

- 9** (a) A circuit used to investigate the photoelectric effect is shown in Fig. 9.1.

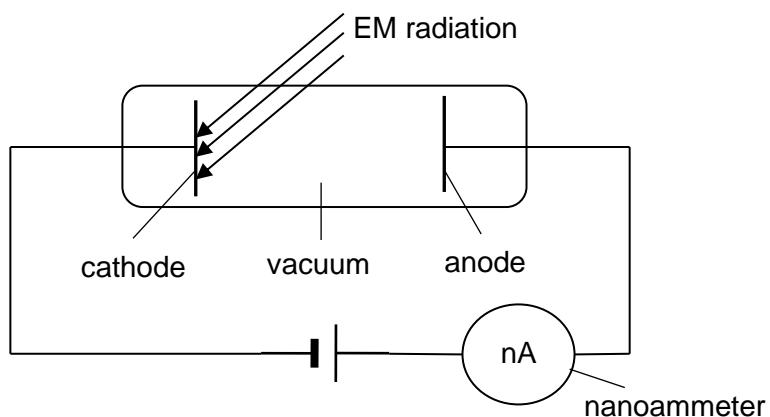


Fig. 9.1

Explain how the photoelectric effect provides evidence for the particulate nature of electromagnetic radiation.

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[3]

- (b) Electrons travel towards the anode with a maximum speed of $1.42 \times 10^6 \text{ m s}^{-1}$. Calculate the stopping potential V_s .

$$V_s = \dots \text{ V} \quad [2]$$

- (c) State how the circuit should be modified in Fig. 9.1 to stop all the electrons from reaching the anode.

..... [1]

- (d) (i) The electrons in (b) have been emitted from the cathode whose work function is 2.80 eV. Calculate the wavelength of the EM radiation that caused the emission of the electrons.

$$\text{wavelength} = \dots \text{ m} \quad [2]$$

- (ii) Suggest the type of EM radiation which has this wavelength.

type of EM radiation: [1]



- (e) X-rays are produced in an X-ray tube as shown in Fig. 9.2.

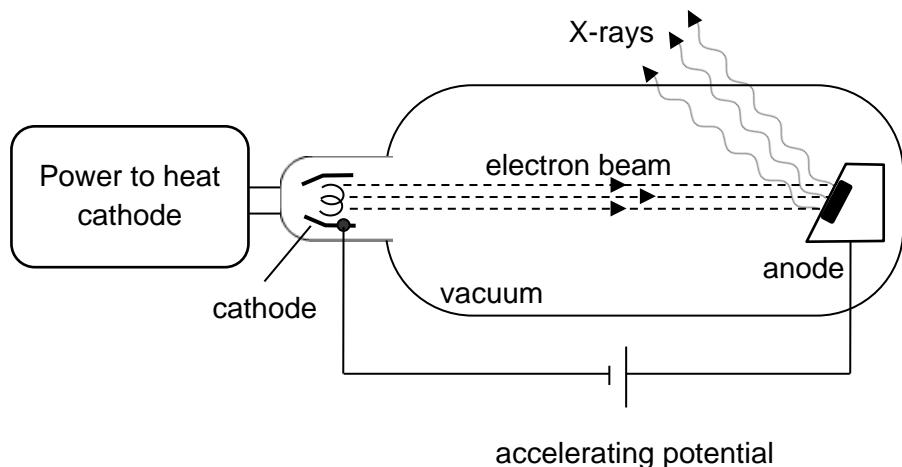


Fig. 9.2

Describe how this setup is used to produce a continuous X-ray spectrum.

[5]

[5]

- (f) State **one** similarity and **one** difference between the setups for the experiment to demonstrate photoelectric effects and the experiment to produce X-ray spectrum.

similarity:

difference:

[2]

- (g) Fig. 9.3 shows the X-ray spectrum of two target anodes.

An X-ray spectrum is first produced by an X-ray tube with tungsten (atomic number, $Z = 74$) anode. Another X-ray spectrum is then produced with the same X-ray tube by using barium (atomic number, $Z = 56$) anode.

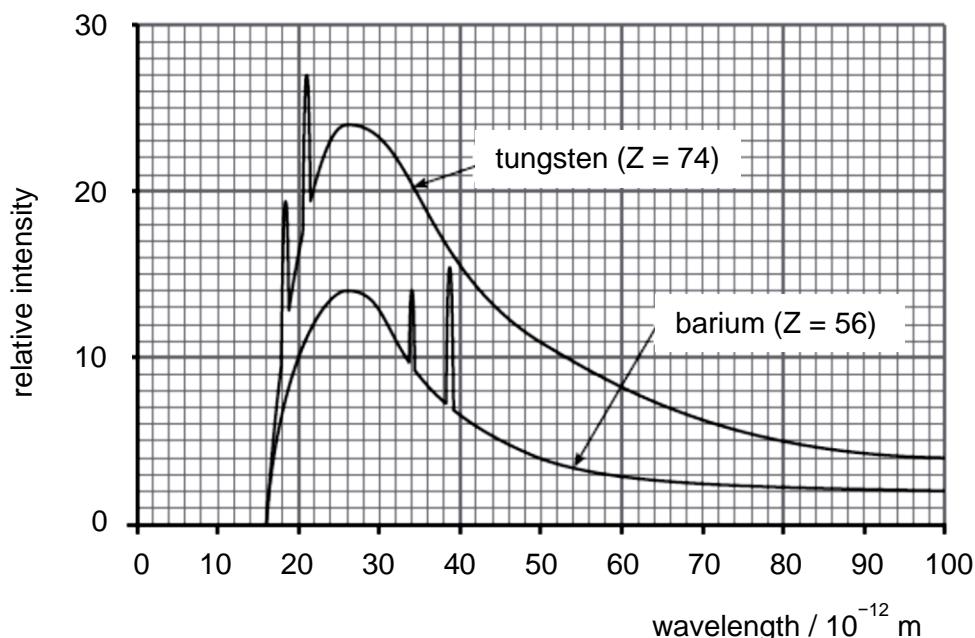


Fig. 9.3

- (i) Determine the accelerating potential of the X-ray tube.

accelerating potential = V [2]

- (ii) Use Fig. 9.3 to explain why the relative intensity of the K_{α} line of the tungsten is larger than that of barium spectrum.
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[2]