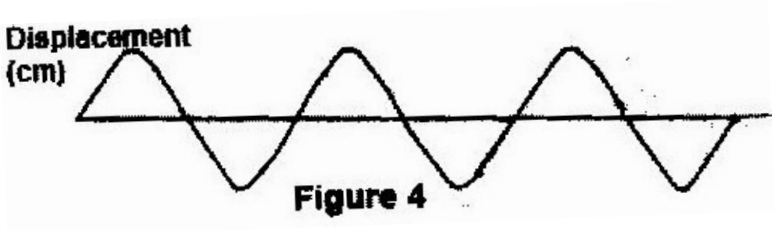


Figure 4

Determine the frequency of the wave. (3mks)

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

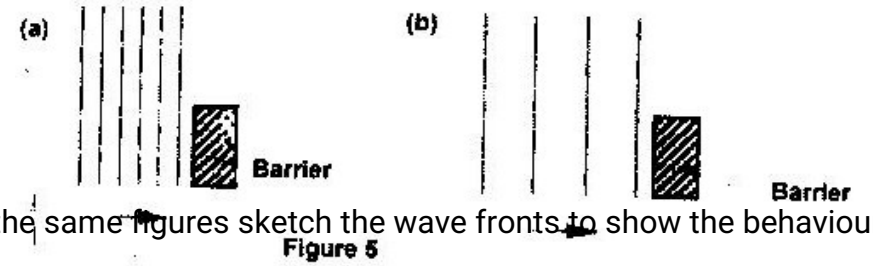


Figure 5

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)

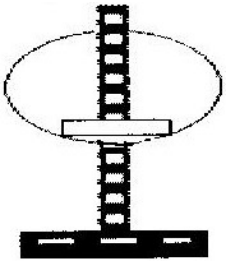
TOPIC 7

ELECTROSTATICS II

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

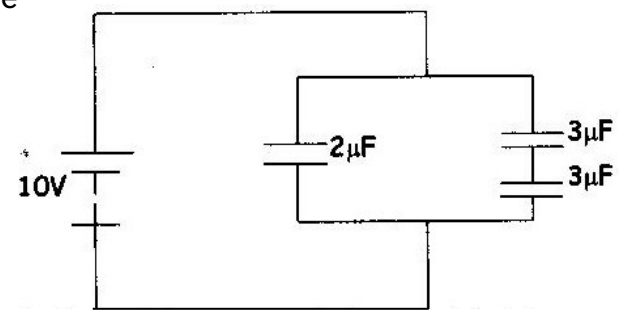
1. a) i) State coulombs law of electrostatics force.
   ii) Define capacitance.
   b) Describe how the type of charge on a charged metal rod can be determined.
   c) The fig. shows a hollow negatively charged sphere with metal disk attached to an insulator placed inside. State what would happen to the 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.

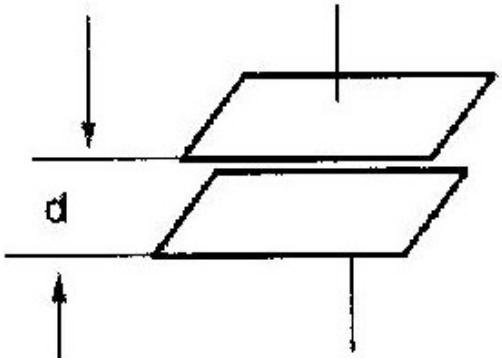
e) The fig. shows an arrangement of capacitors connected to a 10v. D.C supply determine·-



i) The charge stored in the 2μF capacitor

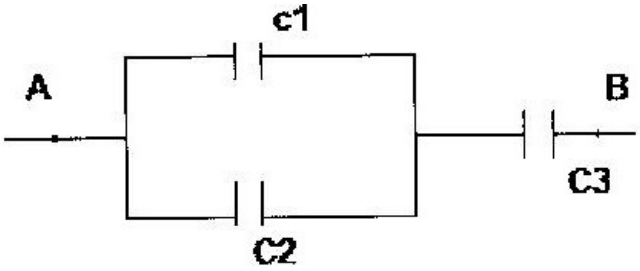
ii) The total capacitance of the arrangement

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.



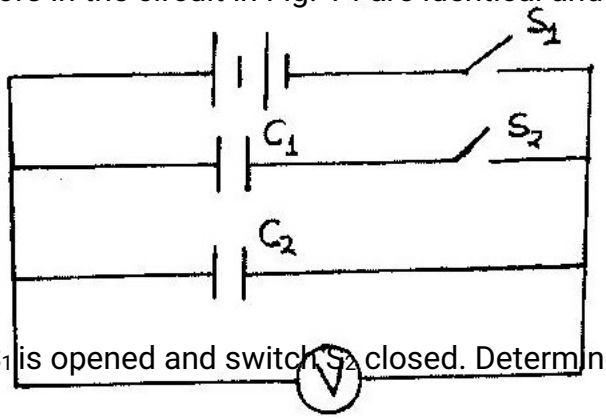
3. The Fig. Shows part of a circuit containing three capacitors. Write an expression for C_T.

   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.

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.

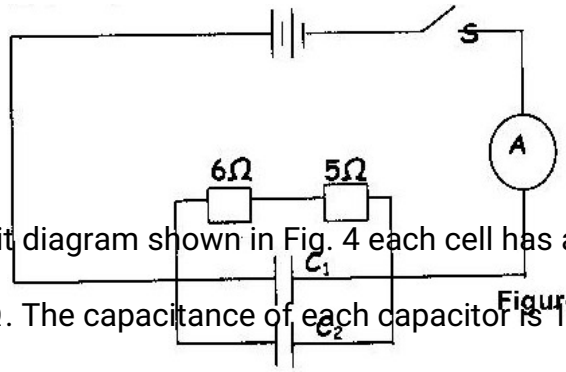


Figure 4

   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.

