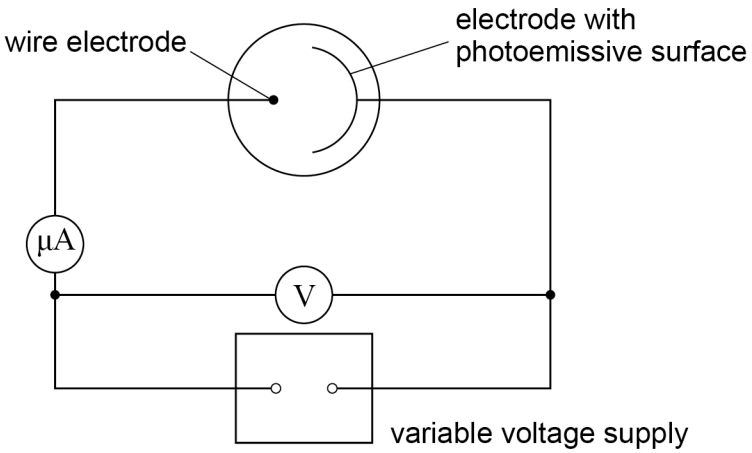
Do not write outside the box

0 2 **Figure 1** shows an arrangement used to investigate the photoelectric effect.

Figure 1



A current is measured on the microammeter only when electromagnetic radiation with a frequency greater than a certain value is incident on the photoemissive surface.

0 2 . 1 Explain why the frequency of the electromagnetic radiation must be greater than a certain value.

[2 marks]

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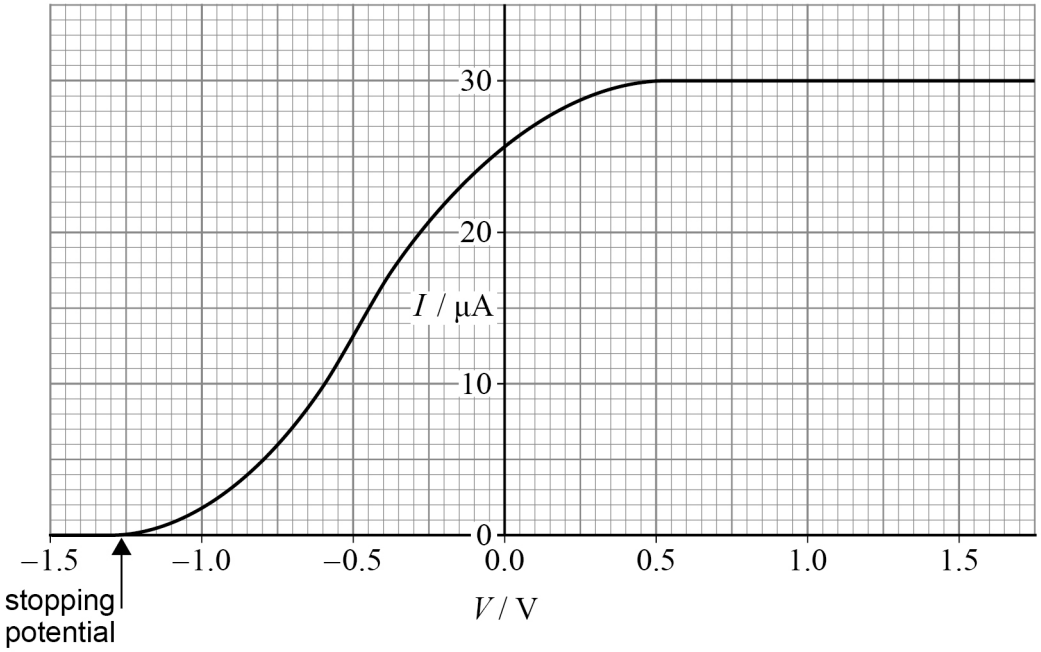
The apparatus in **Figure 1** is used with a monochromatic light source of constant intensity. Measurements are made to investigate how the current I in the microammeter varies with positive and negative values of the potential difference V of the variable voltage supply.

Figure 2 shows how the results of the investigation can be used to find the stopping potential.

Figure 2



0 2 . 2 Determine the number of photoelectrons per second leaving the photoemissive surface when the current is a maximum.

[2 marks]

number of photoelectrons per second = _____

Question 2 continues on the next page

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0 2 . 3 Explain why I reaches a constant value for positive values of V.

[2 marks]

0 2 . 4 Explain why I decreases as the value of V becomes more negative.

[3 marks]

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0 2 . 5 The investigation is repeated with a different photoemissive surface that has a smaller value of the work function. The source of electromagnetic radiation is unchanged.

Discuss the effect that this change in surface has on the value of the stopping potential.

[3 marks]

12

Turn over for the next question

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0 8 A photon has energy of 1×10^{18} eV.
An object of mass 0.03 kg has kinetic energy equal to the energy of the photon.

What is the speed of the object?

[1 mark]

A 1 m s^{-1} ⬭

B 3 m s^{-1} ⬭

C 10 m s^{-1} ⬭

D 30 m s^{-1} ⬭

0 9 A deuterium nucleus and a tritium nucleus fuse together to produce a helium nucleus and particle **X**.

$$^{2}_{1}\text{H} + ^{3}_{1}\text{H} \rightarrow ^{4}_{2}\text{He} + \mathbf{X}$$

What is **X**?

[1 mark]

A an electron ⬭

B a neutron ⬭

C a positron ⬭

D a proton ⬭

1 0 The radioactive nuclide $^{232}_{90}\text{Th}$ decays by one α emission followed by two β^- emissions.

Which nuclide is formed as a result of these decays?

[1 mark]

A $^{238}_{92}\text{U}$ ⬭

B $^{230}_{90}\text{Th}$ ⬭

C $^{228}_{90}\text{Th}$ ⬭

D $^{228}_{88}\text{Rn}$ ⬭