**NAME……ADM NO……...CLASS..…**

**232/1** **Candidate's Signature…..…….**
**Physics**
**Paper 1** **Date……**
**March /April 2015**
2 hours

MOKASA JOINT EXAMINATION
Kenya Certificate of Secondary Education
PHYSICS
Paper 1
2 hours

# MARKING SCHEME

**INSTRUCTIONS TO CANDIDATES**

*Write your **name, admission number** and **class** in the spaces provided above.*

***Sign and write the date** of examination in the spaces provided above.*

*This paper consists of **TWO** sections: **A** and **B**.*

*Answer **ALL** the questions in sections **A** and **B** in the spaces provided.*

***ALL** working **MUST** be clearly shown.*

*Non-programmable silent electronic calculators and KNEC mathematical tables may be used.*

***Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing**.*

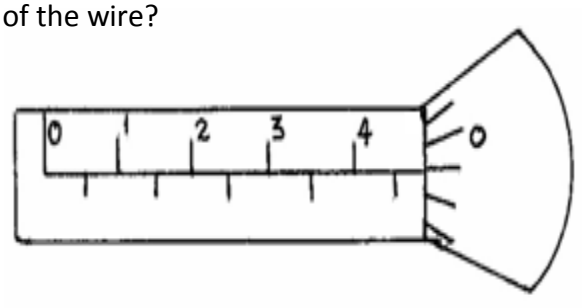
**For Examiner's Use Only**

| Section | Question | Maximum Score | Candidate's Score |
|---|---|---|---|
| **A** | **1 – 8** | **25** | |
| **B** | **9** | **09** | |
| | **10** | **12** | |
| | **11** | **10** | |
| | **12** | **10** | |
| | **13** | **07** | |
| | **14** | **07** | |
| | **Total Score** | **80** | |

## SECTION A (25 MARKS)

***Answer all questions in this section in the spaces provided:***

1. The diagram **below** shows a micrometer screw gauge used by a student to measure the thickness of a wire. If it has a zero error of 0.06mm, what is the actual thickness of the wire? (2mks)




***=4.99-0.06***

***=4.93mm***

2. (a). State two differences between heat transfer by convection and radiation ***(2mks)***

- ***Convection requires a medium ,radiation does not***
- ***Convection is by actual movement of particles while radiation is by electromagnetic waves***

(b). Give a reason why a thick glass bottle cracks when boiling hot water is suddenly poured inside it (1mk)

***Uneven expansion***

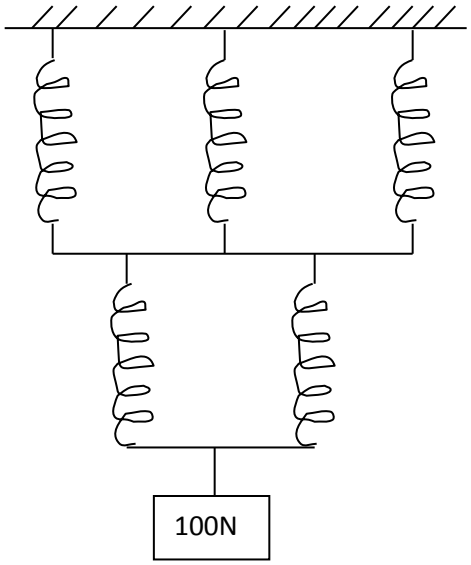
3. An aircraft 300m from the ground, travelling horizontally at 400 m/s releases a parcel. Calculate the horizontal distance covered by the parcel from the point of release. (Ignore air resistance) (2mks)

***$300= 0.5gt^2$***

***t= 7.746sec***

***R=ut = 400×7.746= 3098.4m***

4. A single spring stretches by 2.0 cm when supporting a load of 50N. If in the system below the springs are identical and have negligible weight;




Find:

a) The total extension of the system. (2mks)

***=2+1.33=3.333cm***

b)The total spring constant. (2mks)

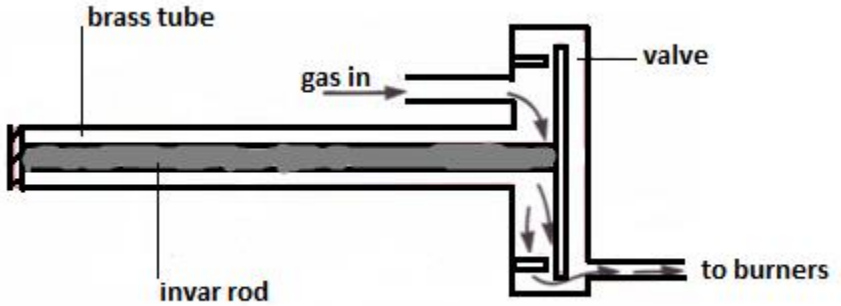
$$= \frac{total\ load}{total\ extension} = \frac{100}{3.3333} = 30.0003N/cm$$

5. (a) The distance between the ice point and steam point on a liquid in glass thermometer is 30cm. what temperature is recorded when the mercury thread is 12cm above the ice point? (2mks)

$$\frac{30}{100} = \frac{12}{x}$$

$$X = 40^0$$

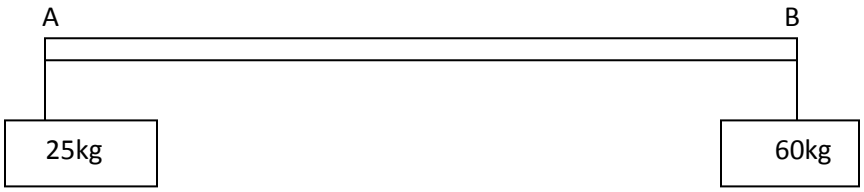
b) The diagram below shows a gas cooker thermostat




Briefly explain how the thermostat works (3mks)

***A temperature increase causes the brass tube to expand and move to the left. The invar rod also moves with it and causes the valve to partially close. This reduces the gas inflow. A decrease in temperature causes the brass tube to contract and move the valve forward. The movement opens the entrance and increases the flow of gas to the burners***

6. The figure below shows a uniform plank AB of length 10m weighing 500N. Two masses measuring 25kg and 60kg are loaded on its ends.




Determine the distance from point A where a support should be placed for the plank to balance horizontally. (3mks)

***250y+100(y-5)= 600(10-y)*** ***600y+350y = 6000+500***

***250y+ 100y- 500= 6000-600y*** ***Y= 6.842m***

7. In an experiment to determine the thickness of an oil molecule, an oil drop of volume $3.60 \times 10^{-6}$ $m^3$ was observed to form a circular patch of diameter 0.016m on the surface of water covered with lycopodium powder

i). Explain why the oil drop forms a circular patch. (1mks)

***Oil lowers the surface tension of water, in attempt of water molecules trying to make their surface as small as possible***

