NAME ..... M/scheme .....ADM.NO. .....CLASS.....

INDEX NO. .....DATE .....SIGN. .....

R.C.E.A GROUP OF SCHOOLS JOINT EXAMINATIONS

Kenya Certificate of Secondary Education
Physics Paper 232/2
2 Hours

INSTRUCTIONS TO CANDIDATES:

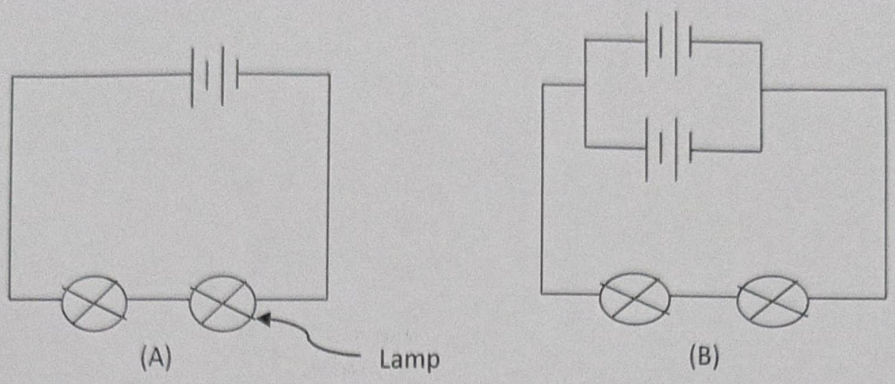
1. Write your name, school, admission number and index number is the spaces provided above.
2. Sign and write the date of examination in the spaces above.
3. Answer **ALL** the questions in section **A** and **B** in the spaces provided.
4. All working **MUST** be clearly shown.
5. Non-programmable silent electronic calculators and KNEC mathematical tables may be used.
6. This paper consists of **15** pages.
7. Candidates should check the question paper to ascertain that **ALL** the pages are printed and that no questions are missing.

FOR EXAMINER'S USE ONLY.

SECTION	QUESTIONS	MAX. SCORE	CANDIDATE'S SCORE
A	1 -10	25	
B	11	11	
	12	11	
	13	12	
	14	10	
	15	11	
	TOTAL	**80**	

SECTION A (25MKS): Answer ALL the questions in the spaces provided

1. In the figure below the lamps in the two circuits, A and B are identical and the cells have the same electromotive force.



Explain why the lamps in B may glow brighter than those in A when the circuits are closed at the same time. (2mks)

Cells in B have a lower effective resistance than in A ✓1
because the cells are arranged in parallel ✓1

2. The figure below shows two rays drawn from an object on to the mirror.

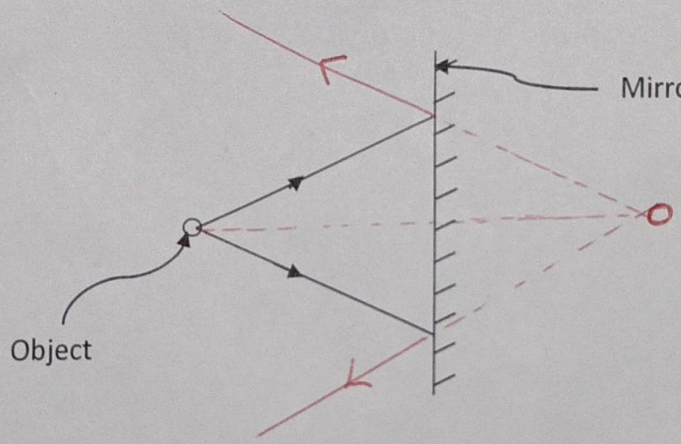


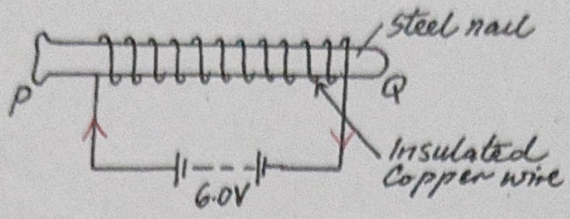
Image position ✓1
Rays (arrows in real rays no arrow in virtual rays

Complete the ray diagram to show the position of the image. (2mks)

3. Your house is supplied with 240 v from a power source which is fitted with a 13 A safe fuse. What is the maximum number of 60w bulbs that can be fitted in the house? (2mks)

