OLABORO JOSEPH UTEC Paper 2

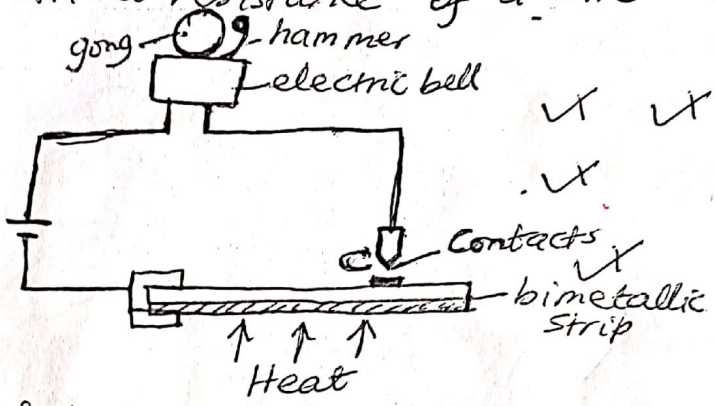
Lower fixed point is the temperature of pure melting ice at normal atmospheric pressure ✓ (01)

The upper fixed point is the temperature of steam above pure boiling water at normal atmospheric pressure of 760 mm Hg. ✓ (01)

(ii) - length of liquid column ✓x

- Volume of a fixed mass of a gas ✓x
- pressure of a fixed mass of a gas ✓x (02)
- e.m.f of thermo couple ✓x first four
- wavelength of a radiation
- electrical resistance of a wire

b(i)



✓x ✓x any four correctly labelled parts ✓x (02)

Consider the literature if the diagram is workable ✓

Heat from the fire makes the bimetallic strip ✓x bend, to expand and completing the ~~bimetallic~~ electrical circuit ✓, so ^ at C ✓ ringing the alarm bell. ✓ (02)

(ii) $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\frac{2}{300} = \frac{V_2}{150}$ ✓

(03)

$300 V_2 = 300$ ✓

$V_2 = 1 m^3$ ✓ (Value and Unit).

c (i) - It is easily/readily available ✓ (02)

(ii) - It has a high heat capacity. ✓

(ii) During the night, land cools ✓x faster ✓x than the sea, because sea has a higher ✓x heat capacity than the ✓x land. The air above the ✓x sea remains warm ✓x, becomes less dense ✓x and rises ✓x. Cool air ✓x from the land moves towards ✓x the sea to take up the space left by rising (03)

(a)(i) For two or more colliding bodies their total momentum remains constant provided there is no external force acting on the colliding bodies. ✓ (01)

(ii) The air moves out through the opening with high speed, high backward momentum hence an equal but opposite forward momentum acts on the balloon. The balloon moves in the opposite direction to that of the escaping air. ✓

It falls down when all the air has escaped.

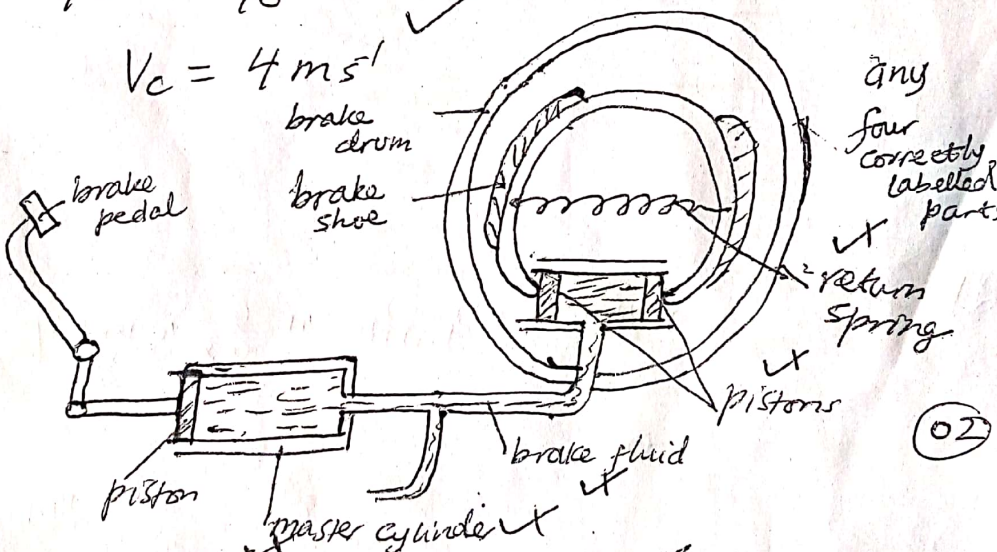
(b) $(50 \times 5) + (20 \times 1.5) = 70 V_c$ ✓