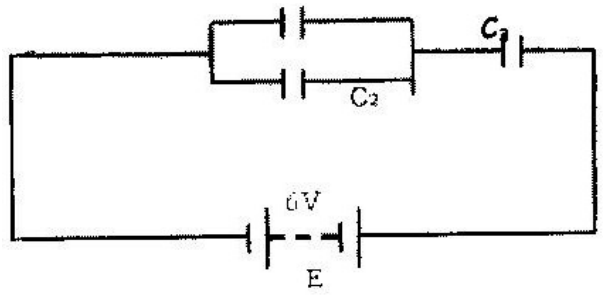
8 Three capacitors of 1.5μF, 2.0 μF and 3.0 μF are connected in series to p.d. of 12V. Find;-

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 -10^0c 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 0^0c 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

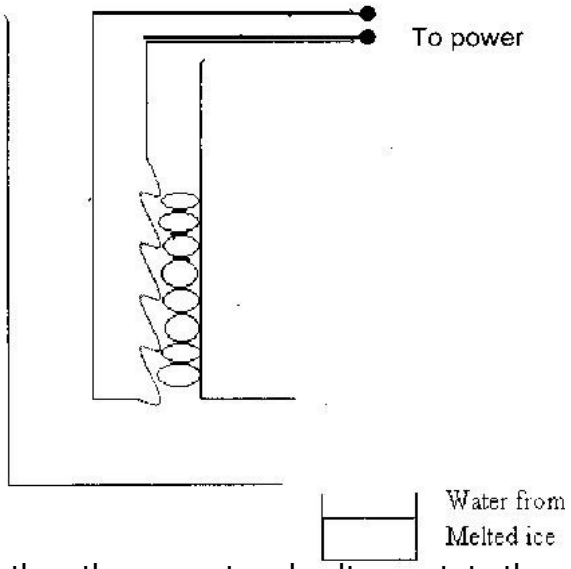
I. Write an expression for the heat given out by steam

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.

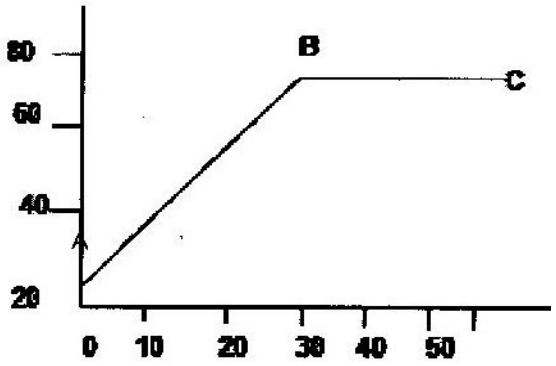


a) Other than the current and voltage, state the measurement that would be taken to determine the quantity of heat absorbed by the melted ice in unit time. (2mks)

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)

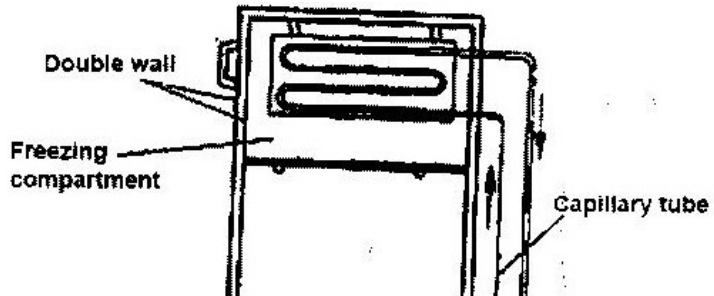
11State two factors that affect the melting point of ice. (2mks)

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.



(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 4.2×10^3J/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. 3.0×10^7J 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^{0}c. Determine the specific heat capacity of the liquid. (Assume no heat losses)

TOPIC 10

THE GAS LAW

PAST QUESTIONS ON THE TOPIC

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.

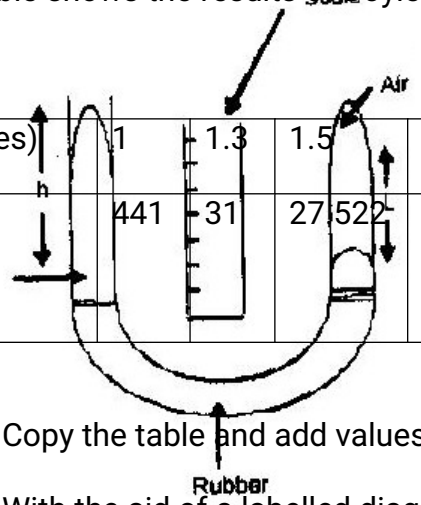
b) The pressure of helium gas of volume 10cm^3 decreases to one third of its original value at a constant temperature. Determine the final volume of the gas.

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.

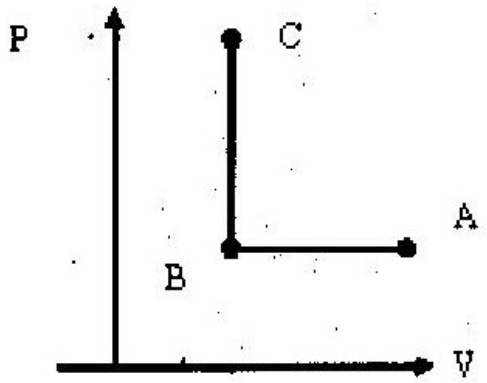
ii) Describe how to use the apparatus to verify the law.

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.