***Or***

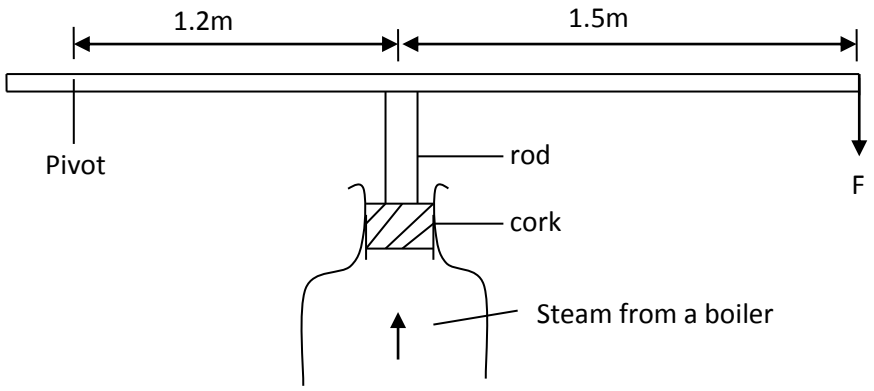
***Oil spread uniformly because it breaks the surface tension of water whose particles pull away from the oil***

ii) Determine the thickness of the oil molecule (2mks)

$$3.60 \times 10^{-6} = \pi \times \frac{0.016^2}{4} t$$

$$t = 5.625 \times 10^{-2} m$$

8. A cork enclosing steam in a boiler is held down by the system shown.




If the area of the cork is 15 $cm^2$ and a force (F) of 500N is needed to keep the cork in place, determine the pressure of the steam in the boiler. (3mks)

$$1.2F = 2.7 \times 500$$

$$F = \frac{2.7 \times 500}{1.2} = 1125$$

$$P = \frac{F}{A} = \frac{1125}{15 \times 10^{-4}} = \frac{1125 \times 10^4}{15} = 750{,}000 N/M^2$$

## SECTION B

***Answer all questions in this section in the spaces provided:***

9. (a) An electric crane lifts a load of 2000kg through a vertical distance of 3.0m in 6s.

Determine:

i) Work done (1mk)

***W=mgh=2000×10×3=60,000 J***

ii) Power developed by the crane (2mks)

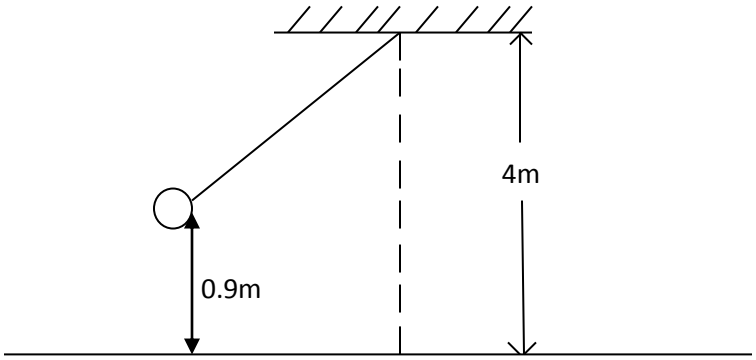
$P=W/t=\frac{60,000}{6}$ ***=10,000W***

iii) Efficiency of the crane if it is operated by an electric motor rated 12.5 Kw (2mks)

$=\frac{Power\ output}{power\ input}$***×100***

$=\frac{10}{12.5}$***×100=80%***

b) A bob of mass 20kg is suspended using a string of 4m from a support and swings through a vertical height of 0.9m as shown below:




Determine:

i) The potential energy of the body at its position. (2mks)

***p.e=mgh***

***=20×10×0.9=180J***

ii) Speed of the body when passing through the lowest point. (2mks)

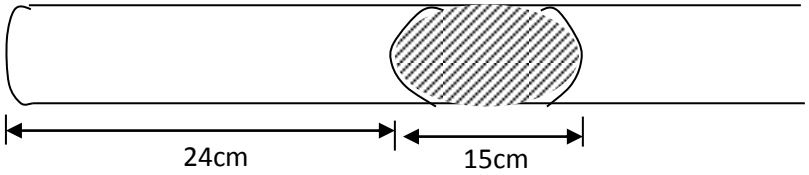
***k.e gained= p.e lost***

$\frac{1}{2}mv^2=mgh$

$v^2=\sqrt{2gh}=\sqrt{2\times10\times0.9}$

***=4.24m/s***

10. (a) A glass capillary contains enclosed air by a thread of mercury 15cm long when the tube is horizontal, the length of the enclosed air column 24cm as shown.




i) What is the length of the enclosed air column when the tube is vertical with the open end uppermost if the atmosphere pressure is 750mmHg? (2mks)

***$P_1V_1=P_2V_2$***

***$24\times750=(750+15)V_2$***

***$V_2=\frac{24\times75o}{765}$ =23.53cm***

ii) Explain why the mercury does not run out when the tube is vertical with the closed end uppermost. (1mk)

***The mercury does not run out because the upwards atmospheric pressure in the mercury column is greater than the downward pressure due to the enclosed air and its own mass.***

b) Explain why an air bubble increase in volume as it rises from the bottom of a lake to the surface. (1mk)

***At the bottom of the lake, the bubble is under the pressure of water column + the atmospheric pressure on the surface of water. As the bottle rises the depth of the water column decreases as so does the pressure decreases in pressure results in increase in where since PV=a constant (Boyle's law)***

c) When an inflated balloon is placed in a refrigerator it is noted that its volume reduces, use the kinetic theory of gases to explain this observation. (2mks)

***Low temperature reduces the kinetic energy of molecules which lead to lower rate of collision which results to reduction of pressure.***

d) A certain mass of hydrogen gas occupies a volume of $1.6m^3$ at a pressure of $1.5 \times 10^5$ Pa and a temperature of $22^0$c. Determine the volume when the temperature is $0^0$c at a pressure of $0.8\times10^5$ Pa. (3mks)

$$\frac{P1V1}{T1}=\frac{P2V2}{T2}$$

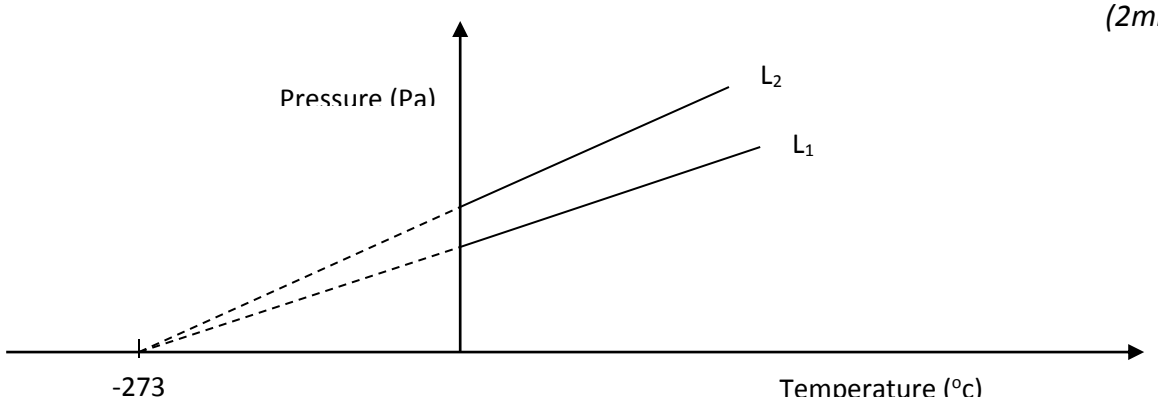
$$\frac{1.5\times10^5\times1.6}{295}=\frac{0.8\times10^5\times V2}{273}$$

**$V_2$= 2.776cm$^3$**

e) i)State the pressure law (1mk)

***Pressure of a fixed mass of a gas is directly proportional to its absolute temperature provided volume is kept constant***

ii)On the axis provided, sketch a graph of pressure against temperature on the celcius scale. On the same axis sketch another graph for a gas of a larger volume. *(2mks)*




11 (a) in a hydraulic press, a force of 200N is applied to a master piston of area 25cm$^2$. If the press is designed to produce a force of 5000N, determine the area of the slave piston. (2mks)

$\frac{F1}{A2}$ = $\frac{F2}{A2} = \frac{200}{25} = \frac{5000}{x}$ = **625cm$^2$**

(b) The barometric height in a town is 70cmHg. Given that the standard atmospheric pressure is 76cmHg and the density of mercury is 13600kg/m$^3$, determine the altitude of the town. (density of air is 1.25kg/m$^3$) (3mks)

$$h_a=\frac{0.06\times13600\times10}{1.25\times10} = 652.8m$$

(c) In an experiment to determine atmospheric pressure, a plastic bottle is partially filled with hot water and the bottle is then tightly corked. After some time the bottle starts to get deformed.