$250 + 30 = 70 V_c$

$\frac{70 V_c}{70} = \frac{280}{70}$ ✓

$V_c = 4 ms^{-1}$ ✓ (04)

(c)(i)



any four correctly labelled parts. (02)

—When the brake pedal is pushed, the piston in the master cylinder exerts a force on the brake fluid.

—The resulting pressure is transmitted equally. This forces the brake shoes or pads against the wheel and stops the car. (03)

(ii) When the air is removed, the bottle collapses because a partial vacuum is created inside the bottle, pressure inside reduces, ~~pressure~~ air greater atmospheric pressure is exerted on the outer [illegible] the bottle, the bottle collapses 03

(ii)- Water is poured in a wide tray
- Lycopodium powder is sprinkled on the surface of water
- A known volume V of oil is measured/got from a pipette.
- The oil is dropped on the surface of water.
- ~~The formed circular patch~~
- The diameter d of the formed circular patch is measured and recorded. (05)
- The thickness t of the oil drop is got from.

$$t = \frac{4V}{\pi d^2}$$

b(i) Adhesion is a force of attraction between molecules of different kinds,
Cohesion is a force of attraction between molecules of same kind. (02)

(ii)- Some water is poured in a beaker.
- Blotting paper is carefully placed on the surface of water
- A dry needle is carefully placed on the blotting paper. (02½)
- After some time, the blotting paper absorbs the water and sinks. The pin remains floating (01)

c(i) $V = \frac{\pi d^2}{4} t$

$0.010 = \frac{22}{28} \times (28)^2 t$ (03)

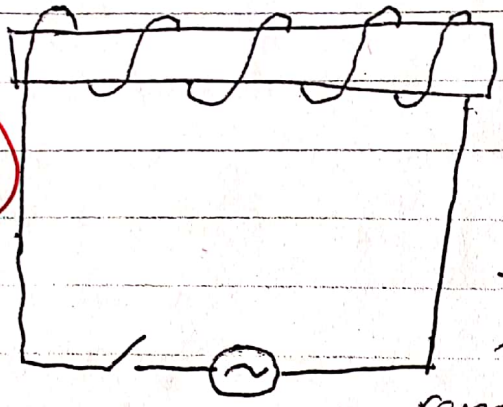
$0.010 = 22 \times 28\, t$

$t = 1.62 \times 10^{-5}$ cm

(ii)- The oil patch is assumed to be one molecule thick.
- The oil drop is assumed to be spherical (01)
- The oil patch is assumed to be cylindrical
- oil is assumed not

(i) Like poles repel, unlike poles attract ✓

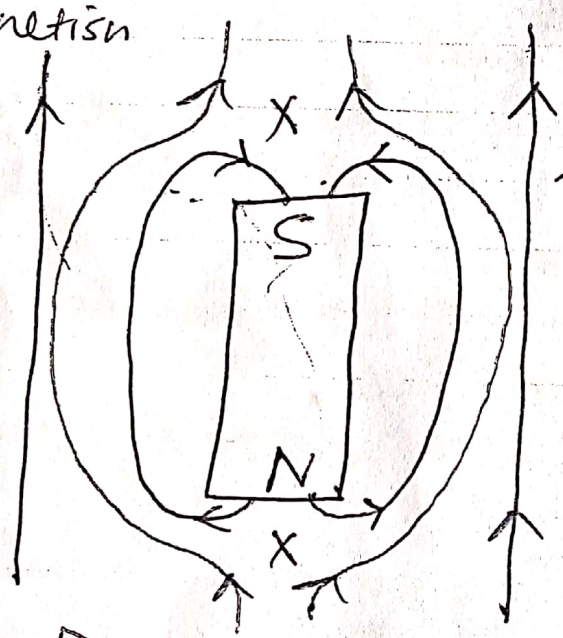
(ii)