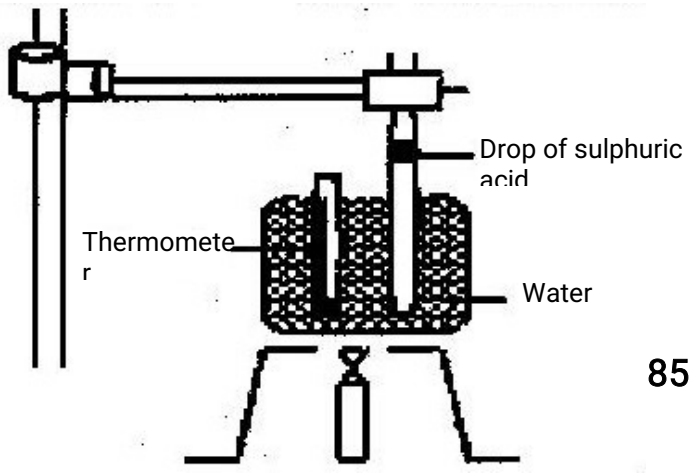
c) Show that the density of a fixed mass of gas is directly proportional to the pressure at constant temperature.

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.

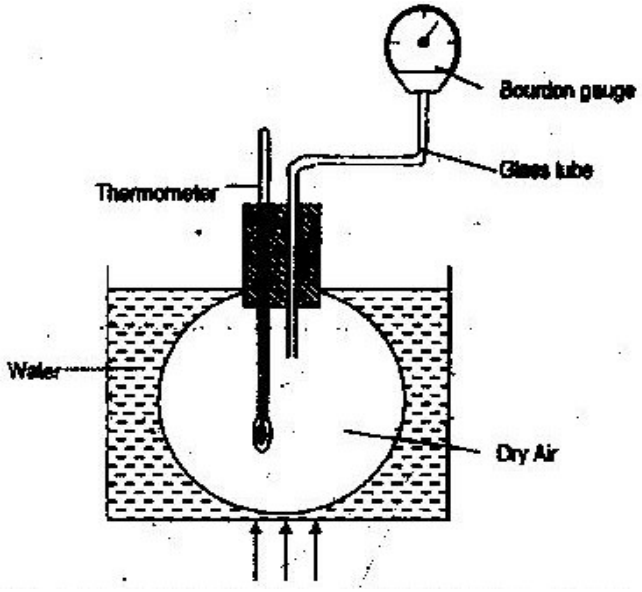
ii) State two limitations of the set up.

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.

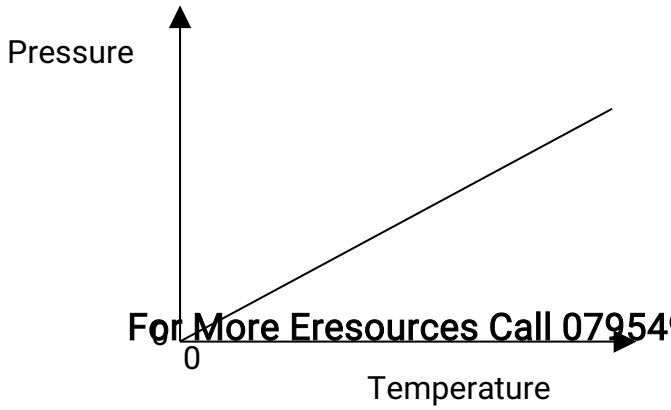
ii) Why would it be impossible for pressure of the gas to be reduced to zero in practice?

c) A gas is put into a container of fixed volume at a pressure of 2.1×10^5 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?

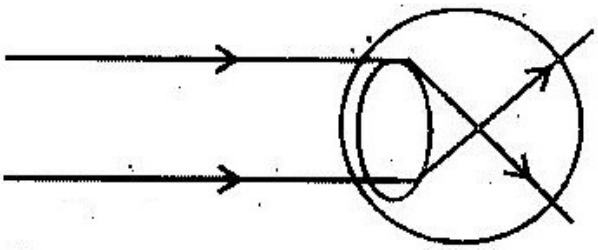
FORM FOUR WORK

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.

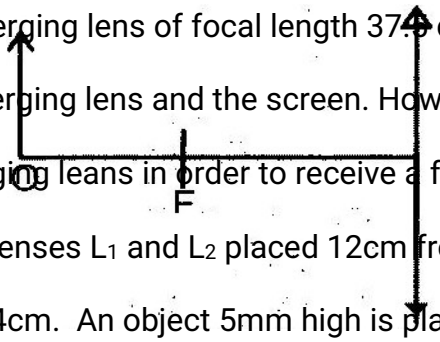
ii) Suggest suitable lens to correct the defect.

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.

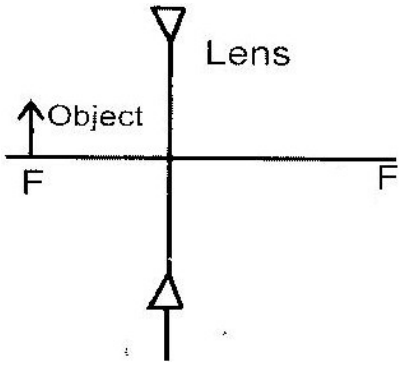
i) Construct a scaled ray diagram on a graph paper to obtain the position of the final image as would be observed by a person on the right hand side of L_2

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.

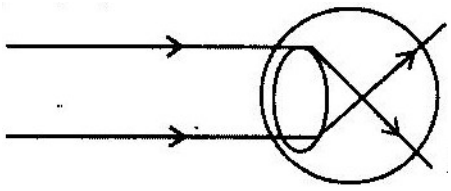


Sketch a ray diagram to show the image of the object. (3mks)

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.

