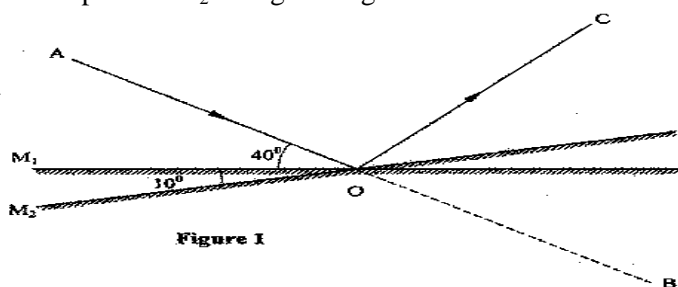


## K.C.S.E YEAR 2010 PAPER 2

### SECTION A (25 marks)

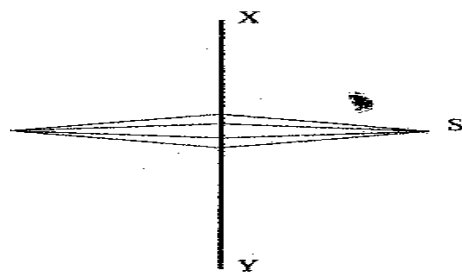
Answer **ALL** the questions in this section in the spaces provided.

1. Figure 1, shows a ray of light incident on a plane mirror at O. The mirror is then rotated anticlockwise about O from position  $M_1$  to position  $M_2$  through an angle of  $10^\circ$ . The final reflected ray is OC.



Determine the angle of deviation BOC.

2. **Figure 2(a)**, shows a magnetic compass placed under a horizontal wire XY



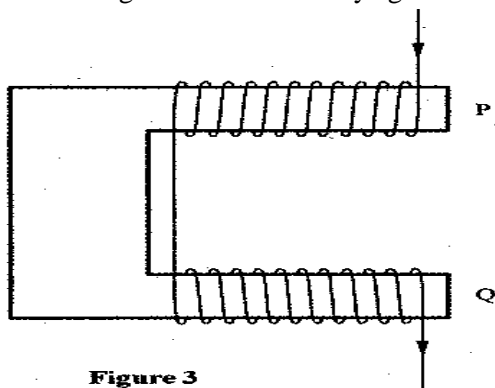
**Figure 2(a)**



**Figure 2(b)**

A large current is passed from X to Y. Draw the final position of the magnetic compass needle in figure

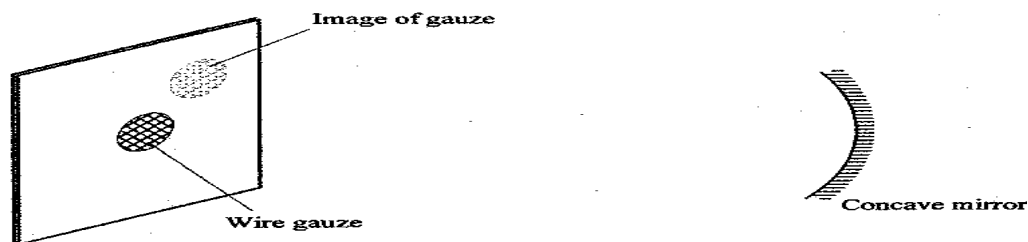
3. **Figure 3**, shows a diagram of a current-carrying wire wound on a U-shaped soft iron



**Figure 3**

Draw the magnetic field pattern around P and Q.

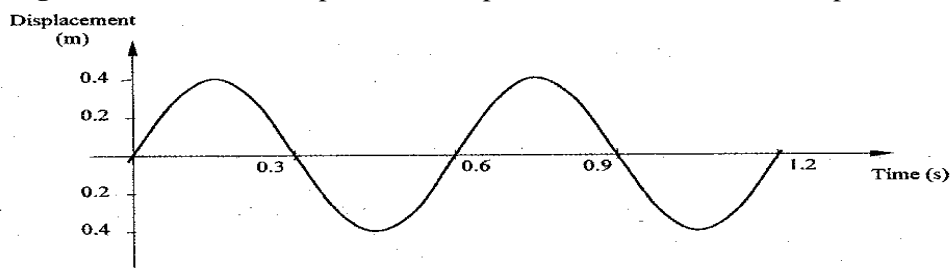
4. A positively charged sphere is suspended by an insulating thread. A negatively charged conductor is suspended near it. The conductor is first attracted, after touching the sphere it is repelled. Explain this observation.
5. **Figure 4**, shows a bright electric lamp placed behind a screen which has a hole covered with a wire gauze. A concave mirror of focal length 25cm is placed in front of the screen. The position of the mirror is adjusted until a sharp image of the gauze is formed on the screen.



**Figure 4**

Determine the distance between the mirror and the screen.

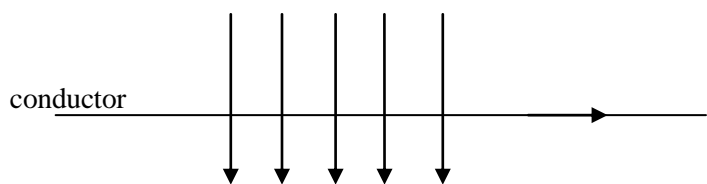
- 6 Explain why electric power is transmitted over long distances at high voltages.
7. **Figure 5**, shows how the displacement of a point varies with time as a wave passes it.