(i) State the purpose of the hot water. (1mk)

***Expel air***

(ii) State the reason why the bottle gets deformed. (2mks)

***Pressure imbalance on the inside and outside causes the higher atmospheric pressure on the outside to act on the bottle***

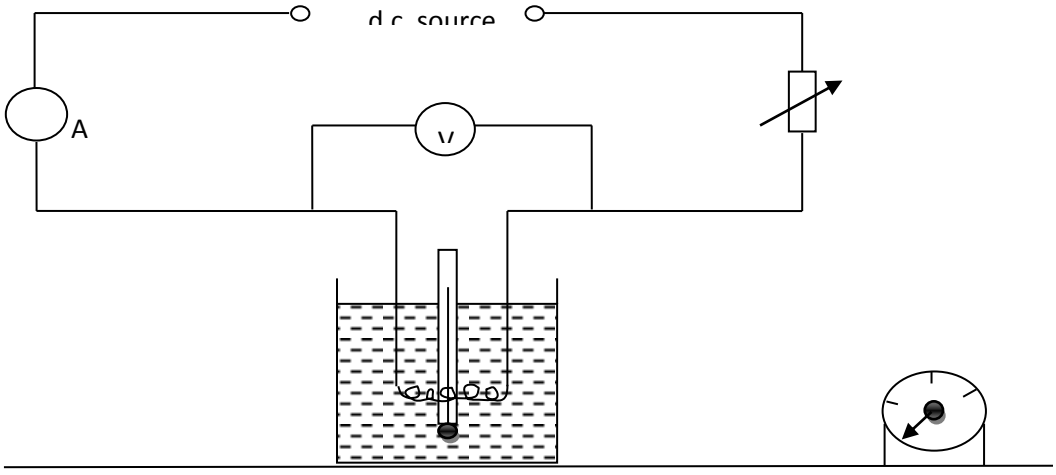
(d) A hole of area 2.0cm$^2$ at the bottom of a tank 5m deep is closed with a cork. Determine the force on the cork when the tank is filled with sea water of density 1.2g/cm$^3$. (2mks)

| | |
|---|---|
| ***P = hdg*** | ***F= PA*** |
| ***= 5×1200×10*** | ***= 6000×2.0×10$^{-4}$*** |
| ***=60000Pa*** | ***= 12.0N*** |

12. (a) Define specific latent heat of vaporization (1mk)

***Amount of heat energy required to change a unit mass of a liquid to vapour at constant temperature.***

b) The illustration below is used to produce a measured rise in temperature of a liquid using electrical energy.




Explain why;

(i) The liquid will tend to be warmer at the top of the container than at the bottom. (1mk)

***Hot water is less dense and thus rises to the top due to convectional current.***

(ii) The temperature will eventually stop rising even though the current is still passing through the heating coil. (1mk)

***The liquid has reached its boiling point***

iii) if the apparatus is used to determine the specific heat capacity of the liquid, the accuracy of the experiment will be increased if the liquid is first cooled to about $5^oc$ below room temperature and the current passed until the temperature is about $5^oc$ above room temperature. (2mk)

***Heat losses are minimized as follows:***
***When $5^oc$ below room temperature heat is gained; when 5oc above room temperature, the same amount of heat previously gained is now lost. Thus the net heat exchange is zero***

(c). A 50W heating coil is totally immersed in100g of water contained in an insulated flask of negligible heat capacity. The initial temperature of water in the flask is $20^oc$.
(i) Determine how long it takes for the water to boil at $100^oC$ when the heater is switched on (2mks)

$$Pt = mc\Theta$$
$$50t = 100 \times 4.2\ (100-20)$$
$$50t = 100 \times 4.2 \times 80$$
$$t = \frac{100 \times 4.2 \times 80}{50}$$
$$t = 672\ sec$$

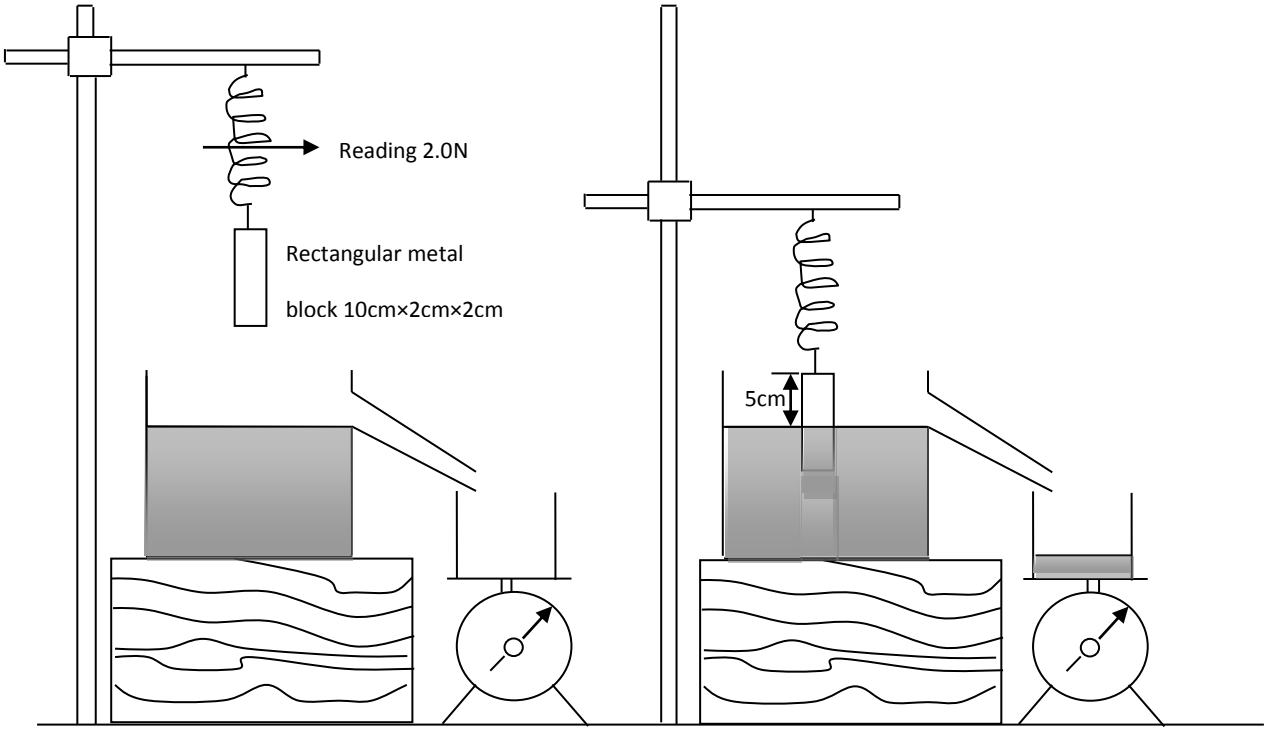
(ii)After the water has been boiling for 15 minutes, it is found that the mass of water in the flask has decreased to 80g. Assuming no external heat losses, calculate a value for the specific latent heat of vaporization of water (3mks)

$$Pt = ml_v$$

$$= 50 \times 15 \times 60 = 20 \times 10^{-3} l_v ;$$

$$l_v = 2.25 \times 10^6 Jkg^{-1}$$

13. (a) The figure below shows details of an experiment performed by a student and the results taken. (take the density of water as 1.0g/cm$^3$)