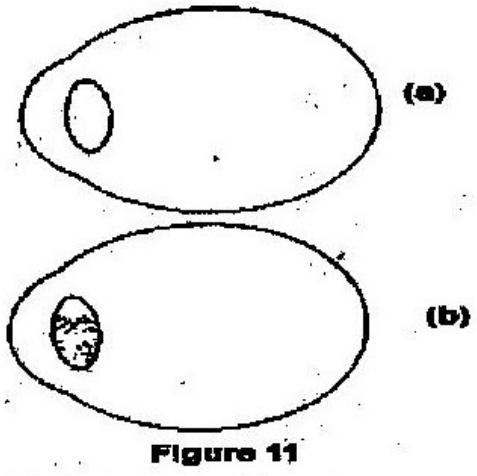


Figure 11

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.

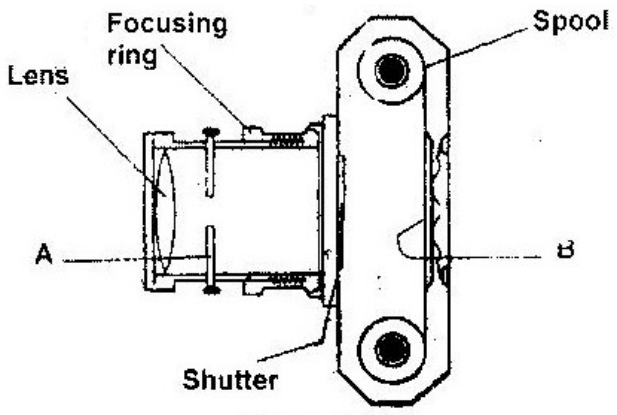


Figure 12

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

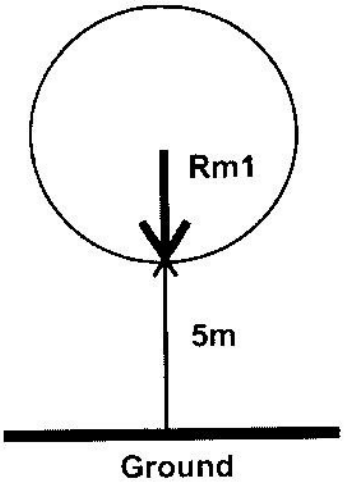
UNIFORM CIRCULAR MOTION

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.

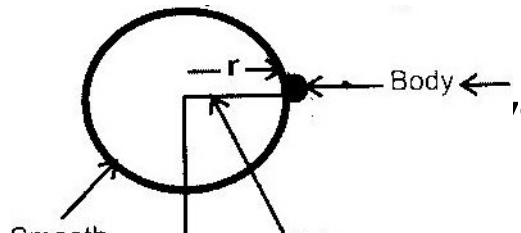
3. State the principle by which a speed governor limits the speed of a vehicle.

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).

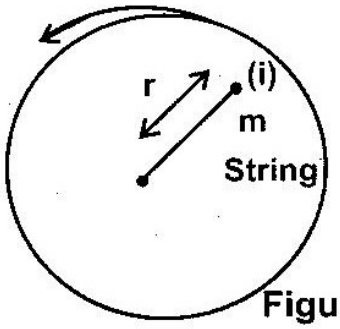


Figure 8

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

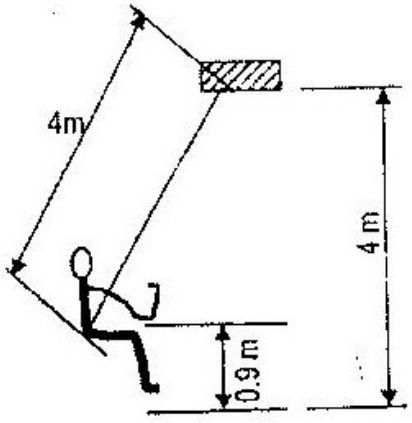
(5mks)

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.

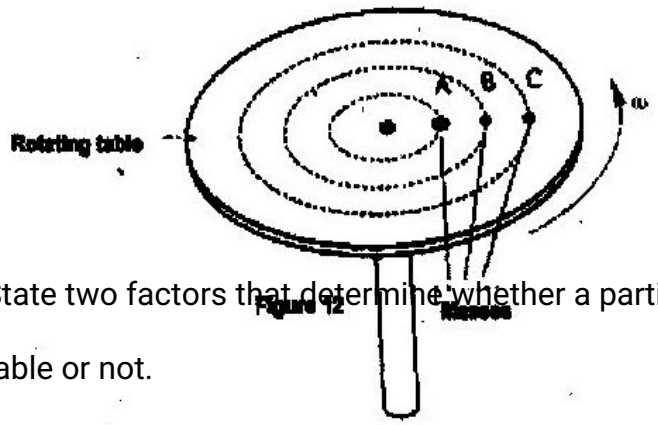


Figure 12

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,

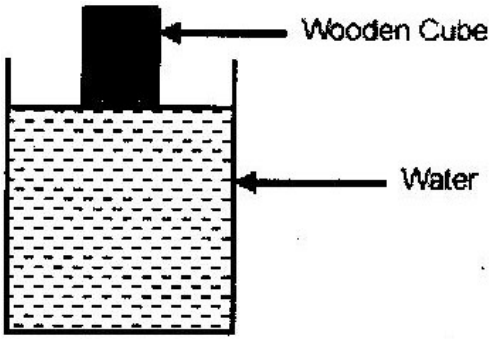
with a speed of 10m/s. What is the maximum tension in the string?