$P = VI$ ✓1
$60n = 240 \times 13$ Where n is the number of bulbs
$n = 52$ bulbs ✓1

4. (a) A steel is to be magnetized by electrical method as shown below. Identify the pole **P** and **Q** of the resulting magnet. (1mk)



P: South pole

Q: North pole

✓1 for both correct

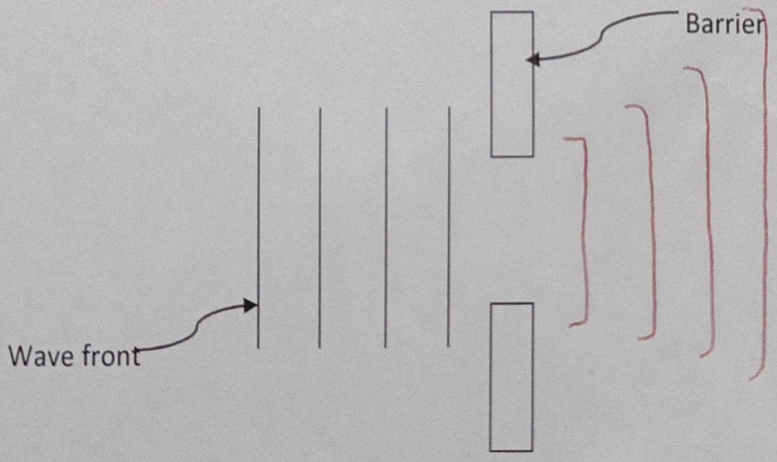
(b) State the difference between a soft magnetic material and a hard magnetic material. (1mk) ✓1

Soft magnetic material are easily magnetised and easily demagnetised while hard magnetic material are difficult to magnetised ~~hard~~ retain magnetism for a time

5. (a) Define diffraction with respect to waves. (2mks)

Is the Spreading ✓1 of Waves as it Crosses over an aperture or barrier

(b) In the diagram below the size of the aperture at the barrier is 10cm while the distance between two consecutive wave fronts is 3cm. If the waves are moving towards the barrier, draw the wave fronts as they appear after passing through the aperture. (2mks)



✓1 Straigh Waves fronts

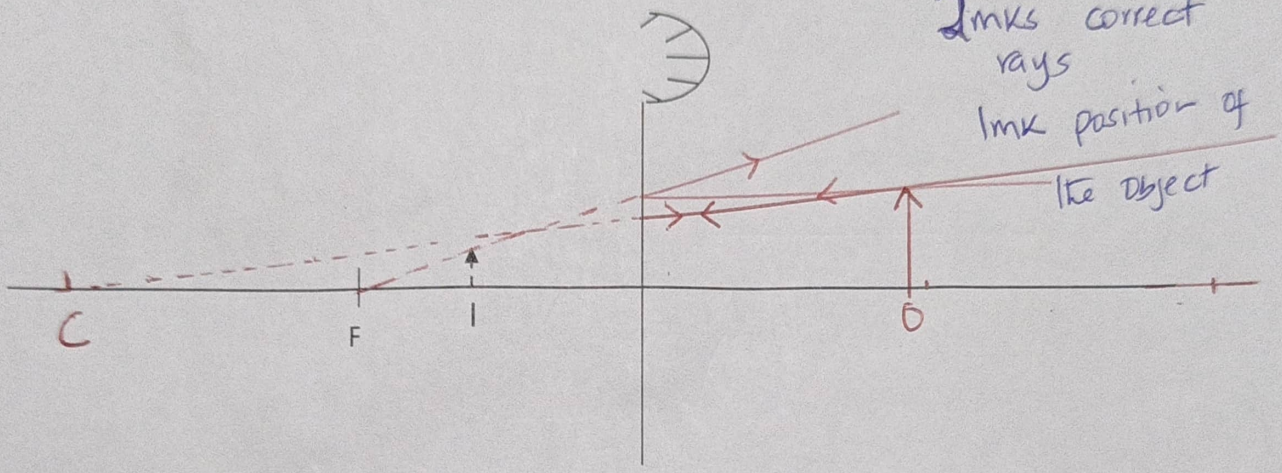
✓1 almost equal Wave With incident Waves

6. A girl standing at a distance claps her hands and hears an echo from a tall building 2 seconds later. If the speed of sound in air is 340m/s, determine how far the building is. (3mks)

$V = \frac{2d}{t}$ ✓1 $d = 340m$ ✓1

$340 = \frac{2d}{2}$ ✓1

7. The figure below (drawn to scale) shows the image I, formed by a convex mirror. F is the virtual principal focus of the mirror.



