SECTION B: (55 marks)

Answer all the questions in this section in the spaces provided.

15 (a) **Figure 4** shows a gold - leaf electroscope.

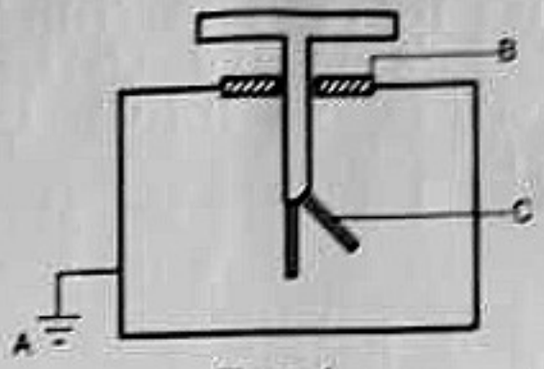

Figure 4

(i) Identify the part labelled A. (1 mark)

Earth connection

(ii) State the function of the parts labelled.

(I) B (1 mark)

protects the gold leaf from the effects of draught.

(II) C (1 mark)

shows the presence of the charge by repelling each other.

(b) A highly negatively charged rod is slowly brought close to a lightly positively charged gold leaf electroscope.

(i) State what is observed on the gold leaf. (1 mark)

The gold leaf falls then diverges.

(ii) Explain the observation made in b(i). (2 marks)

The high negative charge attracts the positive charge causing the fall of the leaf. It then repels the negative charge to the leaf causing the divergence.

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10 Explain why it is not advisable to leave a lead acid accumulator in the discharge condition for a long time. (2 marks)

- It destroys the cells.

11 State two properties that distinguish electromagnetic waves from mechanical waves. (2 marks)

- They travel through space with the speed of light.
- They don't require material medium for transmission

12 Thorium element decayed to produce gamma radiation as shown in the equation below:

$^{a}_{90}Th \rightarrow {}^{230}_{b}Th + \gamma$. State the values of a and b. (2 marks)

a = 230

b = 90

13 A student observed a rainbow when it was raining and the sun was shining. Explain how dispersion of white light by rain drops leads to the formation of the rainbow. (2 marks)

- The colours of white light travel with the same velocity in vacuum and not in other media. Due to different velocities the colours separate in the transparent raindrops

14 State the reason why sound waves get refracted away from the ground on a hot day. (1 mark)

The colder air above and warmer air below on the ground makes sound to move at different velocities

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7 **Figure 2** shows a student using a small plane mirror to view her image.

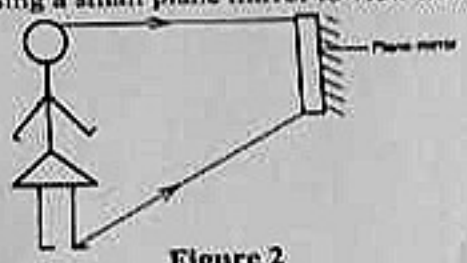

Figure 2

Explain why the student is able to see her face but not her legs in the mirror. (2 marks)

light travels in a straight line. Since the mirror is perpendicular, reflected rays will be perpendicular

8 **Figure 3** shows a coil made from tungsten being used to heat some water in a beaker at a constant voltage.

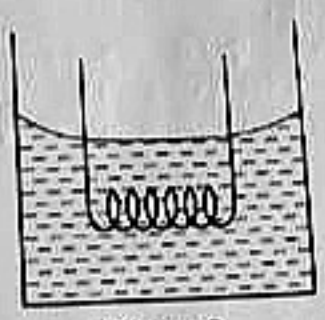

Figure 3

State **two** ways in which the coil can be improved so that the water boils in a shorter time. (2 marks)

- Increase the number of turns
- Use a metal of high conductivity like aluminium

9 Describe how a cathode ray oscilloscope may be used to measure the voltage of an alternating signal. (3 marks)

- The signal is fed into the Y-plates of the with the time base on. The time base is adjusted to give the output signal on the screen. The number of divisions of the Y-gain is noted. Then Peak voltage is calculated as peak voltage = Y-gain x number of divisions

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17 (a) Figure 8 shows a setup that may be used to investigate photoelectric effect. In the setup, a UV source is placed close to the window.