Compression balance reading 4N

i) Calculate the volume of the metal block below the water (1mk)

***V= 5×2×2=20cm$^3$***

ii) Calculate the new reading on the compression balance after the block is halfway immersed (2mks)

***= 4.0+ 0.2= 4.2N***

iii) Calculate the reading you would expect to obtain on the spring balance (2mks)

***= 2.0- 0.2= 1.8N***

iv) Give a statement of the principle you have used in part (iii) above (1mk)

***When a body is wholly or partially immersed in a fluid, it experiences an upthrust equal to the weight of the fluid displaced***

b). Explain why the narrow stem of a hydrometer provides greater sensitivity than a wide one (1mk)

***To displace the required amount of liquid a narrow stem sinks deeper giving a larger reading than a wide stem which sinks less deep.***

14 (a) (i) A car goes round a flat circular bend whose radius is 100m at a constant speed of 30m/s. Calculate its acceleration (2mks)

$$a = \frac{v2}{r} = \frac{30^2}{100} = 9rad/s^2$$

(ii) if the mass of the car is 1500kg, calculate the frictional force required to provide this acceleration. (2mks)

$$Fr = Fc = \frac{mv^2}{r} = \frac{1500 \times 30^2}{100} = 13500N$$

(b) (i) Calculate the maximum speed at which the car can go round the bend without skidding if the coefficient of friction between the tyres and the ground is 0.5. (2mks)

$$Fc = Fr = \mu N = 0.5 \times 15000$$

$$= 7500N = \frac{mv^2}{r} = \frac{1500 \times v^2}{100}$$

$v^2$ $$= \frac{7500}{15} = 500$$

$$V = \sqrt{500} = 22.36m/s$$

(ii) Give a reason why the driver of the car has to move through the same bend at a lower speed during a rainy day. (1mk)

***Friction is reduced thus centripetal force is less to avoid skidding hence reduced speed.***

# *MOKASA PHYSICS PAPER TWO*

# *2015*

# *MARKING SCHEME*

## *SECTION A (25 marks)*

1. Describe the changes that can be observed during discharging process of a lead –acid accumulator (2mks)

   - ***Hydrogen gas bubbles seen at the cathode***
   - ***White deposit forms at the plates***
   - ***Relative density of the electrolyte drops***

2. a) Define power of a lens and give its units (2mks)

   ***The reciprocal of the focal length in metres; units dioptres (D)***

   b) An object whose height is 24cm is placed 20cm in front of a diverging lens of focal length 20cm.

   Determine the image distance (3mks)

$$\frac{1}{f}=\frac{1}{u}+\frac{1}{V},$$
$$\frac{1}{-20}=\frac{1}{20}+\frac{1}{V},$$
$$\frac{1}{V}=\frac{1}{-20}+\frac{1}{-20},$$
$$\frac{1}{V}=\frac{1}{-10}$$
$$V = 10cm.$$

   a) Give one property of sound waves (1mk)

   - ***travel in a straight line***
   - ***can be reflected***
   - ***are longitudinal***
   - ***require a medium for transmission***

   b) a person claps his hands at approximately 0.5s intervals in front of a wall 90m away. He notices that each echo produced by the wall coincides with the next clap.

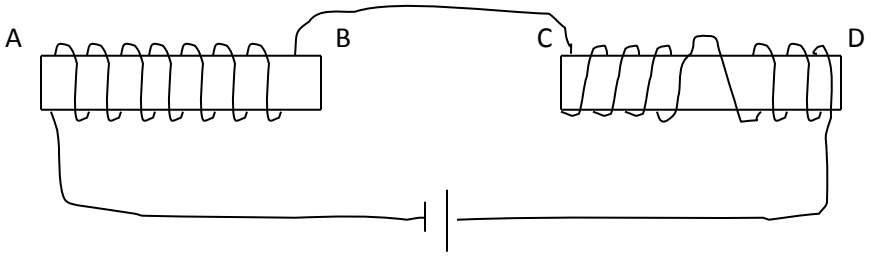
   i) Calculate the approximate speed of sound (3mks)

   ***t = 0.5s,***
   ***Distance = 2 x 90***
   ***= 180m,***
   ***Speed =*** $\frac{180}{0.5}$,
   ***= 360m/s***

   ii) if the results obtained above were used as a basis for an experimental method to determine the speed of sound, what procedure should be adopted to obtain high accuracy in the timing part of the experiment? (1mk)

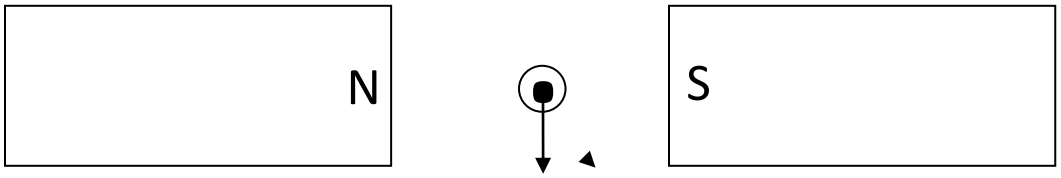
   ***recording the time for more number of claps, (increasing the time interval)***

3. Identify the magnetic poles A, B, C and D in the diagram below. (2mks)




***A - North***
***B - South***
***C - south***
***D - south***

4. The diagram below shows a current carrying conductor placed in a magnetic field.




i)show on the diagram the direction of force on the conductor (1mk)

ii) if the current through the conductor is reduced, state and explain what happens to the force in (i) above. (2mks)

- ***Force reduces***
- ***The magnitude of the force depends on the current flowing***

5. Gamma, radio, infrared, x-rays are part of the electromagnetic spectrum.

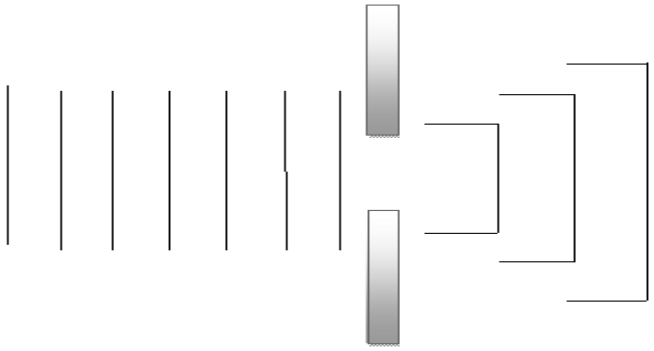
i) Arrange these radiations in order of increasing energy (1mk)

