NAME:.....M/ Scheme.....INDEX NO:.....

SCHOOL:.....DATE:.....

SIGN:.....

232/2
PHYSICS
(THEORY)
DECEMBER 2021

TIME: 2 HOURS

BUTULA SUB COUNTY JOINT EVALUATION

KENYA CERTIFICATE OF SECONDARY EDUCATION (KCSE)

INSTRUCTIONS TO CANDIDATES

1. Write your name and index number in the spaces provided at the top of this page.
2. Sign and write the date of examination in the spaces provided above.
3. This paper consists of **TWO** sections: A and B
4. Answer **ALL** the questions in the sections A and B in the spaces provided.
5. ALL working **MUST** be clearly shown.
6. Non-programmable silent electronic calculators and **KNEC** mathematical tables may be used.

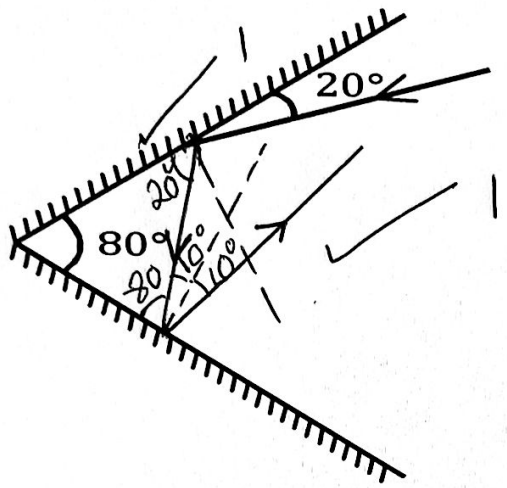
FOR EXAMINERS USE ONLY.

SECTION	QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
A	1 – 11	25	
B	12	10	
	13	11	
	14	10	
	15	11	
	16	13	
Total Score		**80**	

This paper consists of 12 printed pages.
Candidates should check the question paper to ensure that all pages are printed as indicated and that no questions are missing.

SECTION A (25 marks)

1. The figure below shows two mirrors inclined at an angle of 80° to each other. A ray of light is incident on Mirror as shown below.



i) Complete the path of the ray as it emerges. (1 mark)

ii) Indicate the angle of reflection on each mirror. (2 marks)

first $r = 70°$ ✓1 $r = 10°$ ✓1

2. State the reason why the magnetic field strength of a magnet is greatest at the poles.

(1 mark)

Within the magnet, north and South poles of the dipoles cancel out but at the end of the poles they don't. ✓1

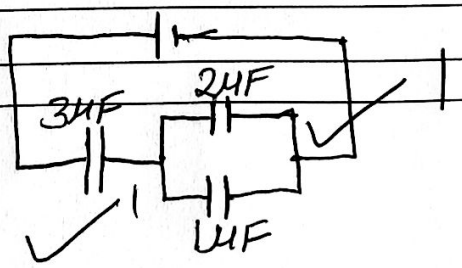
3. You are provided with; 1.0 μF, 2.0 μF and 3.0 μF capacitors. Arrange the three capacitors with a cell such that the total capacitance is 1.5. (3 marks)