2mks correct rays
1mk position of the object

Using ray diagrams locate the position of the object and draw the object. (3mks)

8. The table below shows part of the electromagnetic spectrum in order of decreasing wavelength

A	B	INFRA RED RADIATION	VISIBLE LIGHT	C	D

(a) How are waves **C** produced? (1mk)

U.V light produced by the sun, Sparks and mercury vapour lamp

Any one

(b) State one use of the wave **D** (1mk)

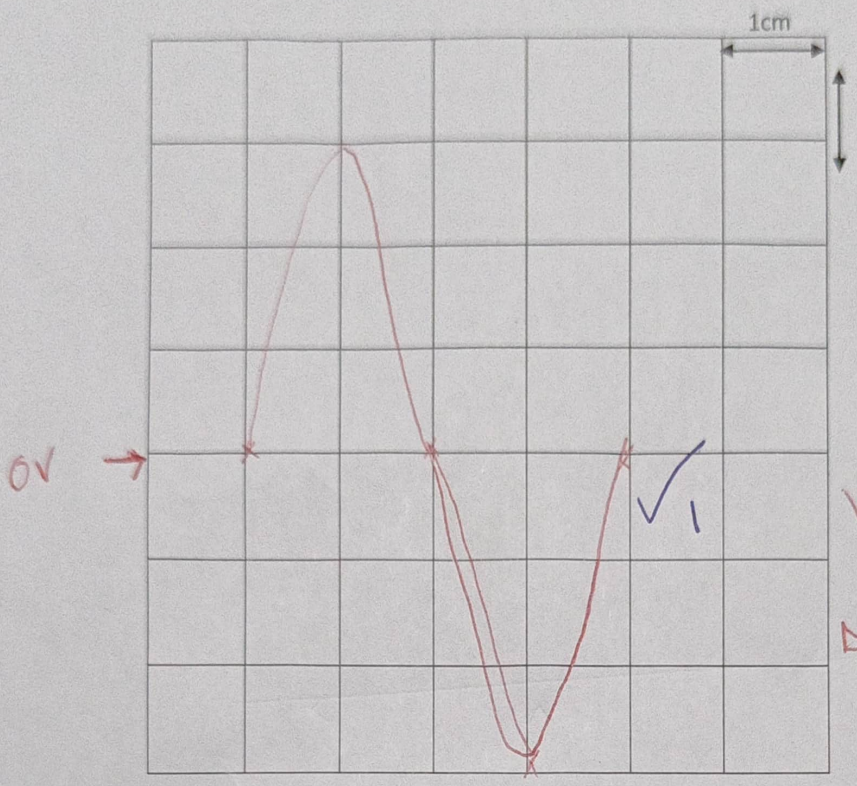
Used in medicine for photography (radiography) Cancer therapy

In crystallography to study crystal lattice

To detect flaws in metals and forgeries

Any one

9. An alternating voltage of peak value 15v and frequency 25Hz is applied to the terminals of a Cathode ray oscilloscope. The Y-gain is set at 5 v/cm and the time base at 10 ms/cm. Draw the trace observed on the screen. (2mks)



√1 Calculation
√1 Diagram

$T = \frac{1}{f}$

$= \frac{1}{25} = 0.04s$ √1

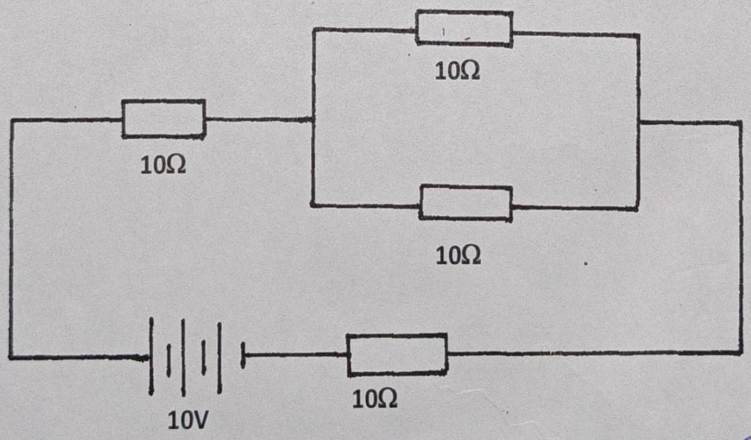
Voltage = Displacement × Sensitivity

$15 = 5 \times 5V/cm$

Displacement = $15V \times \frac{cm}{5V}$

$= 3cm$

10. Four 10Ω resistors are connected to a 10V dc supply as shown in the diagram below.



Calculate the total current flowing in the circuit. √1 (3mks)