- ***Radio, infrared, x-rays, gamma***

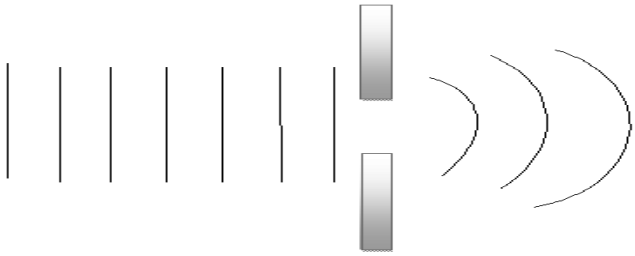
ii) State how radio waves are detected (1mk)

***Detected by resonant circuits in radio receivers***

6. The diagram below shows waves being diffracted.

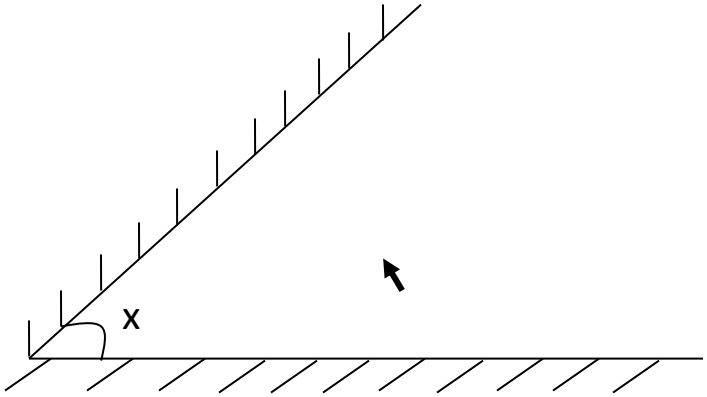


What adjustments should be done to obtain the wave form below? (2mks)



- ***Reducing the size/diameter of the slit***
- ***Increasing the wavelength of the waves/decreasing the frequency of the waves***

7. The diagram below shows an object placed in front of two mirrors inclined to each other at an angle x




An observer sees five images, determine the value of angle x? (2mks)

$$\boldsymbol{n = \frac{360}{\theta},}$$

$$\boldsymbol{5 = \frac{360}{\theta},}$$

$$\boldsymbol{\theta = \frac{360}{6},}$$

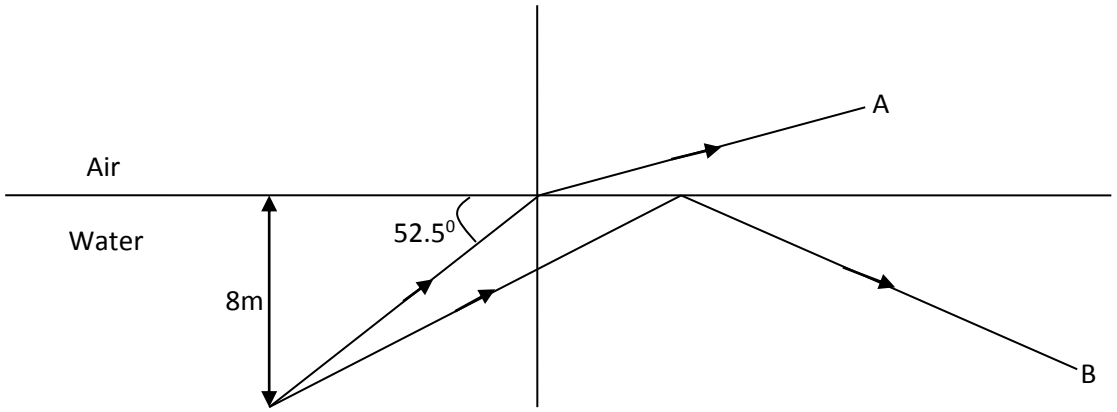
$$\boldsymbol{\theta = 60^0}$$

***SECTION B (55 marks)***

8. a) State Snell's law (1mk)

***the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant for a given pair of medium***

b) The figure below shows a ray of light incident on a water-air interface from a source 8m deep.




i) Ray A is observed to bend as it enters the air. Give a reason why this occurs (1mks)

- ***there is change in optical density of medium***
- ***change in velocity of light as it moves from water to air***

ii) If the refractive index of water is 1.35, calculate the angle of refraction of ray A (3mks)

$$\mathbf{1.35 = \frac{\sin r}{\sin 37.5}},$$

$$\mathbf{\sin r = 1.35 \sin 37.5}$$

$$\mathbf{r = 55.268^0}$$

iii) Find the critical angle of water (3mks)

$$\mathbf{n = \frac{1}{\sin C}}$$

$$\mathbf{1.35 = \frac{1}{\sin C}}$$

$$\mathbf{\sin C = \frac{1}{1.35}}$$

$$\mathbf{C = 47.795^0}$$

iv) Give a reason why ray B is not travelling out of water (1mk)

***the critical angle of water has been exceeded***

v) a fish is placed at the source of light ray. Calculate the maximum area of view on the surface of water (3mks)

***$\vartheta$ = 90 – 47.795, $\vartheta$ = 42.2***

***Tan 42.2 = $\frac{8}{r}$, r = 8.8227***

***Area $= \pi r^2$, Area = 8.8227$\pi^2$***

***Area = 244.573m$^2$***

9. a) define local action (1mk)

***eating away of the zinc plate***

b) a charge of 4.8C flows through a lamp every second. Calculate the number of electrons involved per second. (3mks)

***Q = 4.8c***

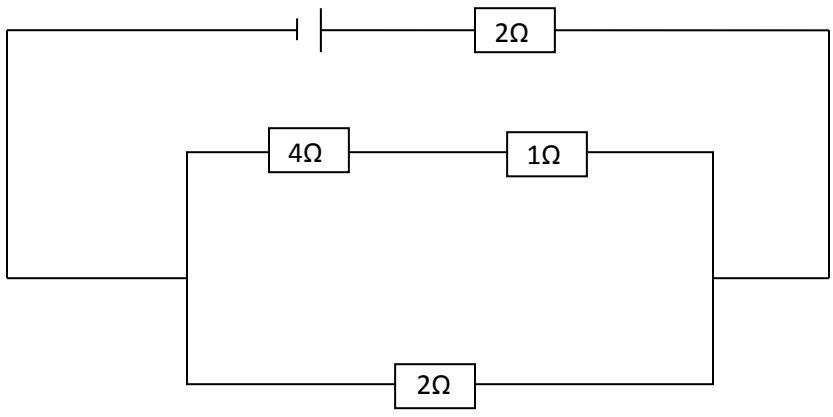
***Number of electrons = $\frac{4.8}{1.6\ x\ 10^{-19}}$,***

***= 3.0 x10$^{20}$electrons***

c) Give two differences between a primary and a secondary cell (2mks)

- ***primary cells cannot be recharged whereas secondary cells can be recharged***
- ***large current can be drawn from primary cells whereas high current can be drawn from secondary cells.***

d) The circuit set up shown below makes a current of 1A to flow through the 4Ω resistor