1μF and 2μF in parallel

$C_T = \frac{(1+2)\times 3}{(1+2)+3}$ ✓1

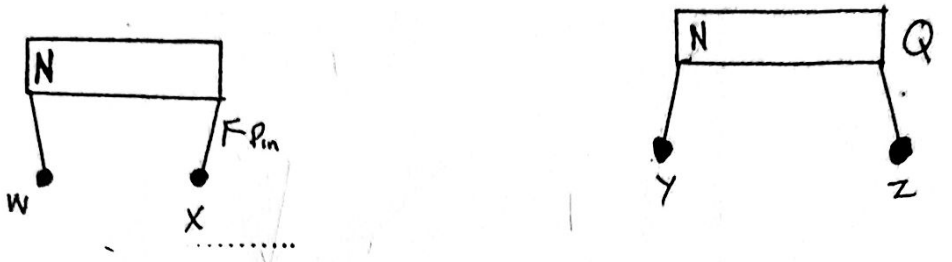
$= \frac{9}{6}$

$= 1.5\mu F$



✓1 ✓1

4. Fours pins were hang onto two magnets as shown.



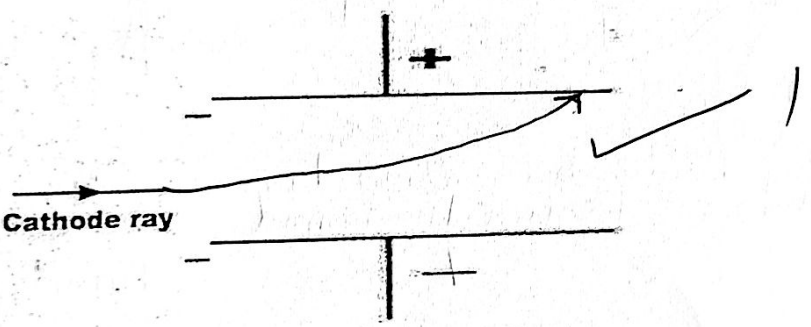
Identify the polarity on end X, Z, and Q. (3mks)

X: South pole ✓ 1

Z: North pole ✓ 1

Q: North pole. ✓ 1

5. **The** Figure shows a cathode ray entering into a region between two charged plates.



Complete the diagram to show the path of the ray in the field. (1 marks)

6. A form two student found the dry cells leaking on removing them from the torch. Name this defect and how is minimized. (2 marks)

Polarization ✓ 1 ✓ 1 ✓ 1
minimised using depolarize, manganese (IV) oxide or potassium dichromate

7. Below is radioactive decay.

$$^{232}_{90}A \xrightarrow{K} {}^{228}_{88}B \xrightarrow{\gamma gamma} {}^{y}_{x}C$$

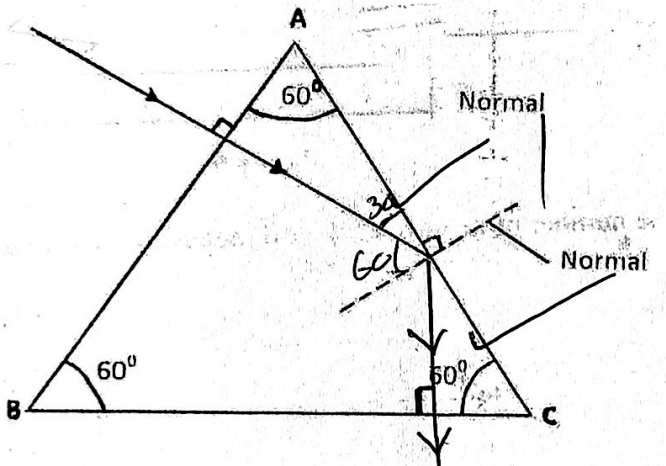
(i) Identify radiation K. (1 mark)

Alpha radiation (α) ✓1

(ii) Determine the values of x and y. (2 marks)

$y = 228$ ✓1 $x = 89$ ✓1

8. **The figure below** shows a ray of light passing into a glass prism ABC.



✓1 for angle 30°

✓1 for drawing ray.

Sketch the path of the ray as it travels from face AC. (*critical angle for glass is 42°*) (2 marks)