(labelled diagram only 02 MKs)

- The magnet is placed in a solenoid connected to an a.c supply. ✓
- With current still flowing the magnet is slowly removed to a distance from the solenoid and placed in E-W direction. It is found to have lost all its magnetism (04)

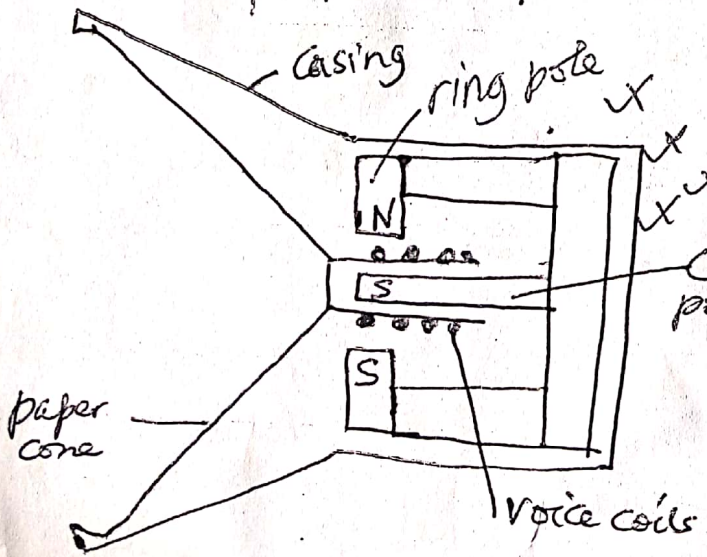
(b)(i)



X-neutral point

direction ✓
pattern ✓
neutral point ✓ (03)

(ii)



- Varying current from a radio pass through a coil whose turns are at right angles to the magnetic fields of a magnet.
- A force acts on the coil, makes it to move in and out. Paper cone attached to the coil moves with it. This sets up sound waves in the surrounding air. (Vibrates) (05)

(c) $R_g = 100\Omega$

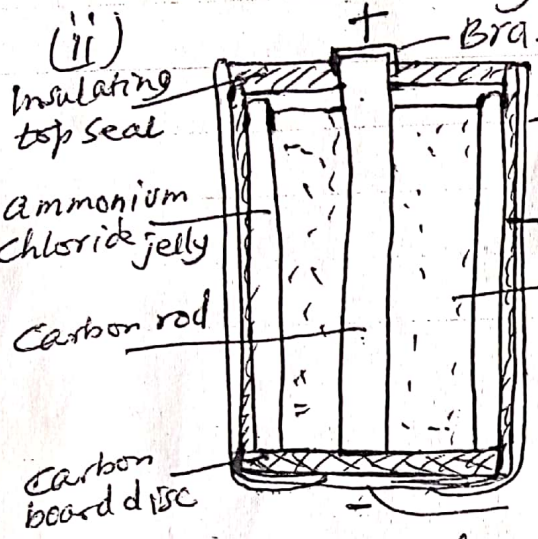
$I_g = 10\ A$ c.01A

$V_g + V_m = V$ ✓

5 (a) (i) - The liquid level should be maintained by refilling with distilled water ✓
- Avoid over charging ✓
- Avoid leaving the accumulator uncharged for a long period
- Avoid putting it on bare ~~ground~~ floor
- Avoid shorting the terminals
- It should be regularly charged

03

(ii)