Calculate;

i) The current through the resistor 2Ω (3mks)

$$V = IR\ ,\ V = 5x1,\ V = 5V$$

$$R = \frac{5\ x\ 2}{7},\ R = 1.4286\Omega$$

$$I = \frac{V}{R},\quad I = \frac{5}{1.4286},\quad I = 3.4999A.$$

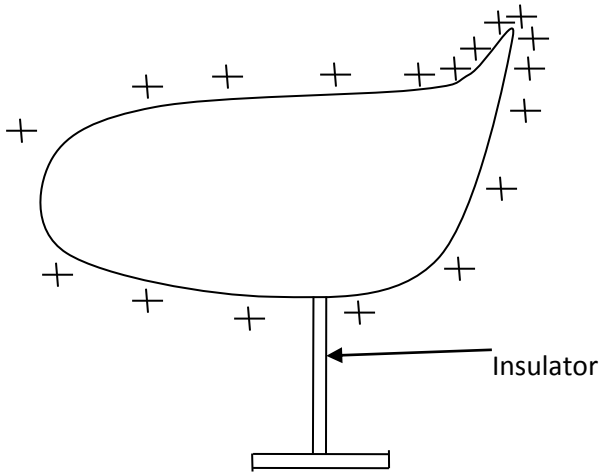
ii) the E.M.F of the cell given that the internal resistance is negligible (3mks)

$V = IR,$ ***R = 2 + 1.4286= 3.4286Ω***

***V = 3.4999 x 3.4286***

***V = 11.9998V***

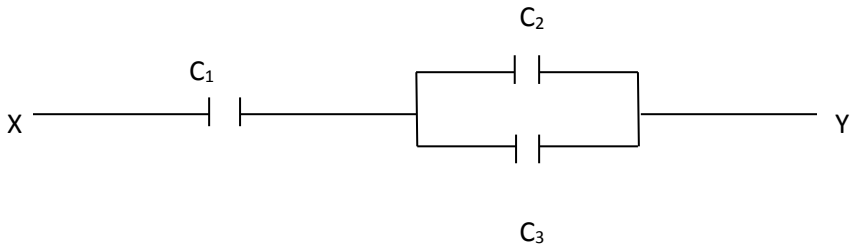
10. Show the charge distribution on the hollow conductor shown below if it is positively charged. (1mk)




b. State three factors affecting capacitance of a parallel plate capacitor. (3mks)

- ***Distance of separation between the plates***
- ***Area of overlap***
- ***Nature of dielectric material***

c) The diagram below shows a circuit containing three capacitors.



i) Write an expression for effective capacitance between X and Y. (2mks)

$\frac{C2\ C3}{C1+C2} + C1$

i) If $c_1$=6µF, $c_2$=4.5µF and $c_3$=5 µF, calculate the charge stored when point XY is connected in series with a battery of 6V (3mks)

$Q = CV$

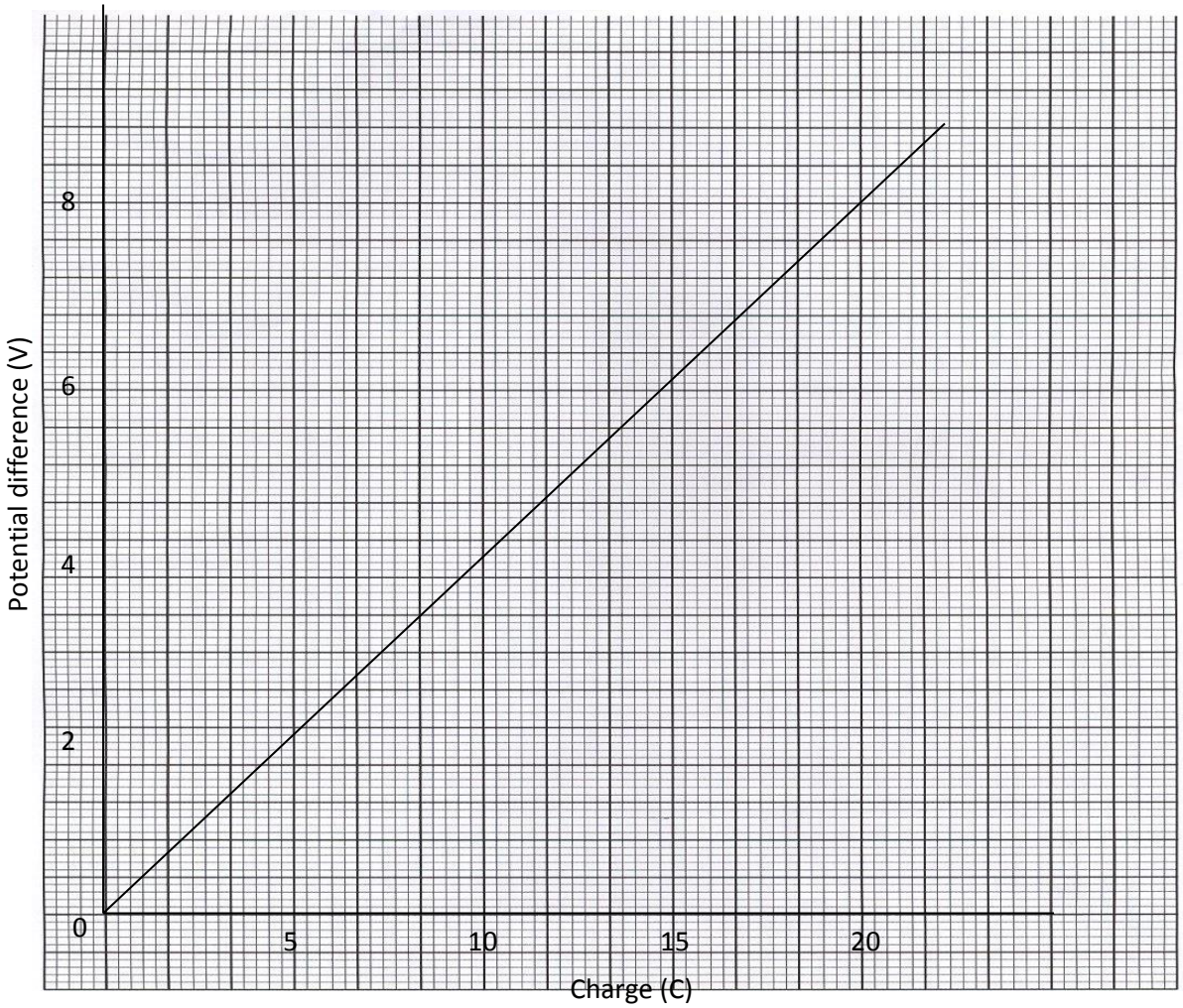
$C = (\frac{4.5+5}{4.5+} + 6)\ x\ 10^{-6}F$

$= 8.368\ x10^{-6}\ F$

$Q = 8.368\ x10^{-6}\ F\ x\ 6$

$= 5.021\ x\ 10^{-5}\ C$

d) The graph below shows the relationship between the voltage drop across a certain capacitor and the charge stored in the capacitor.




From the graph calculate the capacitance of the capacitor. (3mks)

$Q = CV$

$$C = \frac{Q}{V} \text{ = gradient,}$$

$$gradient = \frac{4-0}{10-0} = 0.4$$

$$C = \frac{1}{0.4} = 2.5F$$

11. a ) State two factors that determine the magnitude of an induced e.m.f in a conductor (2mks)

- ***strength of the magnetic field***
- ***rate of change of magnetic flux linkage***

(b ) A Power station has an input of 30kw at a potential difference of 5kv.A transformer with a secondary coil of 1000 turns is used to step down the voltage to 1000v for transmission along a grid .Assuming there are no power loses in the transformer .calculate.