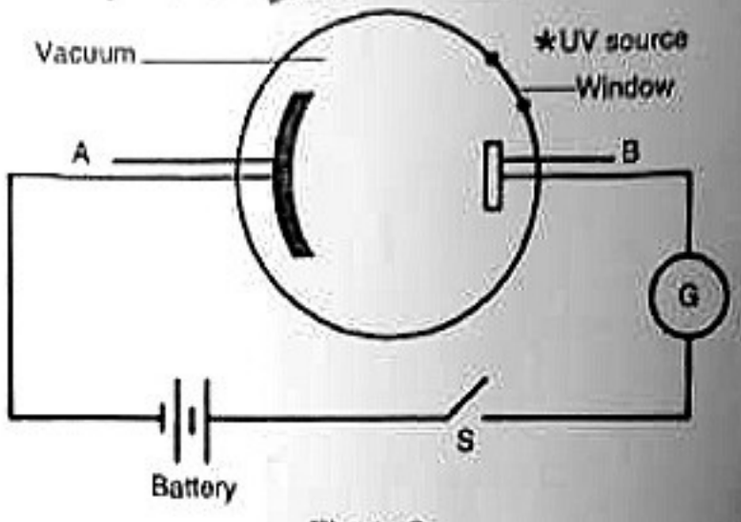

Figure 8

(i) Explain what is observed on the galvanometer when the window is opened and the switch is closed. **(3 marks)**

The galvanometer shows deflection. The light of sufficient frequency falls on the cathode dislodging photoelectrons that flows to constitute current.

(ii) Explain why parts A and B are placed in a vacuum. **(2 marks)**

To prevent dislodged photoelectrons from interacting with air particles to loose their energy. When they collide with air particles they loose energy and will not reach the anode.

(b) A photon of red light has a wavelength of 8.0×10^{-1} m. Determine the energy it contains. (*Planks constant h is 6.63×10^{-34} Js and the speed of light c is 3.0×10^{8} ms^{-1}*) **(3 marks)**

$\lambda = 8.0 \times 10^{-1}$ m

$E = \frac{hc}{\lambda}$

$= \frac{6.63 \times 10^{-34} \times 3.0 \times 10^{8}}{8.0 \times 10^{-1}}$

$= 2.48625 \times 10^{-25}$ Joules

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(c) A metal surface has a work function of 4.5 eV. (*Planks constant h is 6.63×10^{-34} Js and the electronic charge e is 1.6×10^{-19} C*).

Determine the;

(i) work function of the metal in joules (J). **(2 marks)**

1 eV = 1.6×10^{-19} J

4.5eV = ?

$= 4.5 \times 1.6 \times 10^{-19}$

$W_0 = 7.2 \times 10^{-19}$ Joules

(ii) maximum wavelength of a radiation that will cause electrons to be emitted from the surface. **(3 marks)**

$W_0 = h\frac{c}{\lambda_0}$

$\lambda_0 = \frac{hc}{W_0} = \frac{6.63 \times 10^{-34} \times 3.0 \times 10^{8}}{7.2 \times 10^{-19}}$

$= 2.7625 \times 10^{-7}$ M

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16 (a) State Fleming's left hand rule. (1 mark)

If the left hand is held with the thumb, the first finger and the second fingers mutually at right angles so that the first finger points in the direction of the magnetic field and the second finger in the direction of the current the thumb points in the direction of motion

(b) Figure 7 shows an electric motor with a coil ABCD in the magnetic field.

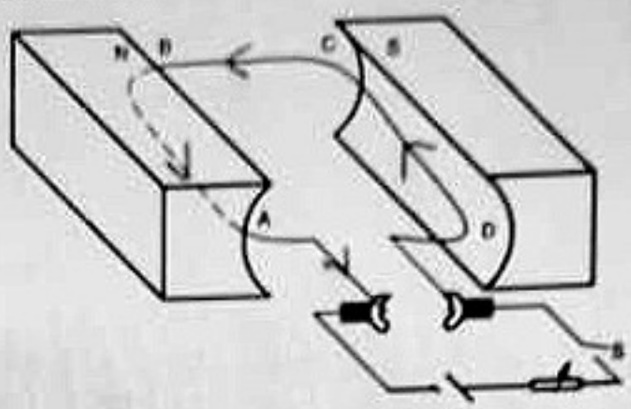

Figure 7

(i) Indicate with an arrow on the coil ABCD, the direction of the current I when switch S is closed. (1 mark)

(ii) State the direction in which the coil rotates when the switch is closed. (1 mark)

CLOCKWISE direction

(iii) Explain what makes the coil to rotate. (3 marks)

By Flemming's left hand rule, the side AB experiences an upward force and DC a downward force. Since current is the same, the forces are equal and opposite causing the coil to rotate in a CLOCKWISE direction

(iv) State three ways in which the power of this motor can be increased. (3 marks)

- Increasing the number of turns of the rotating coil
- Using a stronger magnet
- winding the coil on a soft iron core

(v) State the purpose of the rheostat in the setup. (1 mark)

To varies the current flowing in the coil

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