

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

When Bragg discovered crystal lattice structure of compounds using x-rays it allowed scientists to be able to describe many results ~~and~~ using the lattice structure.

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

The Braggs used the interference of x-rays to penetrate particles and understand their make up from beneath the surface. They applied thin streams of x-rays to the particles which were diffracted to make the penetrating power more efficient.

**Question 25** (6 marks)

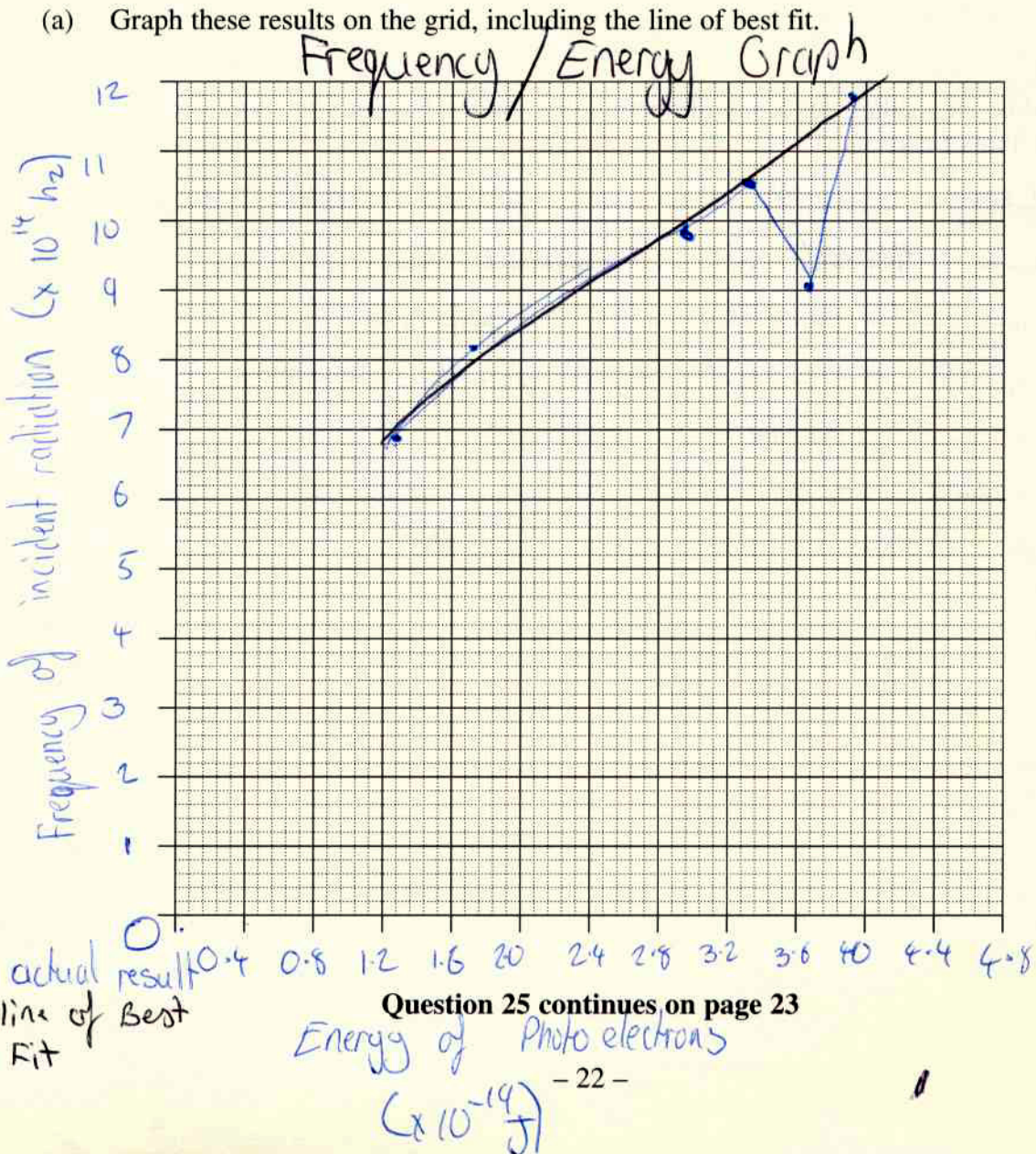
A student carried out an experiment on the photoelectric effect. The frequency of the incident radiation and the energy of the photoelectrons were both determined from measurements taken during the experiment.

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

Have ~~either~~ the frequency at consistent intervals, ie every  $\frac{1}{4}$ ,  $\frac{1}{2}$ , 1, 2 etc. repeat the experiment, and repeat under certain conditions

Question 26 (8 marks)

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

8

A semiconductor works by efficiently allowing electrons to pass through. It does this by having gaps in which the electrons can pass. These are called holes. The more efficient the semi-conductor, the more holes. These holes work by letting the electron occupy the whole and then move to a different hole. When many electrons do this a current has then passed through the semiconductor. The more holes, the quicker the electrons can pass through resulting in less resistance