3 A circuit used to investigate the photoelectric effect is shown in Fig. 3.1.

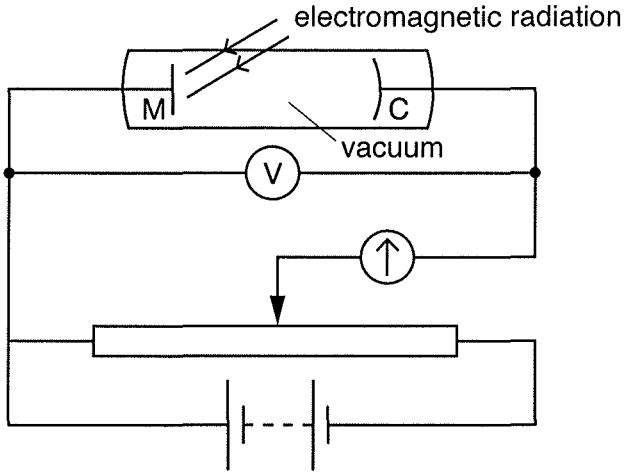

Fig. 3.1

A potential divider circuit is connected to two metal electrodes M and C enclosed in an evacuated glass tube.

The electromagnetic radiation incident on M is of a single frequency and constant intensity.

The voltmeter measures the potential difference V between the electrodes and a sensitive meter measures the current I between the electrodes. The potential difference applied across M and C can be changed from positive to negative by reversing the battery terminals.

(a) State, in terms of energy changes, the required condition for electromagnetic radiation to cause electrons to be emitted from the surface of M.

.....

.....

.....

..... [2]

(b) The variation with potential difference V of current I is shown in Fig. 3.2.

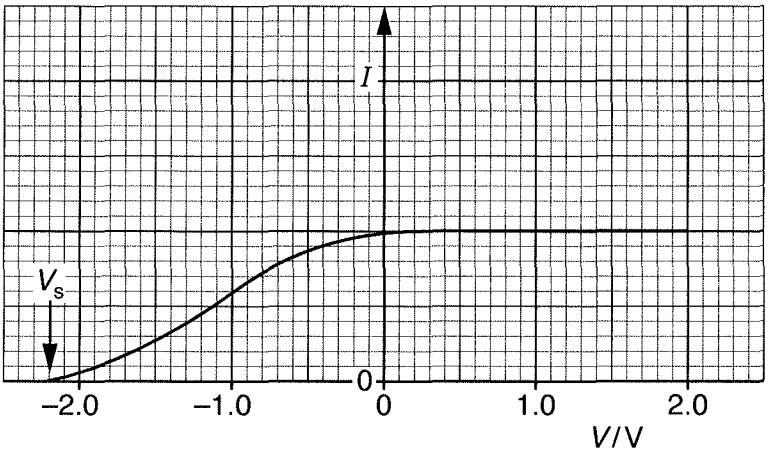

Fig. 3.2

(i) Explain, in terms of the energy changes of the emitted electrons, why there is a minimum potential difference, V_s, to reduce the current to zero.

.....

.....

..... [1]

(ii) Explain why the current does not continue to increase for positive values of V.

.....

.....

..... [1]

(c) The work function of metal of M is 1.8 eV. Use Fig. 3.2 to calculate the frequency of the electromagnetic radiation.

frequency = ... Hz [2]

(d) The frequency of the electromagnetic radiation is kept constant as its intensity is doubled. On Fig. 3.2 sketch a graph to show the variation with V of I for this increased intensity. [2]