$R_T = 10 + \left(\frac{10 \times 10}{10+10}\right) = 10 + \frac{100}{20} = 5\Omega$

$I_T = \frac{V_T}{R_T} = \frac{10}{5} = 2A$ √1 √1

SECTION B (55MKS): Answer ALL the questions in the spaces provided

11. (a) Define the following terms as used in photoelectric effect (1mk)

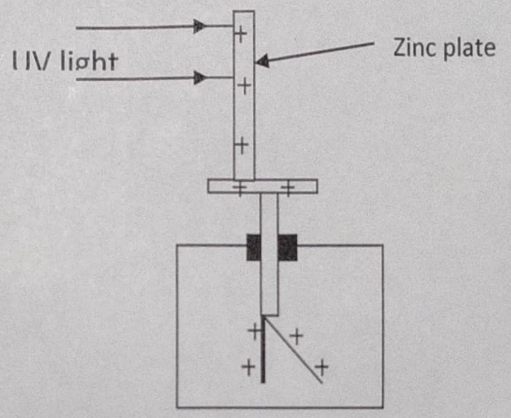
(i) Work function

Is the Minimum energy ✓1 required to dislodge an electron from a Metal surface

(ii) Threshold frequency. (1mk)

Is the minimum frequency ✓1 of radiation that can dislodge an electron from the metal surface or Minimum frequency below which no photo electric effect takes place

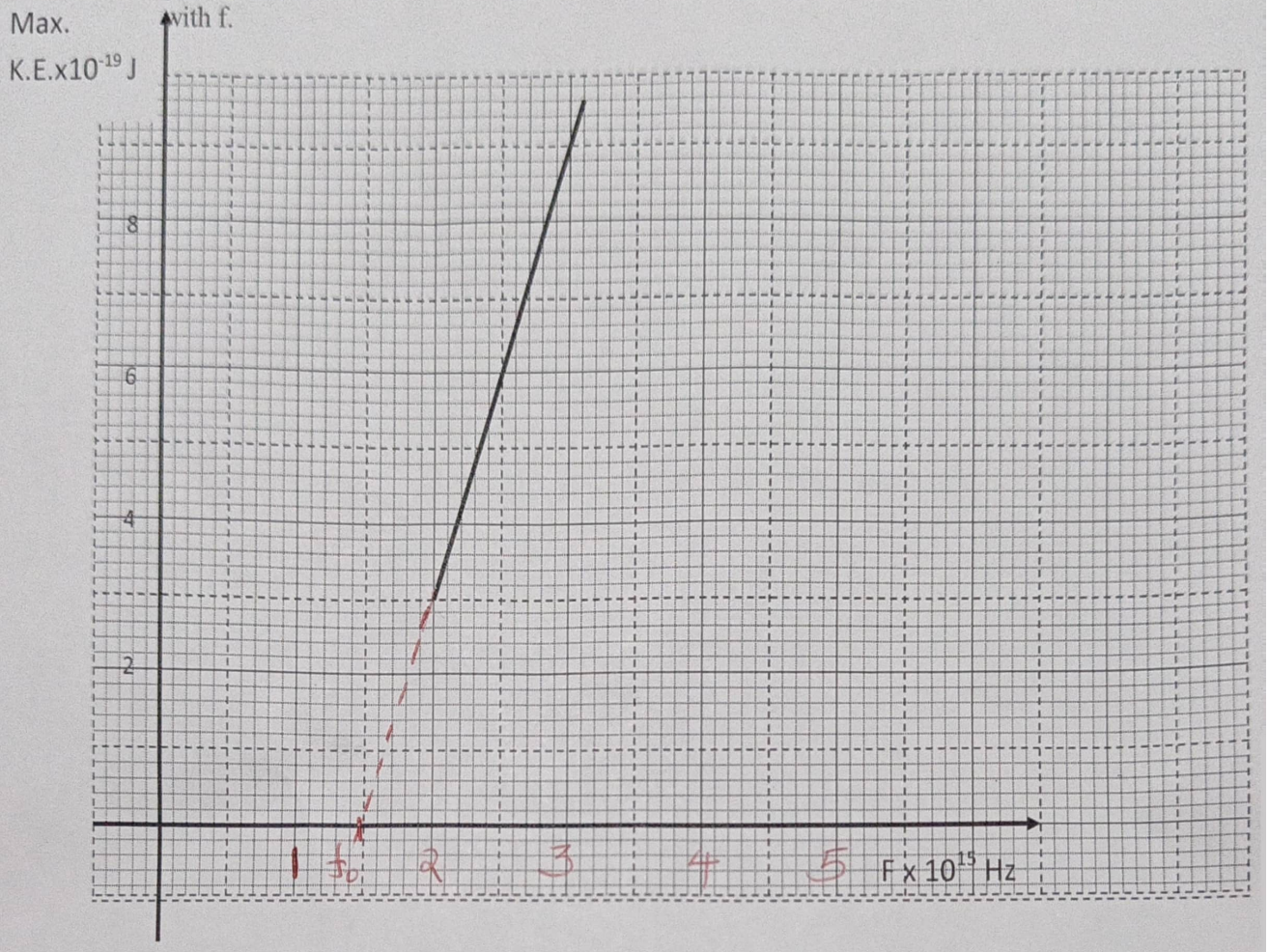
(b) The figure below shows Ultra-violet light striking a polished Zinc plate placed on a positively charged gold-leaf electroscope.