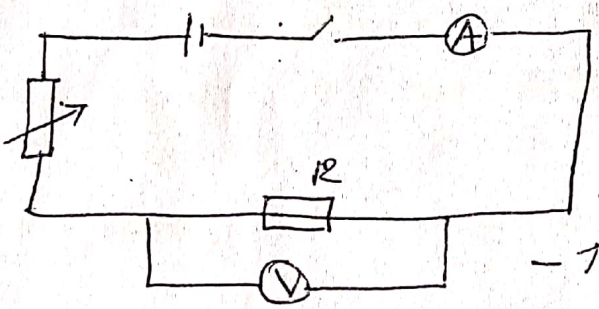
any 5 correctly labelled

02

Carbon rod is the positive electrode
Zinc can is the negative electrode (element)
Ammonium Chloride jelly is the electrolyte
Manganese (IV) oxide prevents polarization
Powered carbon reduces the internal resistance of the cell

05

(b)



- The circuit is connected as shown in the figure.
- The switch is closed,
- The rheostat is set to the maximum. The voltmeter reading V and ammeter reading I are noted. The rheostat is adjusted to obtain other values of V and I. The results are tabulated. A graph of V against I is plotted. A straight line graph is obtained. Its slope is the resistance of the resistor.

04

(c) $E = I(R + r)$

$6 = 3.0R$ ✓

$R = 2\,\Omega$ ✓

(01)

$6.0 + 1.5 = 3.0(2 + r)$ ✓

$7.5 = 6 + 3r$ ✓

$\frac{1.5}{3} = \frac{3r}{3}$

$r = 0.5\,\Omega$ ✓

04

16

6(a) (i) Wave length: This is the distance between two successive crests or troughs ~~or two successive~~ or rarefactions or compressions
Distance btn two successive wave particles which are in the same phase.

(ii) frequency: Number of complete cycles made in one second. (02)

b(i) determination of the sea depth, detect shoals of fish, (02)
spectacles for the blind, used to reveal flaws in welded joints
- cut holes in glass or steel by ultrasonic drills
- dry paper, detect gall bladder stones
- medical scanning - monitor the growth of embryos pregnant mothers.
(the first two)

(ii) $V = \frac{d}{t}$ ✓ $330 = \frac{d}{5}$ ✓ (03)

$d = 330 \times 5 = 1650\ m$ ✓

c(i) A vibrating tuning fork of known frequency, f is brought near a resonance tube containing water, its tap is slightly opened until a loud sound is obtained and then closed
- The length l_1 of the air column in the tube is noted.
- The vibrating tuning fork is again brought near the open end of the resonance tube, the tap is again slightly opened until a second loud sound is obtained and then closed
- The length l_2 of the air column in the tube is noted
- The wavelength λ of sound is given by

$\lambda = 2(l_2 - l_1)$ (04)

(use of burette accept)

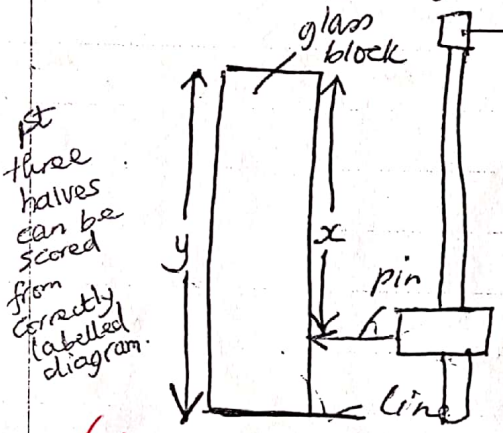
(ii) They are transverse, travel at a speed of light in vacuum
Travel through a vacuum (02)
can be reflected, refracted, diffracted and under go interference, carry no charge
(the first four)

(e) The ~~shorter~~ longer the wavelength the more penetrating is the light (accept shorter)

Qn 7

(a)(i) refractive index is the ratio of sine of the angle of incidence in air to the sine of the angle of refraction in the substance. ✓ (01)

(ii) A glass block is placed vertically over a straight line ruled on a sheet of paper.
- A pin on a sliding cork adjacent to the block is then moved up or down until there is no parallax between it and the image of the line seen through the block



- The length y of the glass block is noted.
- The distance x from the top of the glass block to the pin is also noted. (05)

The refractive index = $\frac{y}{x}$ ✓

(First three halves can be scored from correctly labelled diagram.)