(i ) current in the primary coil (3mks)

***P = IV***

***3000 = I x 5000***

***I = 6A***

(ii ) the number of turns in the primary coil (3mks)

$$\frac{Np}{1000} = \frac{5000}{1000},$$

**Np = 5000 turns**

(iii) The current in the secondary coil (2mks)

$$\frac{Ip}{Is} = \frac{Vs}{Vp},$$

$$\frac{6}{Is} = \frac{1000}{5000}$$

$$Is = 30A$$

(iv) State which of the coils is thick and why (2mks)

- ***primary coil***
- ***minimize copper/ resistance losses***

12. a) Define magnification (1mk)

***Change in image size relative to the object***

b) State two differences between a concave and convex reflectors (2mks)

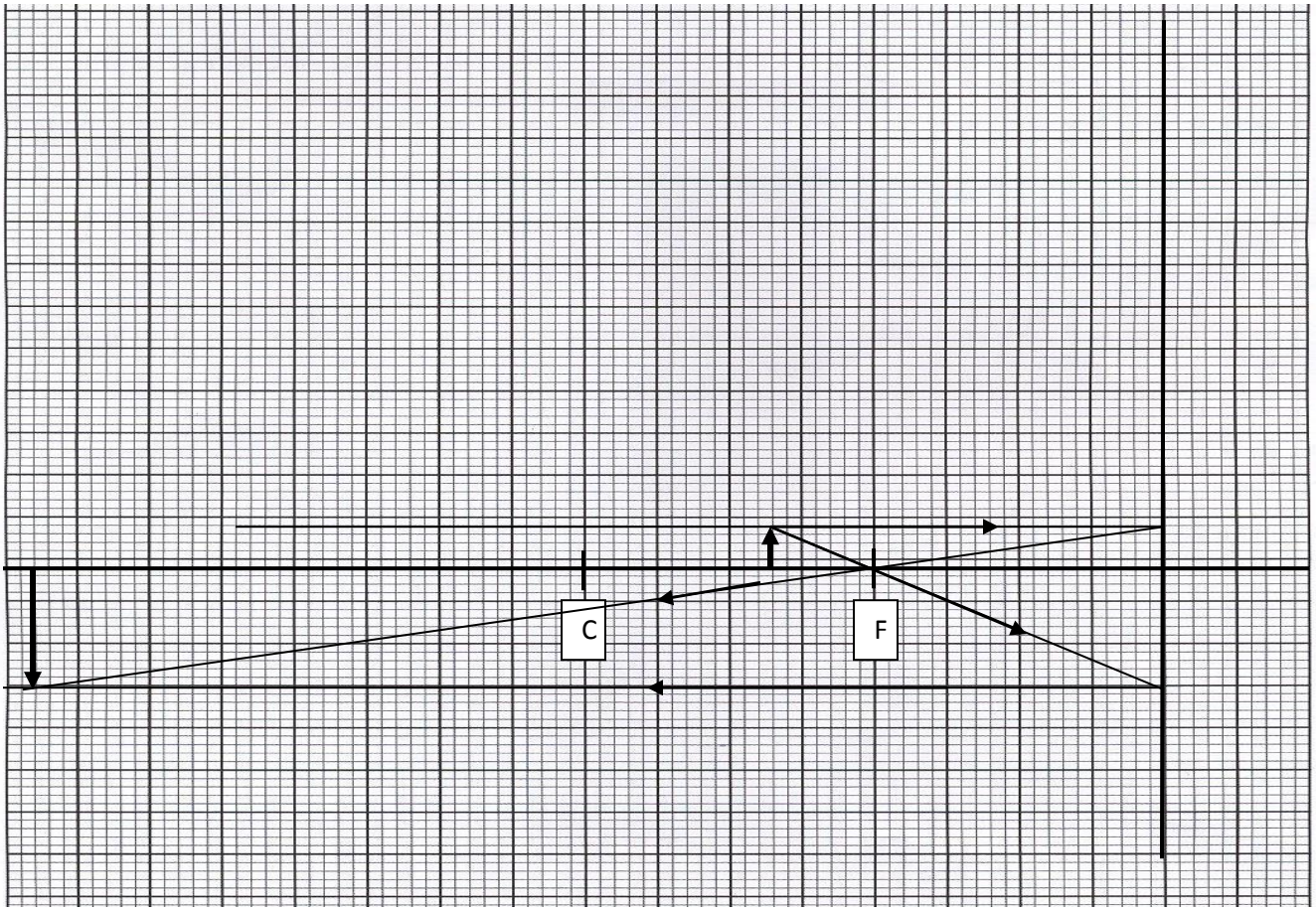
- ***concave have a real focus while convex have a virtual focus***

- ***convex mirrors form upright images while concave mirrors form upright and inverted images***
- ***concave mirrors form real and virtual images convex form virtual images***

c) a concave mirror of focal length 20 cm forms a real image three times the size of the object. If the object height is 4cm; determine, using graphical method, the:

( i)object distance (3mks)

(ii) The image distance (1mk)




***Rays – 1mk***

***Image -1mk***

***Object – 1mk***

***Image distance = 78 cm***

***Object distance = 27cm***

CONFIDENTIAL

MOKASA PHYSICS PP3 2015

QUESTION 1

- Two new dry cells size D
- An ammeter 0 – 1 A
- Voltmeter 0 – 5 V
- A resistance wire labeled XY (30 gauge) on mm scale
- Jockey
- cell holder
- switch (one way)
- six connecting wires at least three with crocodile clips at one end

QUESTION 2

- A glass block
- Soft board
- 4 optical pins
- Plain paper
- Four thumb pins
- A protractor
- 30 cm ruler

# MOKASA 2015

## 232/3

## Physics

## March / April

## Marking scheme

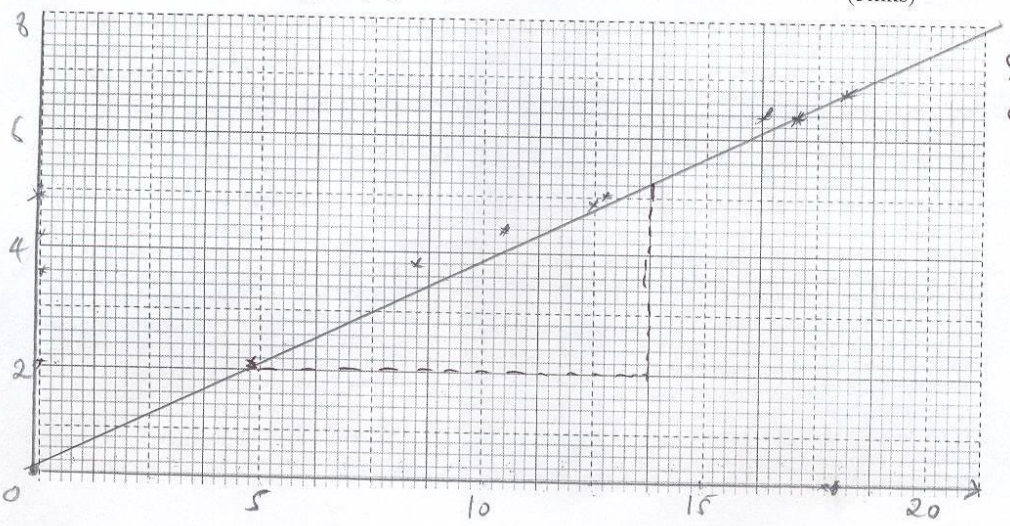
| L (cm) | 0.2 | 0.4 | 0.5 | 0.6 | 0.7 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|
| p.d. (V) | 2.10 | 2.40 | 2.50 | 2.6 | 2.6 | 2.7 | 2.70 |
| I (A) | 0.44 | 0.28 | 0.24 | 0.21 | 0.20 | 0.16 | 0.15 |
| R (Ω) | 4.7730 | 8.5714 | 10.41667 | 12.3810 | 13.000 | 16.875 | 18 |
| $\frac{1}{I}$ | 2.273 | 3.571 | 4.1667 | 4.7619 | 5.00 | 6.250 | 6.6667 |