(i) Explain the observations that the leaf did not fall. (1mk)

U.V light dislodges electrons but they are attracted back ✓1 by the highly positive Zinc (electrons do not escape)

(ii) In an experiment using a photocell, U.V light of varying frequency but constant intensity was made to strike a metal surface. The maximum kinetic energy (KE_{Max}) of photoelectrons for each frequency, f, was measured. The graph shows how KE_{Max} varies with f.



Use the graph to determine the:

(I) Threshold frequency (2mks)

$f_o = 1.5 \times 10^{15}$ Hz ✓1 evident in the graph

✓1 Correct Value + Unit

II) Planck's constant (3mks)

$h = \text{slope} = \frac{(3-0) \times 10^{-19}}{(2-1.5) \times 10^{15}} = 6.0 \times 10^{-34}$ Js ✓1 ✓1 ✓1

III) Work function (3mks)

$W_o = hf_o = 6.0 \times 10^{-34} \times 1.5 \times 10^{15} = 9 \times 10^{-19}$ J ✓1 ✓1 ✓1

12. (a) A radioactive element A of half-life 31 days decays to element B. A sample of A of mass 32g is kept in a container. Assuming B is stable, calculate the mass of B that will be in the container after 124 days. (3mks)

$t_{1/2} = \frac{124}{31} = 4$ half-lifes ✓1

32g $\xrightarrow{t}$ 16g $\xrightarrow{2t}$ 8g $\xrightarrow{3t}$ 4g $\xrightarrow{4t}$ 2g ✓1

Amount of B = 32 − 2 = 30g ✓1

OR

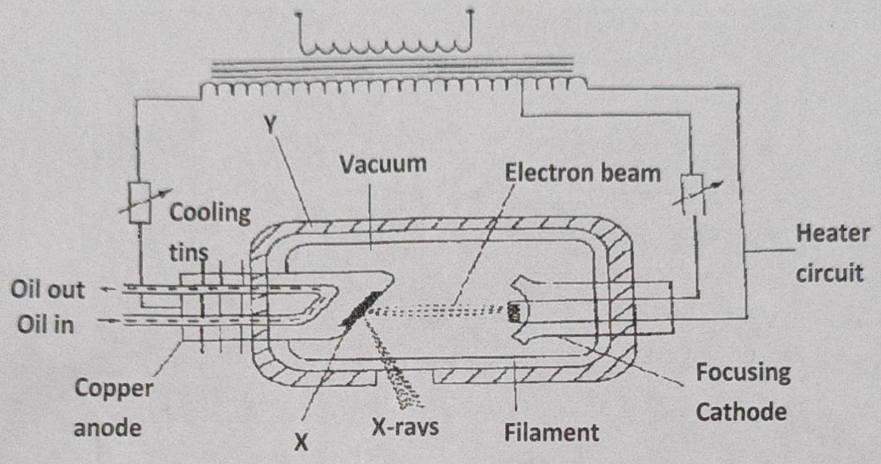
$N = N_0\left(\frac{1}{2}\right)^{t/t_{1/2}}$ ✓1