(½ for indicating F)

(b)(i) $1.6 \times 2 = 3.2$ cm ✓ ±0.1 scale ✓ rays ✓ (03)

Provided correct symbol of convex lens

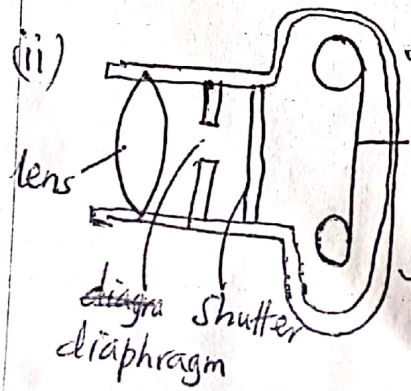
(ii) $\frac{16}{4} = 4$ ✓ (01)

c(i)

Human eye	Lens camera
- Variable focal length	- Fixed focal length ✓
- Lens - biological	- Artificial lens
- The distance between the lens and retina is fixed	- The distance bth the lens and film is variable

(02) (the first 2 the different ones)

(ii)



- Lens camera focus the object/Image on the film
- Controls exposure time of film to light
- diaphragm – controls the amount of light into the camera
- Film: where the image is formed.

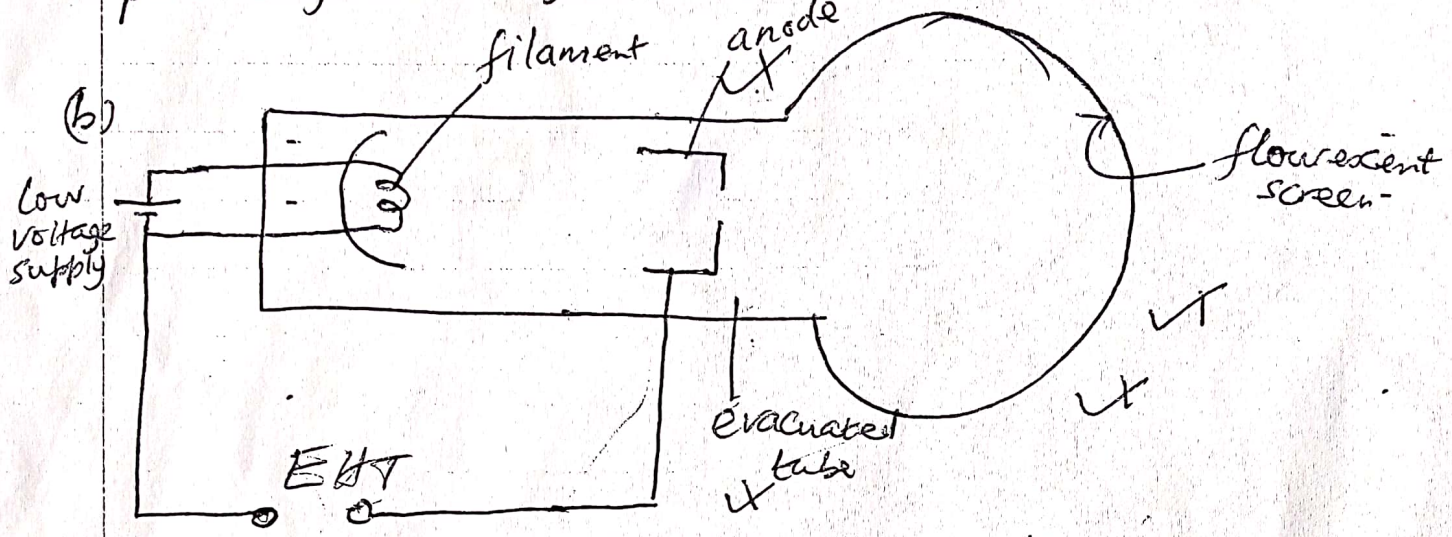
Give the literature if the diagram is (04)

electrons are released from a heated metal surface (01)

Photoelectric effect: is a release of electrons from a metal surface when a radiation of high enough energy falls on it (high enough frequency) (01)

(ii) When the wave length is reduced, the penetrating power of X-rays increases. (01)

(b)



The cathode is heated by a low p.d, produces electrons by thermionic emission

- The electrons are focussed by the cathode and accelerated by EHT to the fluorescent screen which gives glow when they strike the screen. (04)

(c) (i) The leaf gradually collapses (01)

(ii) When ultraviolet radiation falls on the zinc plate electrons are released, they are repelled away by the negative charge on the electroscope

The electroscope continously loses the negative charge, the leaf gradually collapses (03)

d(i) Thickness gauge for sheets of paper and metal (Consi... the fi...