TOPIC 3

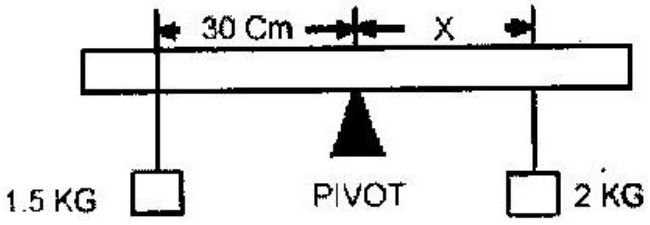
FLOATING AND SINKING

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 x 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.

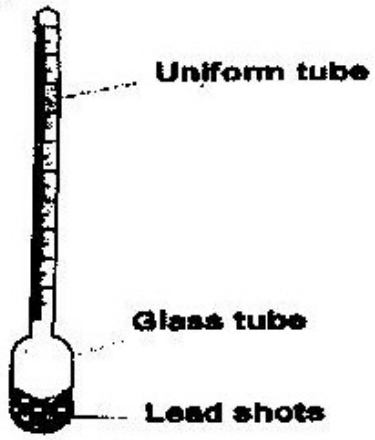


Figure 13

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

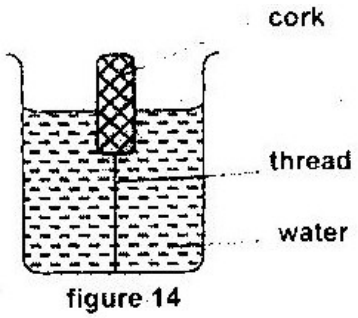
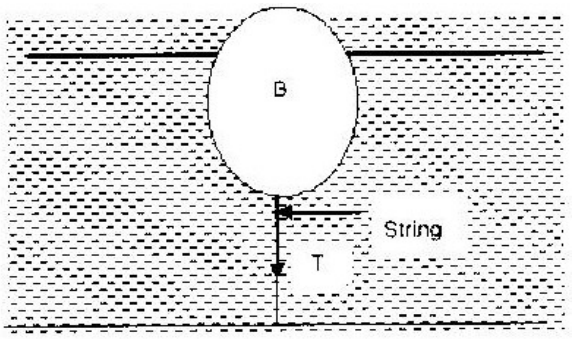


figure 14

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

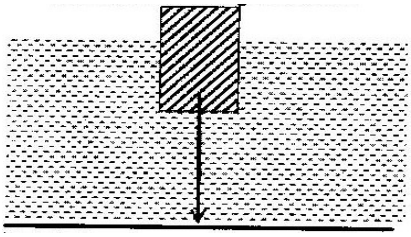
ii) Describe how each of the forces mentioned in (i) above changes when water is added into the beaker until it fills up. (3mks)

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 9.0×10^{-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.

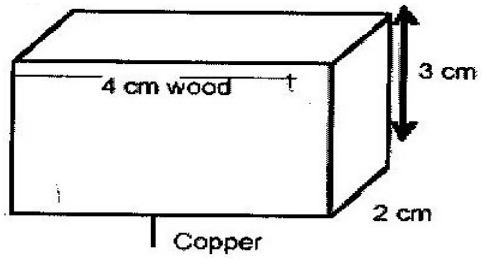
b) Volume of water displaced.

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

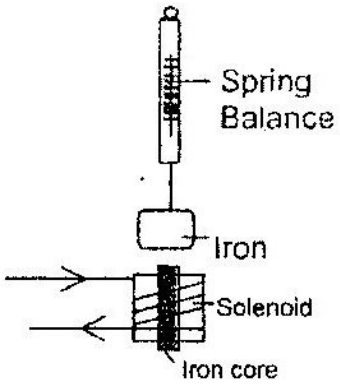
    ii) Infrared

TOPIC 5

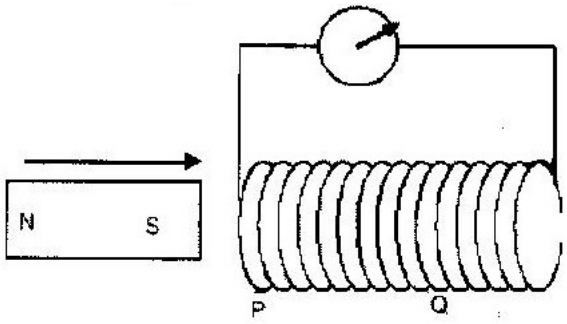
ELECTROMAGNETIC INDUCTION (EM I)

PAST KCSE QUESTIONS ON THE TOPIC

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.



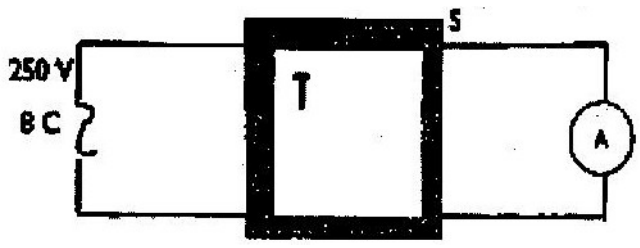
2 a) The free ends of a coil are connected to a galvanometer. When the north pole of a magnet is moved towards the coil, the pointer deflects towards the coil, the pointer deflects towards the right as shown. State with reason the behaviour of the pointer in the following cases.