$= 32\left(\frac{1}{2}\right)^{\frac{124}{31}}$ ✓1

$= 32 \times \frac{1}{16} = 2g$ ✓1

B = 32 − 2 = 30g ✓1

(b) The figure below shows the features of an x-ray tube.



i) Name the parts **X** and **Y** (2mks)

X Target ✓1 made of Tungsten / Molybdenum

Y Lead block/glass ✓1

ii) State the reason why the inner part of an X- Ray tube is evacuated. (1mk)

So as electrons do not loss ~~Kinetic~~ energy as they collide with air molecules

iii) Explain how the X-rays are produced in the X-ray tube. (3mks)

- When the current flows through the filament in the cathode, electrons are produced by thermionic emission ✓1
- The electrons are accelerated towards the target by high potential differences ✓1 between the anode and the cathode
- Most of the Kinetic energy ✓1 of the electrons is converted to heat and the rest to X-rays

iv) X-ray tube operates at 1000KV between the cathode and the anode. Calculate the maximum energy of the X-ray photons produced.
(charge of an electron, $e = 1.6x10^{-19}\ C$). (2mks)

$E = eV$

$= 1.6 \times 10^{-19} \times 1000\,000$ ✓1

$= 1.6 \times 10^{-13}\ J$ ✓1

13 (a) A transformer with 2000 turns in the primary circuit and 150 turns in the secondary circuit has its primary circuit connected to a 800Va.c. source. It is found that when a heater is connected to the secondary circuit it produces heat at the rate of 1000W. Assuming 100% efficiency, determine the:

(i) Voltage in the secondary circuit. (2mks)

$\frac{N_s}{N_p} = \frac{V_s}{V_p}$ $\frac{150}{2000} = \frac{V_s}{800}$ $V_s = \frac{150 \times 800}{2000}$

$= 60V$

(ii) Current in the primary circuit. (2mks)

Power input = Power output

$800 \times I_p = 1000$

$I_p = \frac{1000}{800}$

$= 1.25A$

(iii) Current in the secondary circuit. (1mk)

$1000 = 60 I_s$

$I_s = \frac{1000}{60} = 16.67A$

iv) State the type of transformer represented above. (1mk)

Step-down transformer ✓

(b) (i) State the reason why long distance power transmission is done at a very high voltage and using thick cables. (1mk)

High voltage leads to low current and thick cables ~~dam~~ reduces resistance for Minimal Power loss ✓1

(ii). Calculate the cost of using the following appliances in one month (30 days) of the company rate is Ksh.9.50 per unit. (3mks)

I A 2000W water heater for 2 hours per day.
II A 75W bulb for 10 hours per day.
III An 1500W electric iron for 1 hour per day.

$30[(2\times2)+(0.075\times10)+(1.5\times1\times3)]$ 1KWh = 9.50/=
$1200+22.5+45$ 187.5 = Ksh
$30[4+0.75+1.5]$ ✓1 1781.25 ✓1
Electrical Energy = 187.5KWh ✓1 ✓1

(iii) Find the total monthly bill for the above household if in addition to the energy consumed, the power company charges each consumer. (2mks)

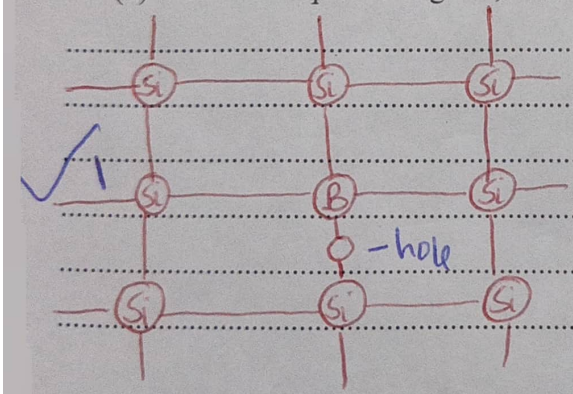
I A standing charge of Ksh.200.
II Fuel cost levy at 70 cents per unit.