- detect brain tumours (02)
- Study the up take of fertilizers in plants
- measure fluid flow in pipes, treatment of cancer
- Carbon dating

NAKAZIBWE SUMAYYAH U3166/002.

535/2
PHYSICS
Paper 2
July /Aug. 2019
2¼ hours

UGANDA TEACHERS' EDUCATION CONSULT (UTEC)

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer **FIVE** *questions.*

Any additional question(s) answered will not be marked

Mathematical tables, and silent non – programmable calculators may be used

Where necessary use the following constants;

Acceleration due to gravity, g	=	$10\ ms^{-2}$
Specific heat capacity of copper	=	$400\ Jkg^{-1}K^{-1}$
Specific heat capacity of water	=	$4200\ Jkg^{-1}K^{-1}$
Specific latent heat of fusion of water	=	$340{,}000\ Jkg^{-1}$
Speed of sound in air	=	$330ms^{-1}$
Density of water	=	$1000\ kgm^{-3}$ / $1\ gcm^{-3}$
Speed of light in vacuum	=	$3.0 \times 10^{8} ms^{-1}$

1. (a) (i) Distinguish between the lower fixed point and the upper fixed point of temperature. *(02 marks)*

(ii) Name four examples of thermometric properties. *(02 marks)*

(b) (i) With the aid of a well labelled diagram, describe the operation of a fire alarm which uses a bimetallic strip. *(04 marks)*

(ii) A gas of volume $2m^3$ at 27°C is coded to -123°C at constant pressure. What is its new volume? *(03 marks)*

(c) (i) Give two reasons why water is used in the cooling system of a car engine. *(02 marks)*

(ii) Why does a breeze blow from land towards the sea during night? *(03 marks)*

2. (a) (i) State the principle of conservation of momentum. *(01 mark)*

(ii) Explain what is observed if a balloon filled with air is released with its neck open. *(03 marks)*

(b) A boy with mass 50kg running at $5ms^{-1}$ jumps onto a 20kg trolley travelling in the same direction at $1.5ms^{-1}$. What is their common velocity? *(04 marks)*

(c) (i) With the aid of a well labelled diagram, describe the operation of the hydraulic car brakes. *(05 marks)*

(ii) Explain what happens to a plastic bottle when air is removed from it. *(03 marks)*

3. (a) (i) State the three states of matter. *(03 marks)*

(ii) Describe an experiment to determine the size of a molecule. *(05 marks)*

(b) (i) Distinguish between adhension and cohesion. *(02 marks)*

(ii) Explain briefly how you can prove that the surface of a liquid behaves like a stretched skin. *(02 marks)*

(c) A drop of oil of volume $0.010cm^3$ is allowed to fall on some clean water dish and it spreads to form a circle water dish and it spreads to form a circle of radius 14cm.

(i) Estimate the maximum value of the diameter of an oil molecule.

(ii) State two assumptions made in your calculations

1. (a) (i) Distinguish between the lower fixed point and the upper fixed point of temperature. *(02 marks)*

(ii) Name four examples of thermometric properties. *(02 marks)*

(b) (i) With the aid of a well labelled diagram, describe the operation of a fire alarm which uses a bimetallic strip. *(04 marks)*

(ii) A gas of volume $2m^3$ at 27°C is coded to -123°C at constant pressure. What is its new volume? *(03 marks)*

(c) (i) Give two reasons why water is used in the cooling system of a car engine. *(02 marks)*

(ii) Why does a breeze blow from land towards the sea during night? *(03 marks)*

2. (a) (i) State the principle of conservation of momentum. *(01 mark)*

(ii) Explain what is observed if a balloon filled with air is released with its neck open. *(03 marks)*