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

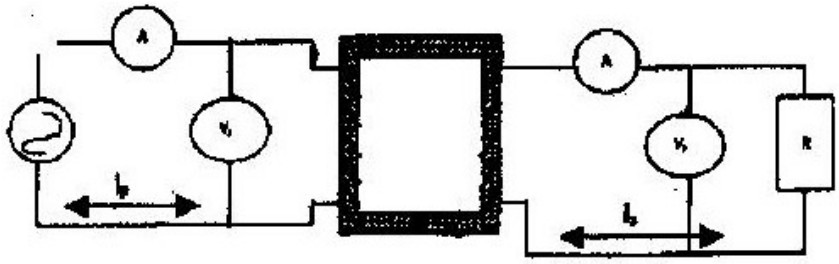
ii) The south pole of the magnet is made to approach the coil from Q.

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.

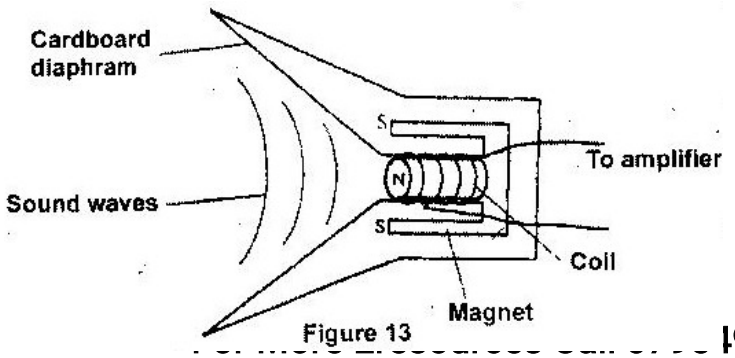


Figure 13

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

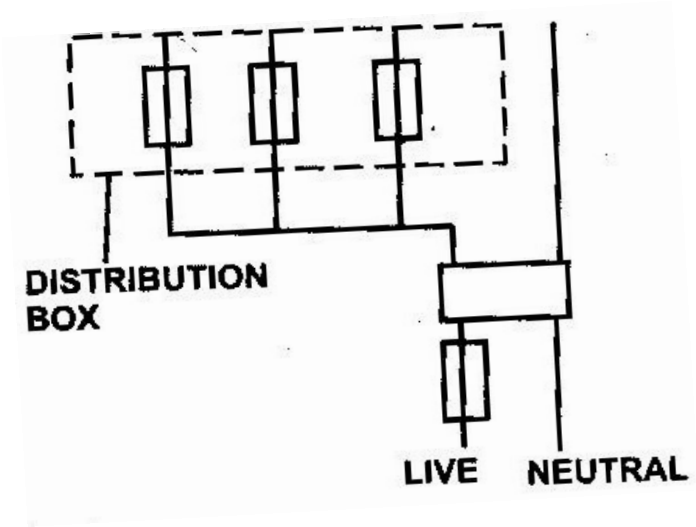
MAIN ELECTRICITY

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.

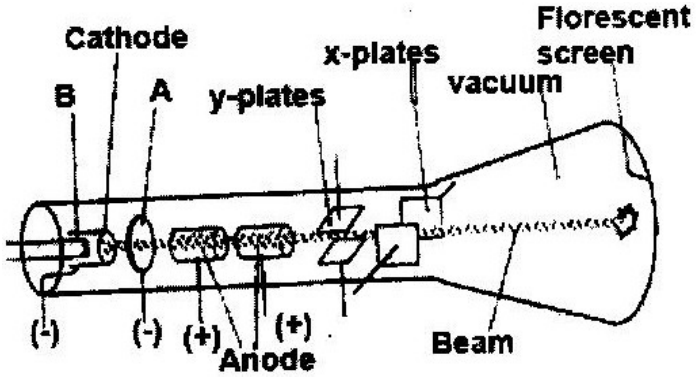
14. An electric iron box is rated 2500W and uses a voltage of 240V. Given that electricity costs Kshs. 1.10 per Kwh, what is the cost of using it for 6 hours?

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.

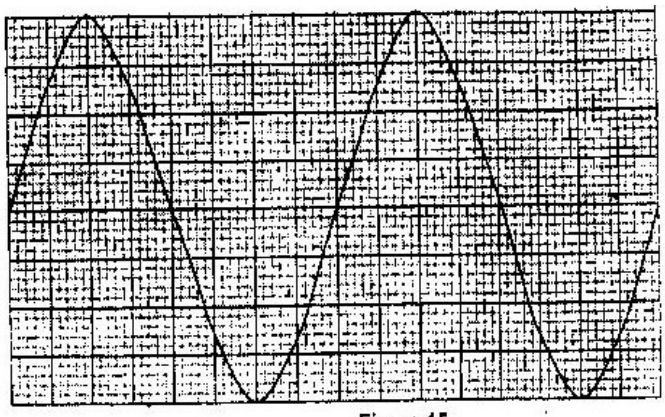


Figure 15

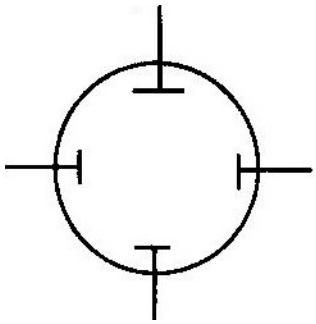
i) Determine the pick voltage of the generator. (2mks)

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)

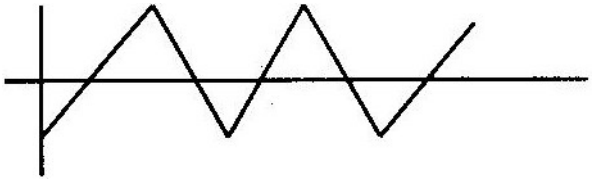
7. Sketch the picture seen on the screen of a cathode ray oscilloscope when the oscilloscope is adjusted so that the spot is in the middle of the screen and the output terminals from a transformer connected to the mains are connected across the Y-plates.
8. The diagram shows the screen of a cathode ray 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.