**Figure 5**

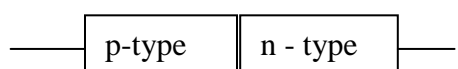
On the same diagram, draw a wave which passes the point with half the amplitude and twice the frequency of the one shown.

8. A water wave of wavelength 18 mm is incident on a boundary of shallow water at right angles. If the wavelength in the shallow end is 14.4 mm, determine the refractive index of water for a wave moving from the deep to the shallow end.
9. The initial mass of a radioactive substance is 20g. The substance has a half-life of 5 years. Determine the mass remaining after 20 years.
10. A current  $I$  flowing through a wire of resistance  $R$  was increased seven times. Determine the factor by which the rate of heat production was increased.
- 11 **Figure 6**, shows a horizontal conductor in a magnetic field parallel to the plane of the paper.



State the direction in which the wire may be moved so that the induced current is in the direction shown by the arrow.

12. An x-ray tube produces soft x-rays. State the adjustment that may be made so that the tube produces hard x-rays.
13. The wavelength of a radio wave is 1km. Determine its frequency. (Take the speed of light as  $3.0 \times 10^8 \text{ ms}^{-1}$ )
14. **Figure 7**, shows a block diagram of a p-n junction diode.

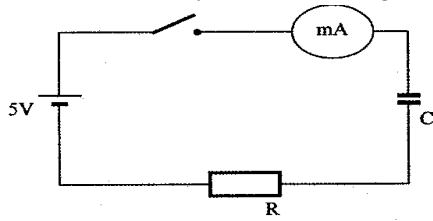


On the same diagram, show how a battery may be connected so that the diode is reverse biased.

**SECTION B** (55 marks)

Answer ALL the questions in this section in the spaces provided. **15**

15. (a) **Figure 8**, shows a circuit that may be used to charge a capacitor.



**Figure 8**

- (i) state the observation on the millimeter when the circuit is switched on;
  - (ii) explain the observation in (i) above.
- (b) The circuit in **figure 8** is left on for some time. State the value of p.d. across:
- (i) the resistor R;
  - (ii) the capacitor C;
- (c) sketch the graph of potential difference (V) across R against time.
- (d) **Figure 9** shows three capacitors connected to a 10V battery.

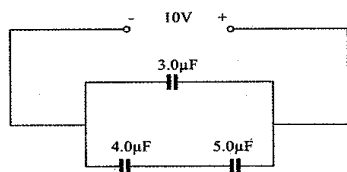


Figure 9

Calculate:

- (i) the combined capacitance of the three capacitors;
  - (ii) the charge on the 5.0 µF capacitor.
- (b) Figure 11, shows a pin 60 mm long placed along the principal axis of the lens used in part (a). The near end of the pin is 80 mm from the lens

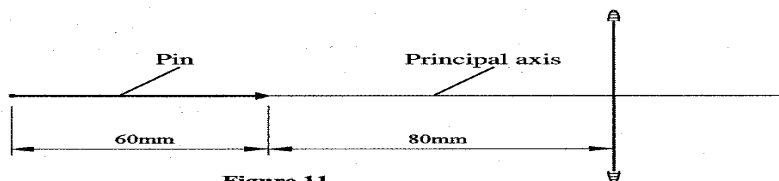


Figure 11

Determine the length of the image.

- 17 (a) **Figure 12**, shows an electrical circuit including three switches,  $S_1$ ,  $S_2$ ,  $S_3$ , and three identical lamps  $L_1$ ,  $L_2$ ,  $L_3$ . A constant potential difference is applied across X and Y.

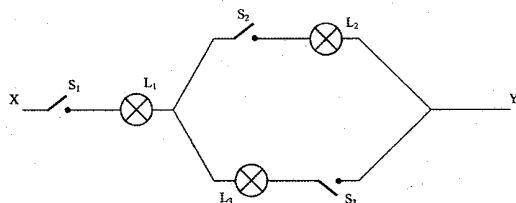
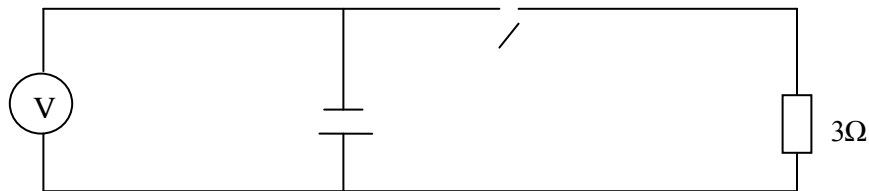


Figure 12

- (i) Other than  $L_1$ , state the lamp that will light when  $S_1$  and  $S_2$  are closed.
- (ii) How does the brightness of  $L_1$  in (i) above compare with its brightness when all the switches are closed?
- (iii) Explain the observation in part (ii) above.