9. An electric heater is rated 1000W, 240V. Calculate the resistance of this element. (3 marks)

$P = \frac{V^2}{R}$ ✓1

$1000 = \frac{240^2}{R}$ ✓1

$R = \frac{240^2}{1000}$

$= 57.6\Omega$ ✓1

10. The figure below shows electromagnetic spectrum.

Radiowave	Microwave	A	Visible light	UV	X-ray	Gamma radiation

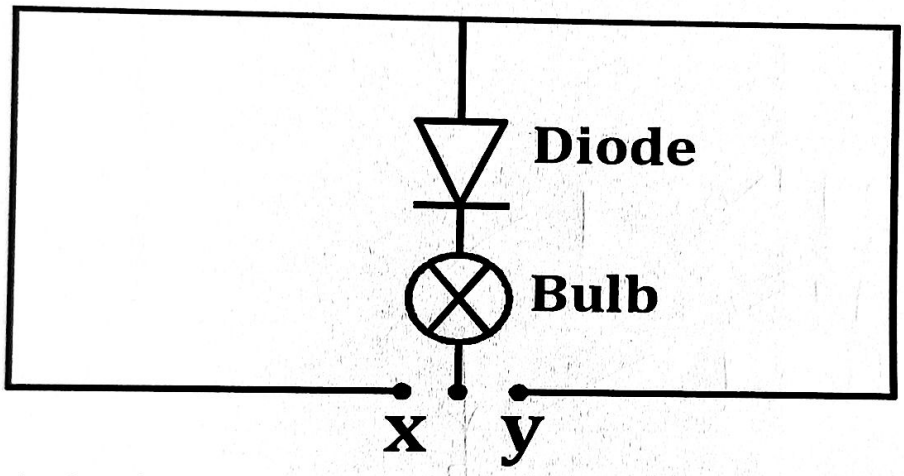
a) Identify A. (1 mark)

Infrared ✓ 1

b) State how A is detected. (1 mark)

Blackened bulb thermometer, Skin. ✓ 1 any 1x1

11. Study the figure below and answer the question that follows.



When switch is closed at x, the lamp lights but when switch is closed at Y, the lamp does not light. Explain this observation. (2 marks)

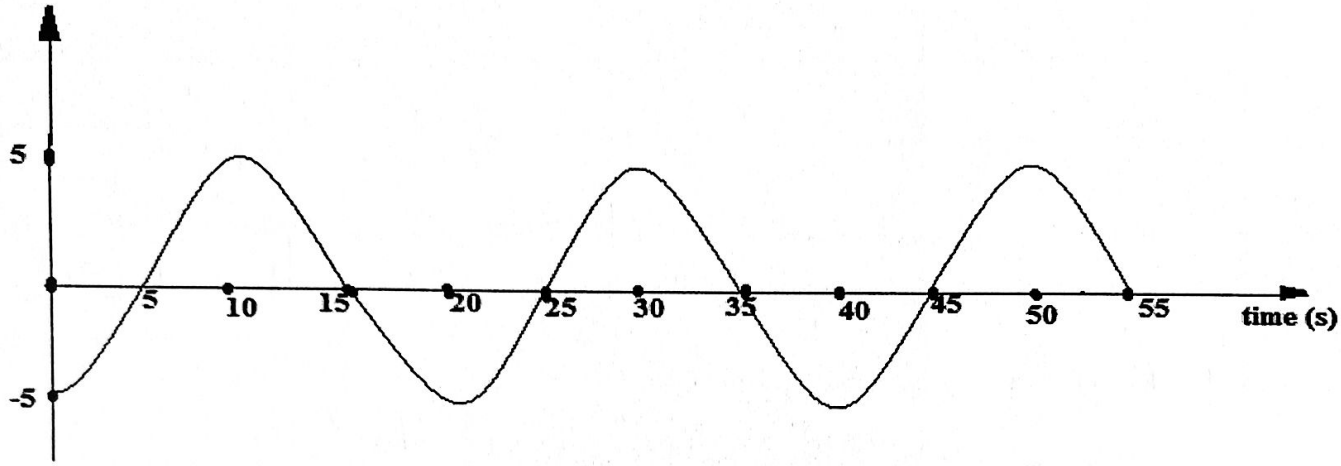
When Switch is at x, diode is forward biased thus allow Current to flow. ✓ 1
When Switch is at Y, dibde is reversed biased Current does not flow. ✓ 1

SECTION B (55 Marks)

12. a) Distinguish between rarefaction and compression. (1 mark)

Rarefaction is a region of low pressure in the wave motion while ✓ 1
Compression is region of high pressure in the wave motion.

b) The **figure** below shows a displacement (cm) time graph for a progressive wave.