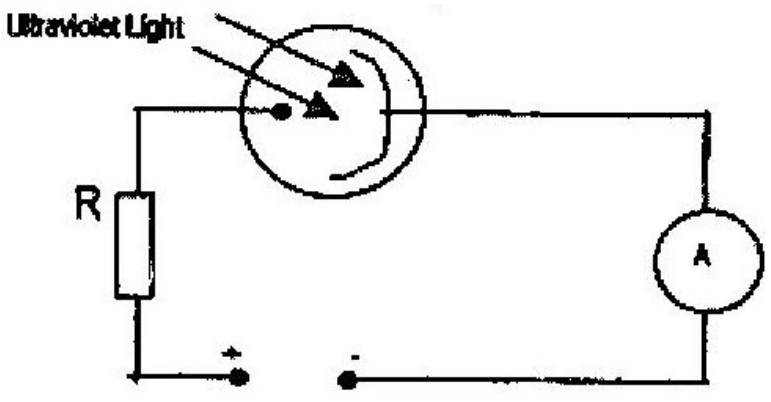
9. If accelerating voltage in an X-ray tube is 40kV, determine the minimum wavelength of the emitted X-rays. (Electronic charge = -1.6 x $10^{-}19$C, planks constant = 6.6 x 10^{-34}Js, velocity of electromagnetic waves = 3.0 x $10^{8}ms^{-1}$)
10. State the purpose of cooling fins in the X-ray tube.
11. X-rays are produced by a tube operating at 1 x 104V. Calculate their wavelength. (Take h= 6.6 x 10^{-34} Js, e= 1.6 x 10^{-19}C, c= 3x$10^{8}ms^{-1}$)
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.

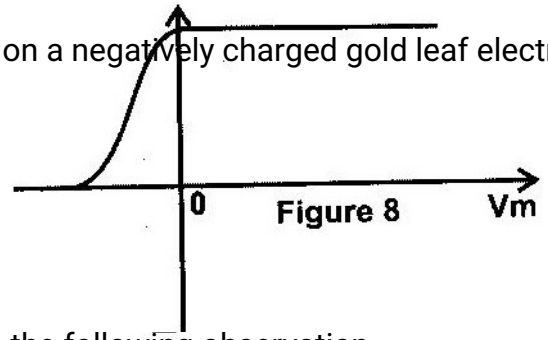


Figure 8

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) = 1.6×10^{-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.

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 x 10^{-19}C and h= 6.63 x 10^{-19}C and Me = 9x 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.

222

   iii) Radon gas Rn decays by emission of $\propto$ particles. Show

86

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 $^{86}_{u}$ contain?

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 $\propto$ 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.

$$^{14}_{C} = ^{X}_{N} + ^{u}_{B}$$

6 7 y

8. Alpha particles are more ionizing than Beta particles. Give one reason for this.

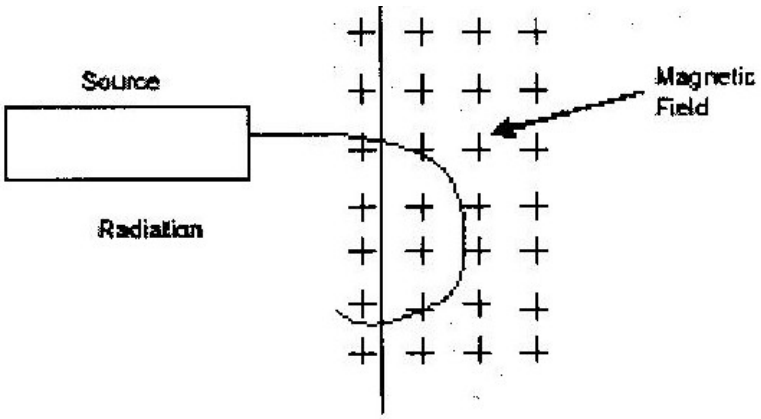
9. In a sample there are 5.12×10^{20} atoms of Krypton 92 initially. If the half-life of Krypton is 3.0s, determine the number of atoms that will have decayed after 6s

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.

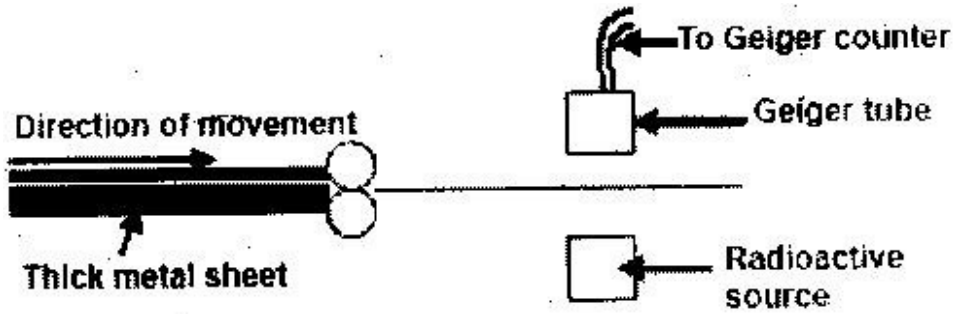
b) Below is a nuclear reaction

$$^{232}_{90}A \longrightarrow {}^{228}_{88}K + {}^{Y}_{x}B + {}^{Y}_{x}C + (\text{gamma})$$

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.