$1781.25+200+0.70(187.5)$ ✓1
Ksh: 2115.50 ✓1

14. (a) Define doping as used in electronics (1mk)

Is the process of adding impurities to a pure (intrinsic) semi-conductor to enhance its electrical conductivity

(b) With the help of a diagram, describe how a p-type semiconductor is made. (3mks)



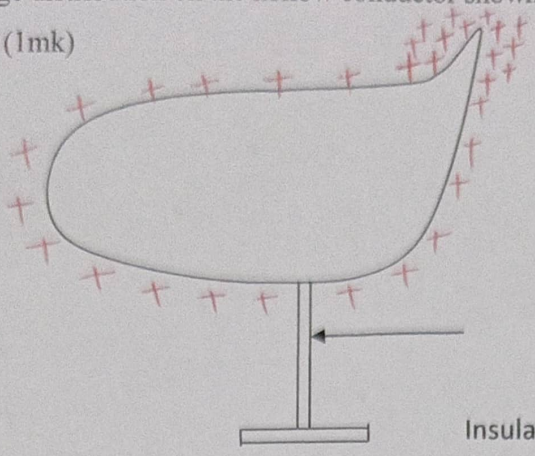
✓1

A trivalent impurity e.g boron is used to doped a pure semi-conductor e.g silicon ✓1
- Silicon has 4 electrons banding covalently with 3 electrons of boron the absent of 1 electron ✓1 results in a hole

(c) Explain what happens to the depletion layer when a diode is forward biased. (2mks)

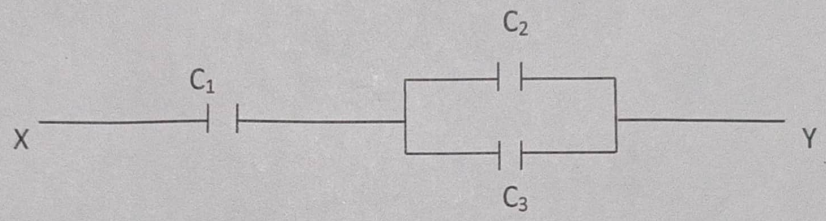
The depletion layer reduces ✓1
Both the holes and electrons are repelled ✓1 by the voltage source into the depletion layer hence reducing it and the diode conducts

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



✓1 higher concentration at sharp point

(e) The diagram below shows a circuit containing three capacitors.



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)