i) State the amplitude of the wave. (1mark)

5cm ✓ 1

ii) Determine the frequency of the wave. (2marks)

Period = 20 s ✓ 1

$f = \frac{1}{20}$

$= 0.05$ Hz ✓ 1

iii) Given that the velocity of the wave is 320 cm/s determine its wavelength (3marks)

$V = \lambda f$ ✓ 1

$320 = 0.05\lambda$ ✓ 1

$\lambda = 6400$ cm or 64m

b) A man standing 600 away from a wall bangs two pieces of wood together and hears an echo 2.5 seconds later. Determine the speed of sound in air at that place. (~~2~~ 3 marks)

$\text{Speed} = \frac{2d}{t}$ ✓ 1

$\text{Speed} = \frac{2 \times 600}{2.5}$ ✓ 1

$= 480$ m/s ✓ 1

c) State any one use of x- rays in medicine. (1 mark)

- Identify fractures in the borne ✓ 1
- Identify turmour in the soft tissues ✓ Any (1x1)

13. (a) State two factors that affect photoelectric emission. (2 marks)

- Energy of incidence radiation ✓
- Work function of metal ✓
- Intensity of radiation ✓ Any (2x1).

(b) Light of wavelength 4.3×10^{-7}m is incident on two different metal surfaces, nickel and potassium.

(*Take speed of light as 3.0×10^{8} ms^{-1} and planks constant h, as 6.63×10^{-34}Js*).

(i) Determine the energy of the incident radiation. (3 marks)

$E = hc$ ✓ 1

λ

$= \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{4.3 \times 10^{-7}}$ ✓ 1

$= 4.626 \times 10^{-19}$ J ✓ 1

(ii) If the work function of nickel is 8.0×10^{-19}J and that of potassium is 3.68×10^{-19}J, state with a reason from which of the two metals the given light will eject electrons. (2 marks)

Potassium ✓ 1

Work function of potassium is less than the energy of incidence radiation. ✓ 1

E

(iii) Determine the velocity of the emitted electrons from the metal surface in b(ii). (3 marks)

(Take the mass of an electron as 9.1×10^{-31} kg).

$E = W_o + K.E$ ✓ 1

$4.626 \times 10^{-19} - 3.68 \times 10^{-19} = \frac{1}{2} \times 9.1 \times 10^{-31} v^2$ ✓ 1

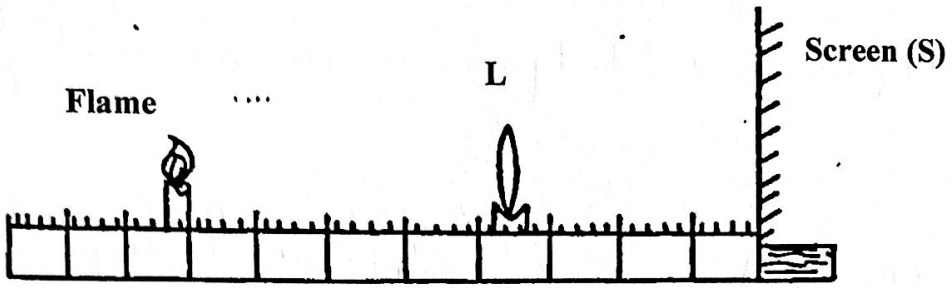
$\frac{1}{2} \times 9.1 \times 10^{-31} v^2 = 9.4558 \times 10^{-20}$

$v = \sqrt{\frac{9.4558 \times 10^{-20} \times 2}{9.1 \times 10^{-31}}}$

$= 4.56 \times 10^{5}$ m/s ✓ 1

7

14. a) Figure below shows an experimental set up consisting of a mounted lens, I, A screens, a metre rule and a candle



i) Describe how the set up may be used to determine the focal length f, of the lens. (3 marks)

