2001 HIGHER SCHOOL CERTIFICATE EXAMINATION

Physics

Centre Number

Student Number

Section I – Part B (continued)

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 development of electron microscope.

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

A x-ray was fired at a metal with a crystal structure. The x ray defracted at different angles which scattered onto an x ray display which showed the structure of the crystal.

Marks

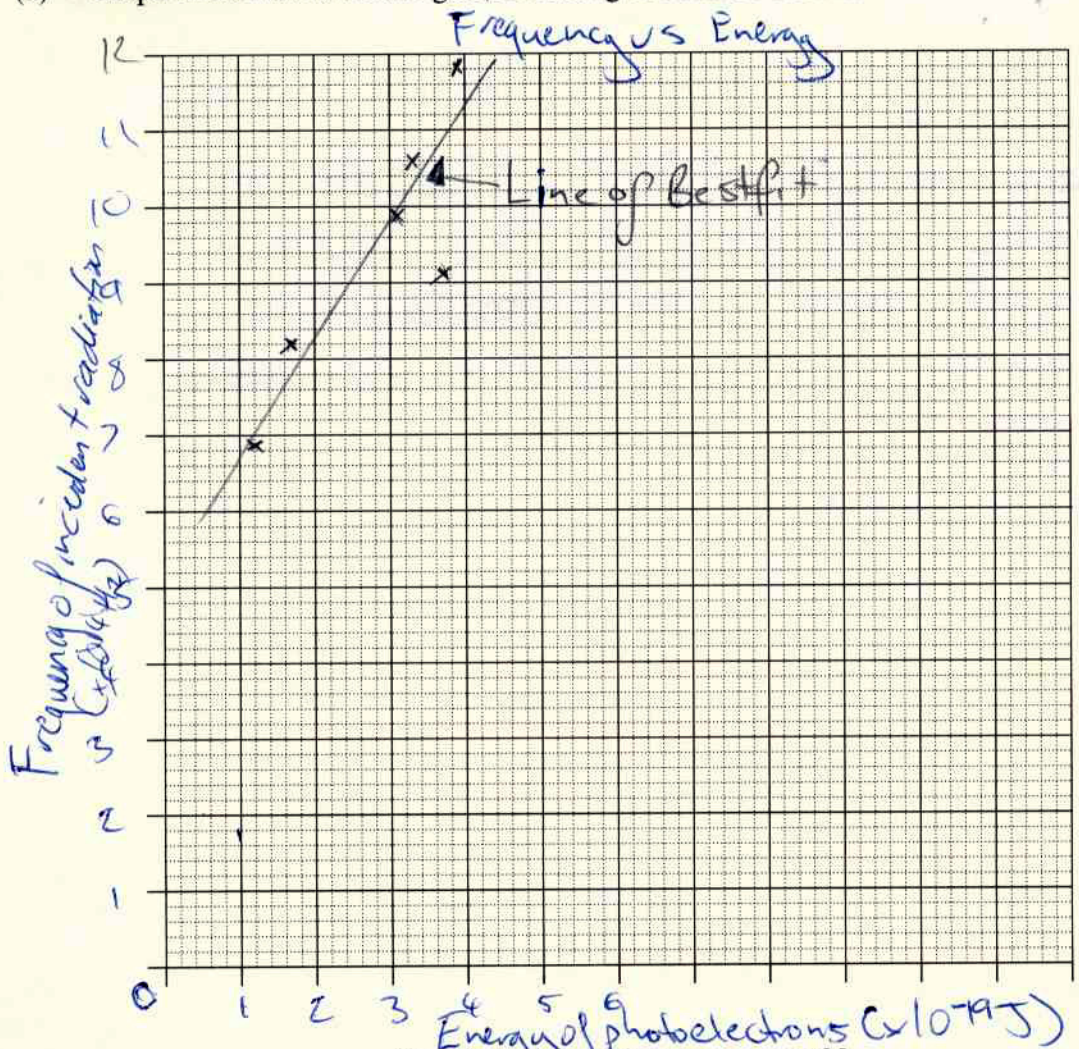
Question 25 (6 marks)

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**



Question 25 continues on page 23

Marks

Question 25 (continued)

(b) How could the reliability of the experiment be improved? **2**

The reliability of the experiment could be improved by showing the other components that allowed for the results determined by the student. Thus increasing the understanding of the results. (They become more reliable)

Question 26 (8 marks)

In the context of semiconductors, explain the concept of *electrons* and *holes*. **8**

Semiconductors, conductors with no resistance. This occurs when there is nothing stopping the flow of electrons through the element conductor. There are two types of semiconductors:

- n-type semiconductors in which the carriers are majorly electrons and minorly holes.
- p-type semiconductors in which the carries are majorly holes and minorly electrons.

The semiconductor consists of protons which move about in the lattice structure, which some times leaves a hole in some areas of the lattice. It is this event which determines what semiconductor it is, either n-type or p-type. A p-type will leave the hole to roam around the structure but the n-type covers the hole with an electron.