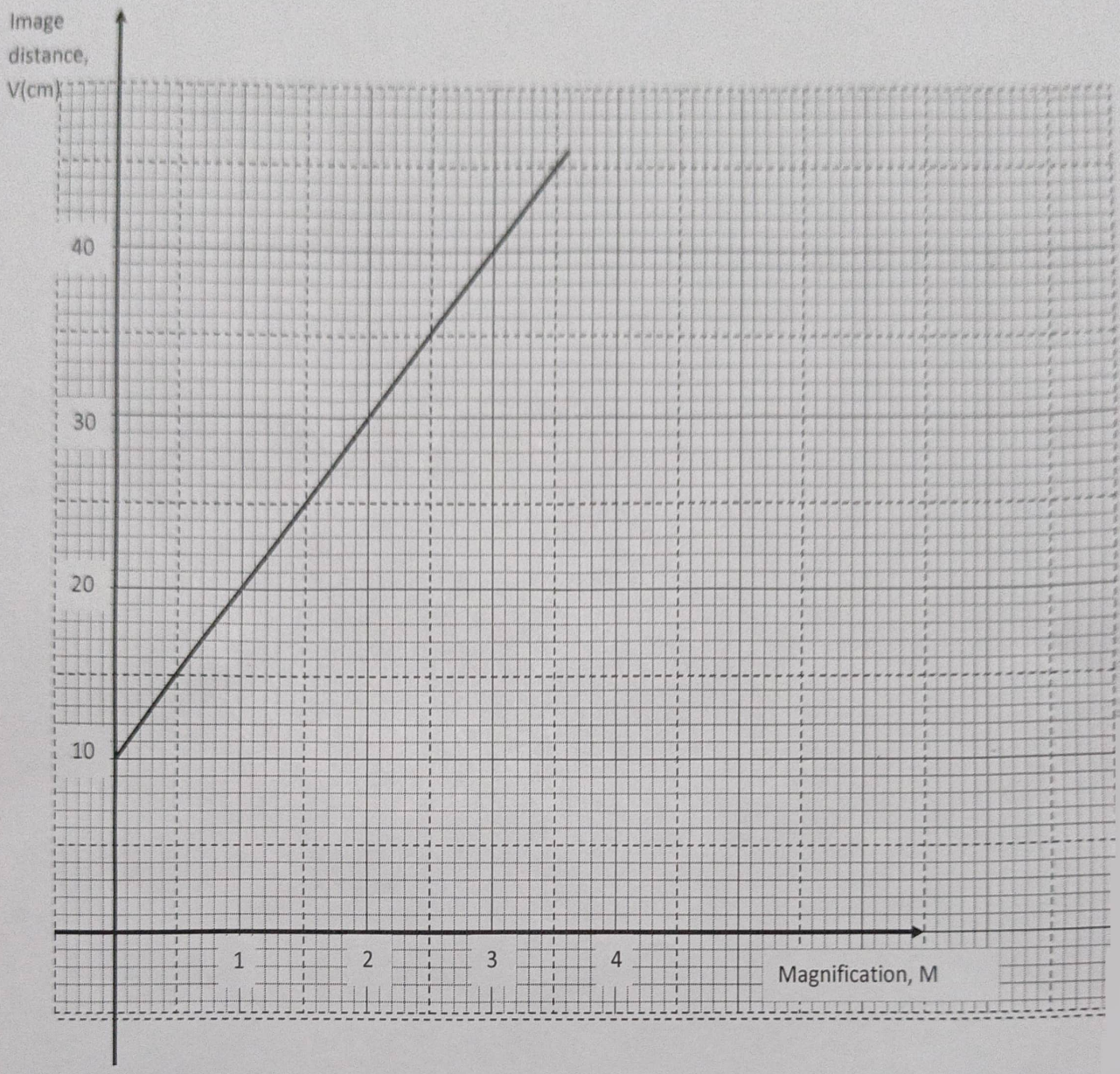
$C_{parallel} = C_2 + C_3 = (4.5+5)\mu F = 9.5\mu F$

$C_{series} = \frac{6 \times 9.5}{6+9.5} = \frac{57}{15.5} = 3.677 \times 10^{-6}\ F$ ✓1

$Q = CV = 3.677 \times 10^{-6} \times 6$ ✓1

$= 22.06 \times 10^{-6}\ C$ OR $2.206 \times 10^{-5}\ C$ ✓1

15. (a) The following graph shows the variation of image distance, v, with magnification, m, for a converging lens.



Using the graph and the equation $\frac{V}{f} = M + 1$ to determine: (3mks)

(i) The object position when the image position is 45cm.

for V = 45cm, m = 3.5

But $m = \frac{V}{u}$ then $u = \frac{V}{m} = \frac{45}{3.5}$ ✓

$= 12.86\,cm$ ✓

(ii) The focal length of the lens. (3mks)

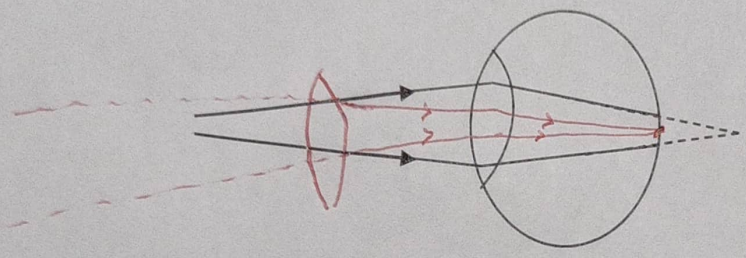
$\frac{V}{f} - \frac{1}{u} = m$ ✓1 | $\frac{4.5}{f} = 4.5$

$\frac{4.5}{f} - \frac{1}{u} = 3.5$ ✓1 | $f = \frac{4.5}{4.5} = 1.0\,cm$ ✓1

(iii) The power of the lens. (2mks)

$Power = \frac{1}{f(m)}$ ✓1 $= \frac{1}{+0.1} = +10D$ ✓1

(c) The following figure shows an eye defect



Lens 1mk

construction of rays 1mk

Name the defect and illustrate on the same diagram how the defect could be corrected. (3mks)

Long Sightedness (Hypermetropia)

or Long Sight

THE END