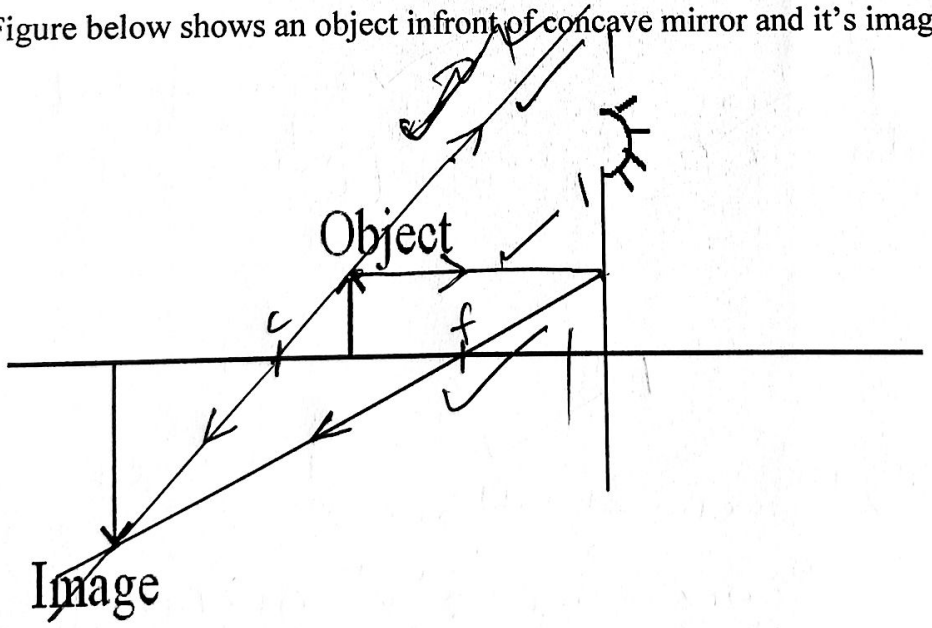
- Place the candle at 0cm mark. Adjust screen until a sharp image is obtained on the screen.
- Measure u and v; Record u and v. Reduce u by say 5cm. and obtain new values of u and v. Repeat the procedure to obtain several values of u and v. Record results on the table and draw a graph $\frac{1}{v}$ vs $\frac{1}{u}$. The intercept on $\frac{1}{v}$ will give $\frac{1}{f}$. hence f can now be obtained.

ii) State why the set up would not work if the lens were replaced with a diverging lens.

(1 mark)

The image may not be focussed on the screen.

b) The Figure below shows an object infront of concave mirror and it's image.



i) Locate position of its principal focus. 3 (2 marks)

ii) If the figure is drawn to scale, determine the magnification. (2 marks)

$v = 5.9$ ✓ | errors
$u = 3.1$ ✓ | If heights is used.
$m = \frac{5.9}{3.1} = 1.90$ ✓ | $m = \frac{2.1}{1.0} = 2.1$ Accept both.

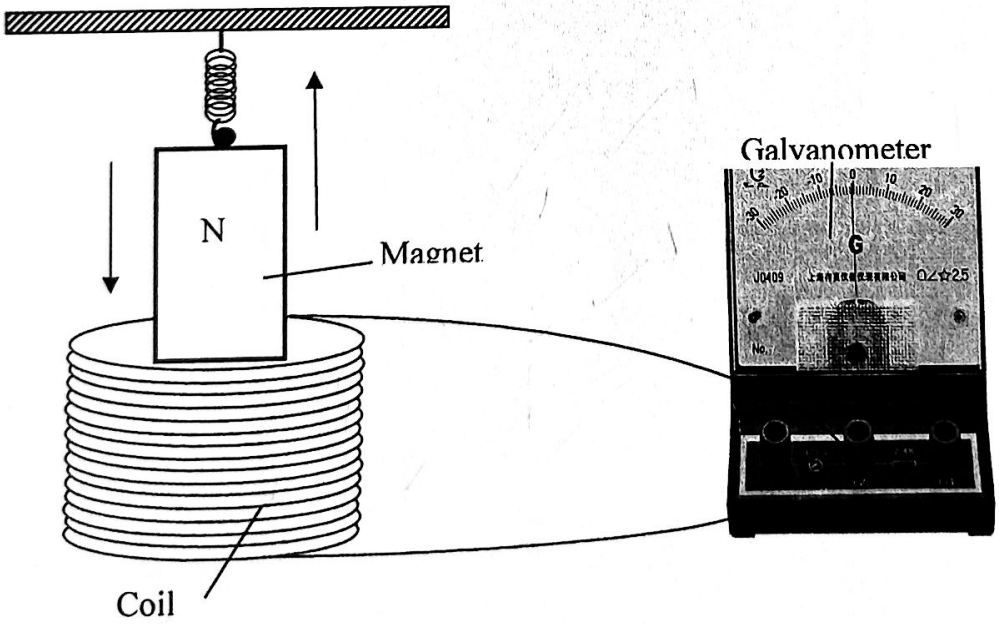
c) State two reason why a convex mirror is preferred over a plane mirror for use as a driving Mirror. (2 marks) 1

