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**

understanding of ~~the~~ structure has allowed design production and selection of materials to be more accurate and efficient for specific applications.

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

project x rays into the object to be studied.
- using a detector to obtain diffraction patterns created by different structures.
- eg body centred cubic structure will produce different patterns to a face ~~centred~~ centred cubic structure solid.

Marks

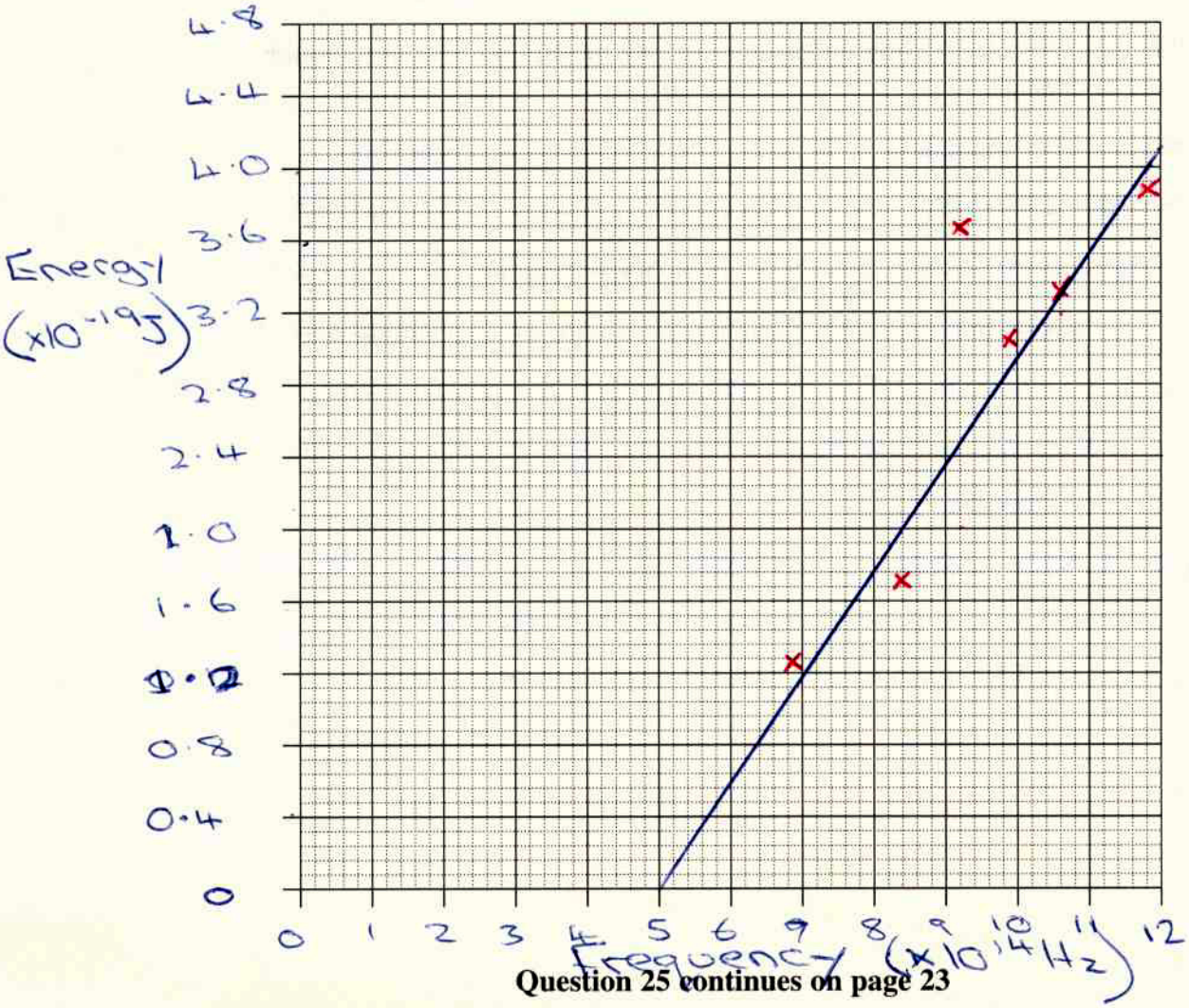
Question 25 (6 marks)

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**

A range of metals could be used, using the same frequency for each to compare the energy for different metals.

Question 26 (8 marks)

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

You can find natural semiconductors or you can dope materials to create semiconductors. To create a p-type semiconductor which has the electron holes, materials from valence group 4 are doped with group III materials. This means when they molecules are joined with group III the group IV material will have a spare hole for an electron. The electron in the hole next to the empty hole can jump into the vacant hole leaving the previous hole empty. So the electron behind it can do the same and it keeps going creating a flow of electrons. Therefore producing a semiconductor.