(b) A boy with mass 50kg running at $5ms^{-1}$ jumps onto a 20kg trolley travelling in the same direction at $1.5ms^{-1}$. What is their common velocity? *(04 marks)*

(c) (i) With the aid of a well labelled diagram, describe the operation of the hydraulic car brakes. *(05 marks)*

(ii) Explain what happens to a plastic bottle when air is removed from it. *(03 marks)*

3. (a) (i) State the three states of matter. *(03 marks)*

(ii) Describe an experiment to determine the size of a molecule. *(05 marks)*

(b) (i) Distinguish between adhension and cohesion. *(02 marks)*

(ii) Explain briefly how you can prove that the surface of a liquid behaves like a stretched skin. *(02 marks)*

(c) A drop of oil of volume $0.010cm^3$ is allowed to fall on some clean water dish and it spreads to form a circle water dish and it spreads to form a circle of radius 14cm.

(i) Estimate the maximum value of the diameter of an oil molecule.

(ii) State two assumptions made in your calculations

4. (a) (i) State the law of magnetism. *(01 mark)*

(ii) Describe how you would demagnetize a magnet by an electrical method. *(04 marks)*

(b) (i) Draw the magnetic flux pattern near a bar magnet with its axis in the magnetic meridian and its south pole pointing north. *(03 marks)*

(ii) With the aid of a diagram, describe the operation of a moving coil loud speaker. *(05 marks)*

(c) A galvanometer of internal resistance 100 Ω gives a full-scale deflection for a current of 10mA. Calculate the value of resistance necessary to convert the galvanometer to a voltmeter reading up to 5V. *(03 marks)*

5. (a) (i) State three precautions which should be taken to maintain the efficiency of a lead acid accumulator. *(03 marks)*

(ii) Draw a well labelled diagram of a dry cell and explain the functions of the various components. *(05 marks)*

(b) Describe an experiment to determine the resistance of a resistor. *(04 marks)*

(c) A cell of 6.0V emf and negligible internal resistance is connected to a resistor and drives a current of 3.0A through it. Another cell of e.m.f 1.5V is inserted in the circuit in series with the first one. The current remains at 3.0A. What is the internal resistance of the second cell? *(04 marks)*

6. (a) Define the terms:

(i) wave length

(ii) frequency of a wave. *(02 marks)*

(b) (i) Give two uses of ultrasonics. *(02 marks)*

(ii) If 5 seconds elapse between a lightning flash and clap of thunder, how far away is the storm? (speed of sound in air = 330 ms^{-1}). *(03 marks)*

(c) (i) Describe the resonance tube method of measuring the wavelength of sound waves in air emitted by a vibrating turning fork. *(04 marks)*

(ii) Give four properties of electromagnetic waves. *(02 marks)*

(d) Why does sunset appear red? *(03 marks)*

7. (a) (i) Define the term refractive index of a substance. *(01 mark)*

(ii) Describe an experiment to determine the refractive index of a glass block using real and apparent depth method. *(05 marks)*

(b) An object is placed 4cm infront of a convex lens. A real image is produced 16cm from the lens. By means of graphical method determine;

(i) the focal length of the lens and mark the principle focus.

(ii) magnification produced by the lens. *(04 marks)*

(c) (i) Give two differences between a human eye and the lens camera. *(02 marks)*

(ii) With the aid of a diagram, describe the operation of a lens camera. *(04 marks)*

(a) (i) Distinguish between thermionic emission and photo electric effect. *(02 marks)*

(ii) How is the penetrating power of X – rays affected by a reduction in their wavelength? *(01 mark)*

(b) Draw a well labelled diagram of a cathode ray tube and describe its operation. *(04 marks)*

(c) A fresh clean zinc plate is placed on a cap of a negatively charged gold leaf electroscope. Ultra violet radiations are irradiated onto the zinc plate;

(i) State what is observed. *(01 mark)*

(ii) Explain the observation in (c) (i) above. *(03 marks)*

(d) (i) Give two uses of radioactivity. *(02 marks)*

(ii) If the half-life of a radioactive gas is 2 minutes. Find the fraction of the initial activity of the gas that will remain after 8 minutes. *(03 marks)*