- ~~Give an upright image~~ ✓
- Wide field field of view, ~~wide~~ angle/range ✓

15.a) State Lenz's law. (1 mark)

The direction of induced e.m.f is such that the induced current it causes to flow produces a magnetic effect that opposes the change producing it. ✓

b) The diagram in the figure below shows a bar magnet attached to a spring oscillating through a coil connected to a galvanometer.



(i) State and explain the observations made on the pointer of the galvanometer.(2 marks)

The pointer moves from left to right through zero at the frequency of oscillation of the magnet. When magnet moves down, the magnetic flux cuts the coil inducing e.m.f in the coil. Pointer deflects in one direction. The same result on the pointer but in different direction.

ii). Explain why the oscillations dies off very fast. (1 mark)

The induced e.m.f causes current flow in a direction such as to oppose the downward and upward movement causing the reduced oscillation.

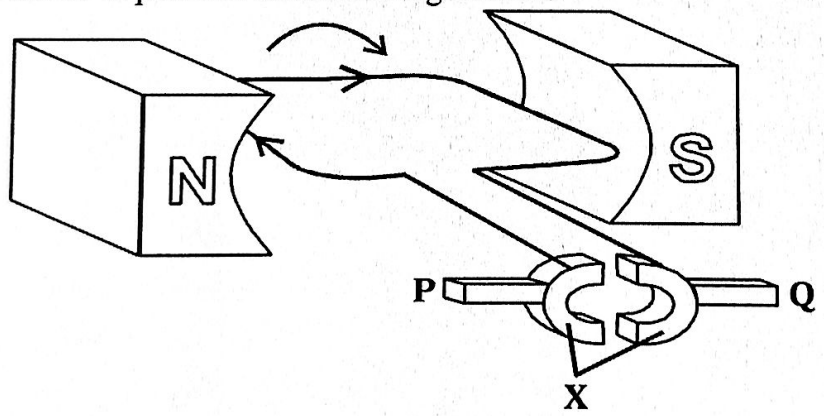
c) The primary coil of a transformer has 1200 turns and the secondary coil has 60 turns. The transformer is connected to a 240V a.c source. Assume there are no energy losses, determine secondary voltage (2 marks)

$\frac{V_S}{V_P} = \frac{N_S}{N_P}$

$\frac{V_S}{240} = \frac{60}{1200}$ ✓

$V_S = 12V$ ✓

d) The following figure shows a coil in a magnetic field. The coil is rotated in the direction shown by the arrow to produce an alternating current.



i)Name the parts labelled X. (1 mark)

Split ring ✓

ii) State two factors that influence the magnitude of the induced e.m.f (2 marks)

- Strength of magnetic field ✓
- Number of turn of a coil ✓
- Rate of change of magnetic flux ✓

Any two (2×1)

e) State and explain any ~~two~~ one ways by which energy losses are minimized in a transformer. (2 marks)

- Use of iron core to minimise energy losses by hysteresis
- Use thick copper wire to minimise energy loss by copper heating
- Flux leakage is minimised by winding secondary coil over primary coil.