± 0.1 ± 0.01

4 correct for any 4 correct 2 marks 1 mark. 1 mark

(7MKS)

(d) Plot a graph of $\frac{1}{I}$ (y axis) against R (5mks)




S1 C1 P2 A1

(e) Determine the slope, S, of your graph (3mks)

$S = \frac{\Delta I}{\Delta x} = \frac{5.2 - 2}{13.75 - 4.75}$ M1

$= \frac{3.2}{9} = 0.3555$ M1 A1

(f) Given that I and R of the graph are related by the equation $\frac{1}{I} = \frac{R}{E} + \frac{r}{E}$, use your graph to determine the values of :

E = $E = g = \frac{1}{E}$ $0.355 = \frac{1}{E}$ m1 (2mks)

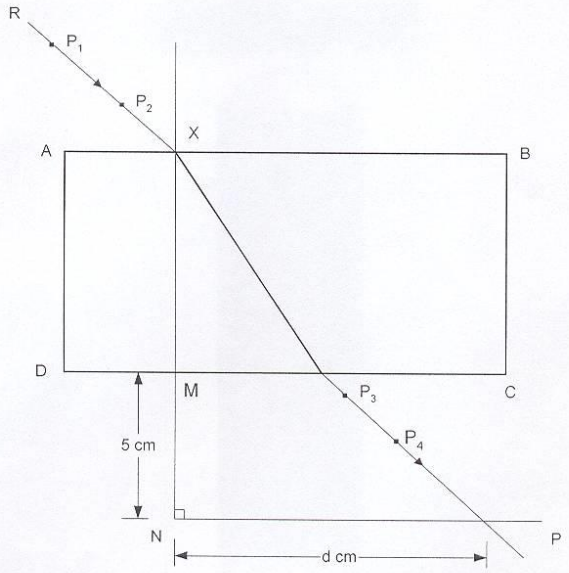
$E = \frac{1}{0.355} = 2.81\ V$ m1

r = (3mks)

$\frac{r}{E} = 0.2$ m1 $\frac{r}{2.81} = 0.2$ m1

$r = 0.562\ \Omega$ m1

h. Using a protractor, construct an incident ray RX at an angle of incidence **i** = $10^0$. Fix two pins $P_1$ and $P_2$ along RX.
i. Replace the glass block to the traced figure.
j. View the path of the incident ray RX through the glass block from face DC. Using other two pins $P_3$ and $P_4$, fix them to seem to align themselves with images of $P_1$ and $P_2$.
k. Remove the glass block and draw the emergent ray through $P_3$ and $P_4$.
l. Measure the distance of the emergent ray from point N along line NP as shown in the diagram below.

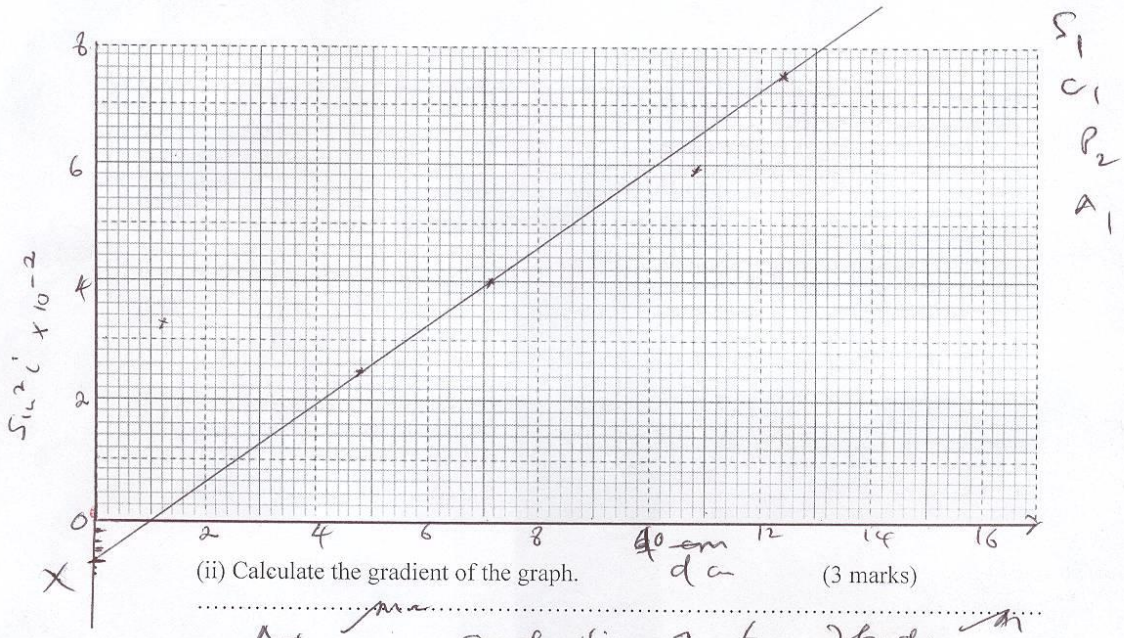



m. Record the corresponding values of d, Sin **i** and $Sin^2$ **i** in the table below. (3 marks)
n. Repeat the procedure for other values of **i**. (8 marks)

| Angle of incidence | 10 | 20 | 30 | 40 | 50 | 60 |
|---|---|---|---|---|---|---|
| Distance d (cm) ±0.2 | 1.70 | 3.70 | 4.70 | 7.10 | 10.80 | 12.40 |
| Sin **i** | 0.1736 | 0.3420 | 0.5000 | 0.6428 | 0.7660 | 0.8660 |
| $Sin^2$ | 0.0301 | 0.1170 | 0.25 | 0.4132 | 0.5868 | 0.7500 |

(1mk)@
(1mk) for 4 Corr
(1mk) for 4 Corr values

o. (i) On the grid provided, plot the graph of $Sin^2 i$ (vertical axis) against d.
(5 marks)




S1
C1
P2
A1

(ii) Calculate the gradient of the graph. (3 marks)

$\frac{\Delta y}{\Delta x}$ = gradient ✓ to 2 d.p ✓

± 0.2

p) what is the equation of the graph (2mks)

$y = mx + X$. — ✓ to 2 d.p

q) Give the value of d when $i=80^0$ (2mks)

Correct substitution ✓ to equation ✓

2 d.p ✓ value

± 0.1 cm.