

2001 HIGHER SCHOOL CERTIFICATE EXAMINATION
Physics

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Centre Number

Section I – Part B (continued)

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Student Number

Marks

Question 24 (6 marks)

Sir William Bragg and his son Sir Lawrence Bragg shared the Nobel prize for physics in 1915 for their work on X-ray diffraction and crystal structure analysis.

- (a) Describe ONE way in which an understanding of crystal structure has impacted on science. 2

The understanding of crystal structure has let people of science explore how crystals are formed and what they can be used for.

- (b) Outline the methods of X-ray diffraction used by the Braggs to determine the structure of crystals. 4

The Braggs used certain shades of light within the X-ray to diffract the crystals structure. The use of different shades allow the X-ray to highlight different parts of the crystal, outlining its distinct structure.

Question 25 (6 marks)

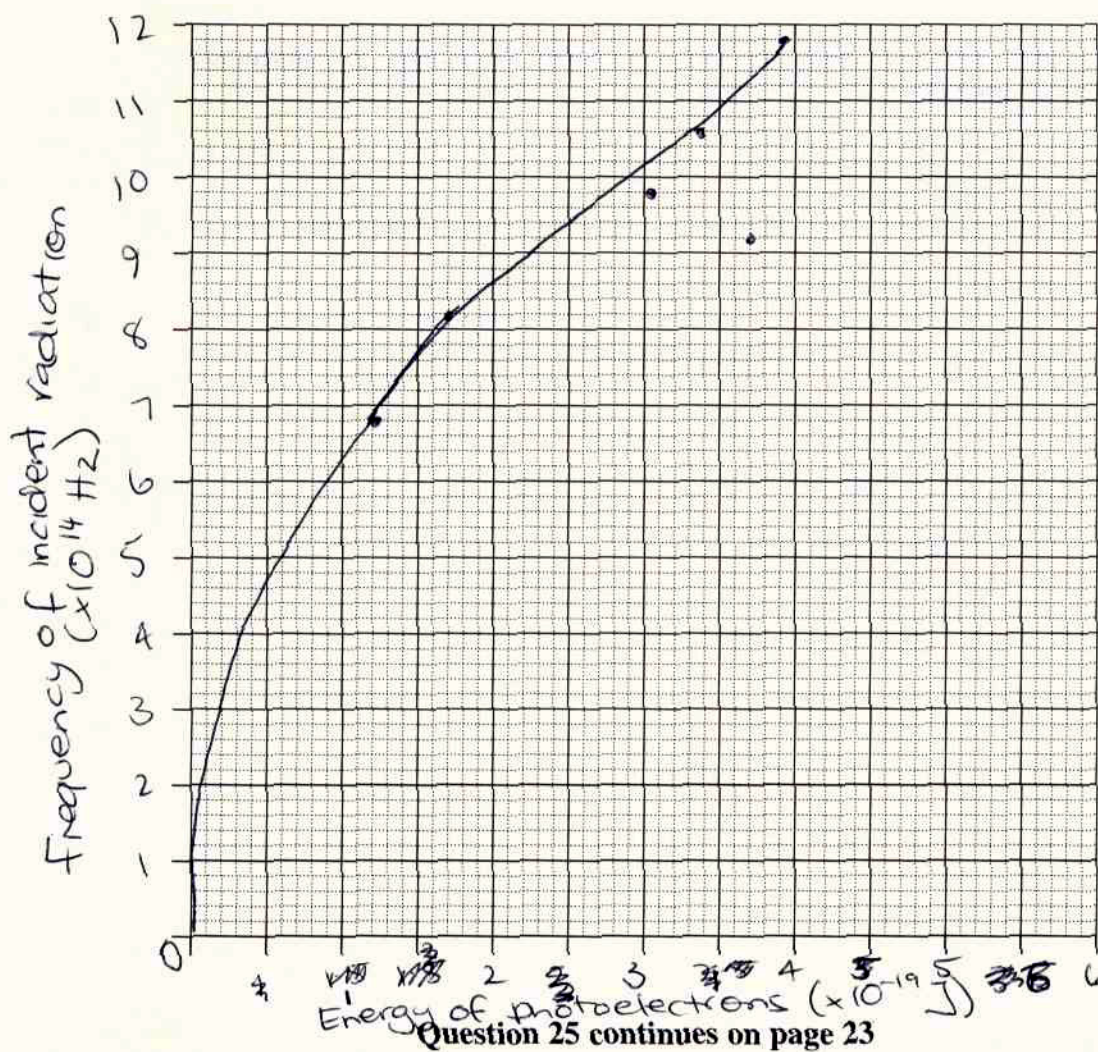
A student carried out an experiment on the photoelectric effect. The frequency of the incident radiation and the energy of the photoelectrons were both determined from measurements taken during the experiment.

The results obtained are shown in the table:

Frequency of incident radiation ($\times 10^{14}$ Hz)	Energy of photoelectrons ($\times 10^{-19}$ J)
6.9	1.22
8.2	1.70
9.1	3.70
9.9	3.05
10.6	3.38
11.8	3.91

(a) Graph these results on the grid, including the line of best fit.

4



Marks

Question 25 (continued)

(b) How could the reliability of the experiment be improved?

2

Repeating it in constant situations

Question 26 (8 marks)

In the context of semiconductors, explain the concept of *electrons* and *holes*.

8

Puring photoelectric effect, some electrons gain energy, thus move out of their space in an atom, and ~~the~~ float around free. This leaves a positive charge in this hole, and other electrons move to this hole. These electrons leave holes behind too, thus the effect continues. This happens within metals which make them semiconductors, such as Germanium or Silicon. These allow certain amounts of energy through.