Any (1 x 1)

18. a) Give a reason why power is transmitted at high voltage. (1 mark)

Minimise power loss through resistance in the wire

b) The cost of electricity in a region is sh.7.20 per kwh.

I. a 1.5KW water heater for 1 hour per day.
II. a 100W light bulb for 30 days at 12 hours per day and
III. a fan of resistance 24ohms connected to a 240V supply for 30 days at 2 hours per day.

i) What would be the monthly bill for a household using the above appliances? (3 marks)

$\left(\frac{1.5\times1}{1000}\times12\times30+\frac{240^2}{24}\times\frac{30\times2}{1000}\right)$ ✓ 1

$1.5+36+144=181.5$ ✓ 1

$181.5\times7.20=1306.8/=$ ✓ 1

ii) In addition to the energy consumed, the company charges each customer the following.

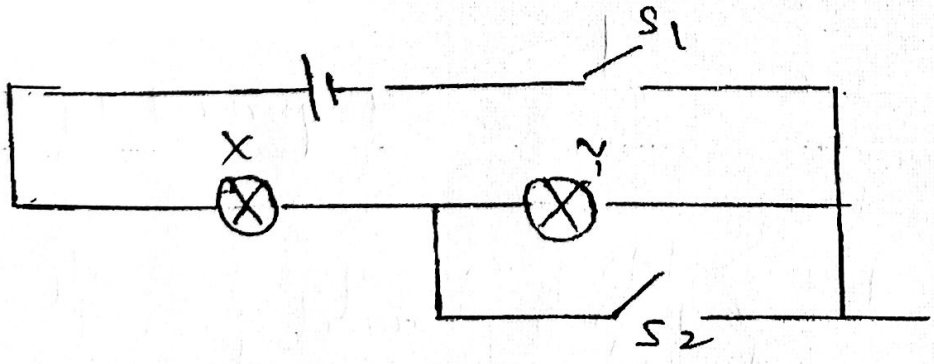
I. a monthly standing charge of sh.150.00.
II. a fuel cost levy of 50 cents per kwh consumer.
III. a foreign exchange levy of 40cts per kwh.
IV. a value added tax of 16% of the monthly energy consumption

Find the total monthly bill. (2 marks)

$1306.8+150+\frac{181.5\times50}{100}+\frac{181.5\times40}{100}+\frac{16}{100}\times1306.8$

$=4647.24/=$ ✓ 1

c) The figure below shows an electric circuit with two bulbs X and Y, which are identical.



Explain what happens to the bulbs when:

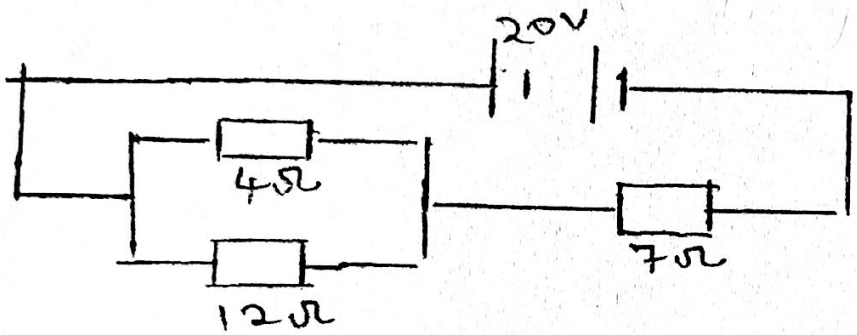
i) S_1 only is closed. (1 mark)

X and Y light with same brightness, Same current flows through the bulb.

ii) S_1 and S_2 are closed. (1 mark)

X lights brightly, Y does not light. No current flows through Y since it is short circuit

d) The figure below shows an electric circuit.



Find

(i) the effective resistance. (2 marks)

$R_T = \frac{4 \times 12}{4+12} + 7$

$= 10\Omega$

ii) the current supplied by the battery (3 marks)

$I = V / R_T$

$= \frac{20}{10}$

$= 2A$