$$^{234}_{83}Bi \xrightarrow{\beta} {}^{a}_{84}X \longrightarrow {}^{230}_{b}Y$$

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 $^{234}_{90}U$

Type or radiation

Reason

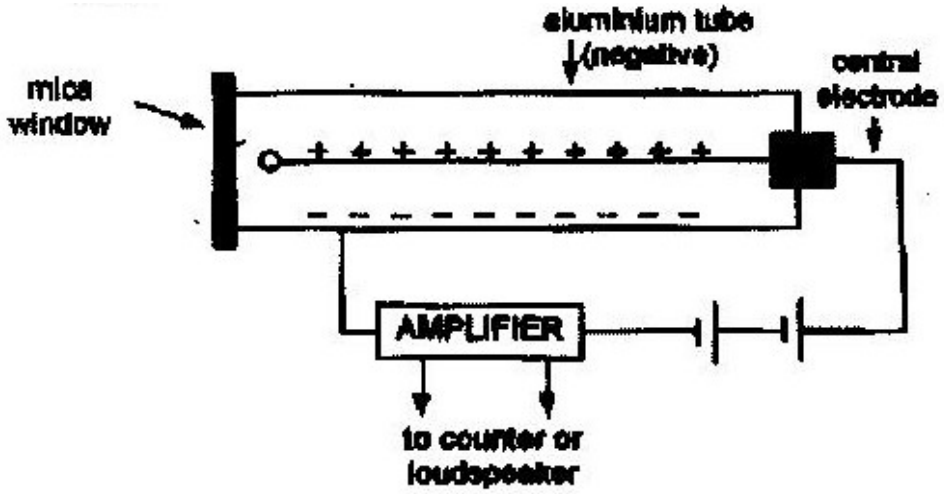
(iii) The radiation is very strongly deflected by a weak magnetic field.

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.

$$^{24}_{11}Na \rightarrow {}^{0}_{-1}y + {}^{e}$$

18. Given that 5g of cobalt-60 is kept in a laboratory and it has a half-life of 5 years.

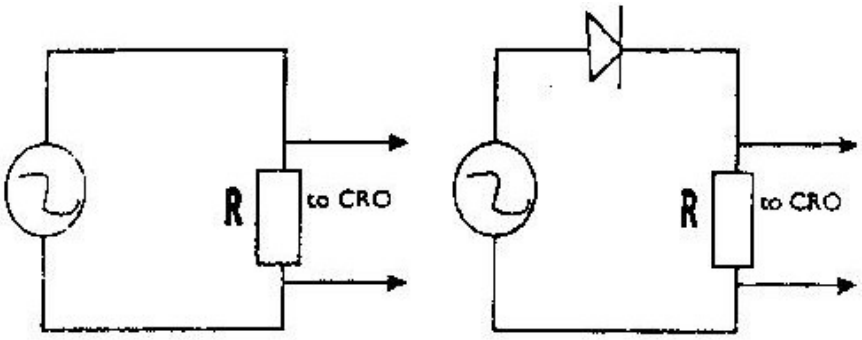
Calculate its mass after 15 years.

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

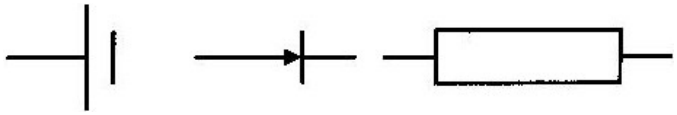


2. State the majority carriers for a p-type semi conductor.
3. a) Using examples explain the difference between a semiconductor and a good conductor.

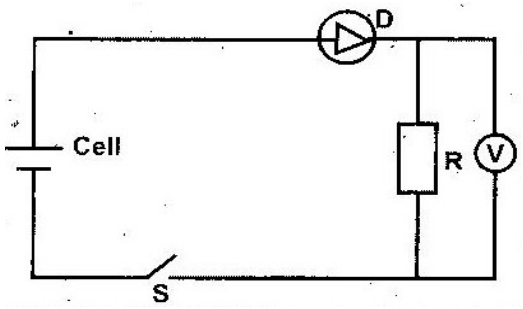
   b) A radio repairer wishes to use an ammeter to detect a faulty diode. With the aid of a circuit diagram describe how he will go about this task.
4. Using examples, explain the difference between a semi conductor and a

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.



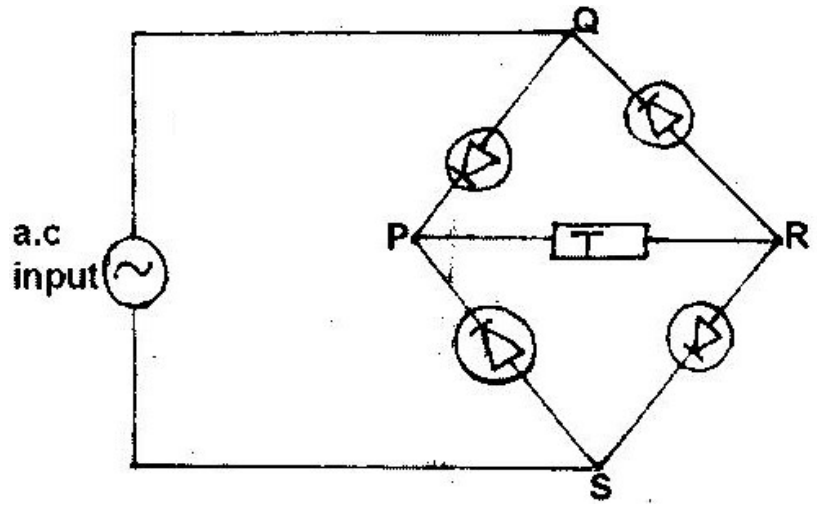
8. (a)
   i) Distinguish between semiconductors and conductors
   ii) Give an example of a semiconductor and one for a conductor.
9. In the circuit below, when the switch s is closed, the voltmeter shows a reading.



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.

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