(b) **Figure 13**, shows a cell in series with a  $3\Omega$  resistor and a switch. A high resistance voltmeter is connected across the cell.



**Figure 13**

The voltmeter reads 1.5V with the switch open and 1.2V with the switch closed.

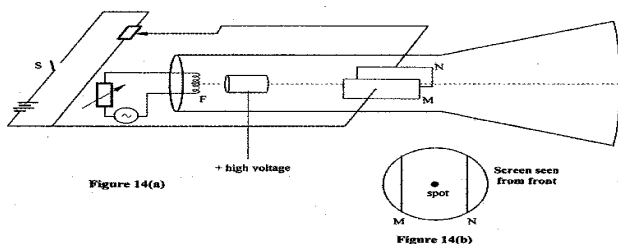
(i) State the electromotive force of the cell.

(ii) Determine the current through the  $3\Omega$  resistor when the switch is closed.

(iii) Determine the internal resistance of the cell.

(c)(i) Another resistor R is connected in series with the  $3\Omega$  resistor so that a current of 0.15A flows when the switch is closed. Determine the resistance of R.

18. **Figure 14a**, is a diagram of a cathode ray tube. M and N are parallel vertical plates.



(a) When switch S is open, a spot is seen at the centre of the screen as shown in **figure 14(b)**.

(i) State what happens to the spot when S is closed.

(ii) State what would happen to the spot if the potential difference across MN is increased.

(iii) State what would be seen on the screen if the battery is replaced with an alternating emf of:

(I) a low frequency of about 1 Hz;

(II) a high frequency of about 50Hz.

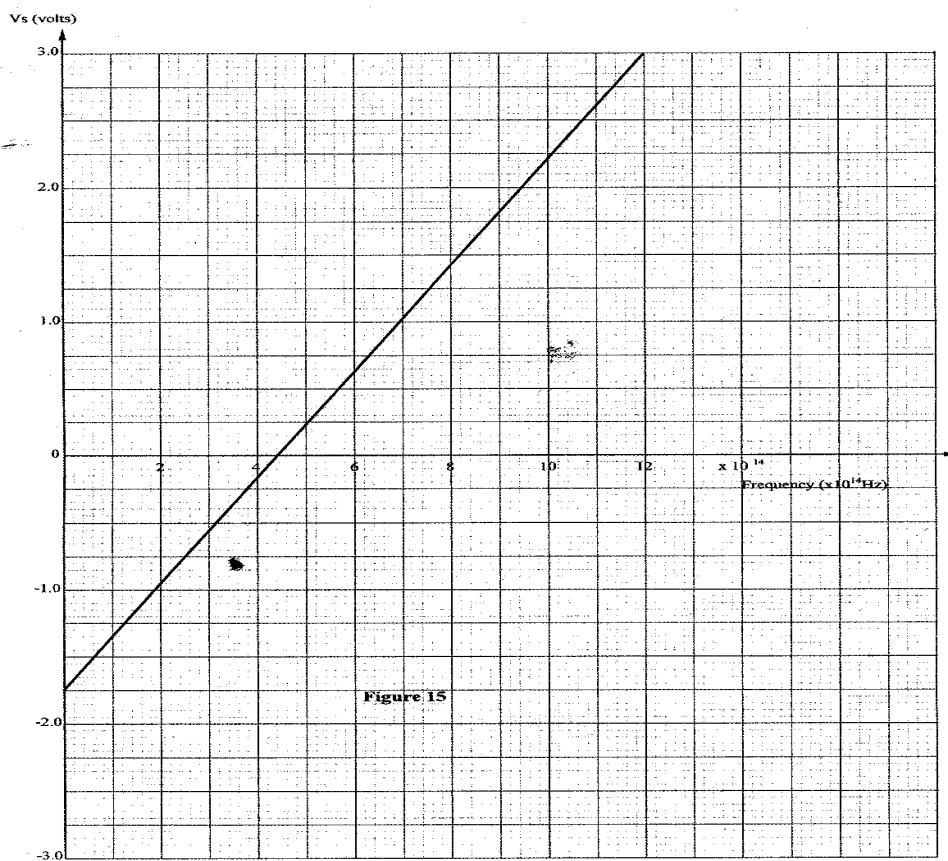
(b) Explain the process by which electrons are produced at F.

(c) State with a reason how the brightness of the spot can be increased.

(d) The accelerating voltage of the tube is 1000V and the electron current in the beam is 1.5mA. Determine the energy conveyed to the screen per second.)

19. (a) State the property of radiation that determines the number of electrons emitted when a radiation falls on a metal surface.

(b) **Figure 15** is a graph of the stopping potential  $V_s$  against frequency in an experiment on photoelectric effect.



- (i) What is meant by stopping potential?
- (ii) Given that the stopping potential  $V_s$  is related to the frequency by the equation.
- $$V_s = \frac{h}{e} f - \frac{w_0}{e}$$
- Where  $e$  is the charge of an electron, ( $e = 1.6 \times 10^{19} \text{C}$ )
- Determine from the graph:
- (I) plank's constant,  $h$ ;
- (II) the work function  $w_0$  for the metal in electron volts (eV).