**2001 HIGHER SCHOOL CERTIFICATE EXAMINATION**

# Physics

**Section I – Part B (continued)**

Centre Number

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 X-ray diffraction *of crystal structure* allow scientist to "see" the structure of crystal so scientist can understand more about the bonding and formation of the crystal. Then can work out the properties of different materials.

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

the X-ray is projected to the crystal and by calculating the defraction the density is then found. Because X-ray has no charge and it can produce an 'image' etta on to a flourescent screen then can be study by scientist
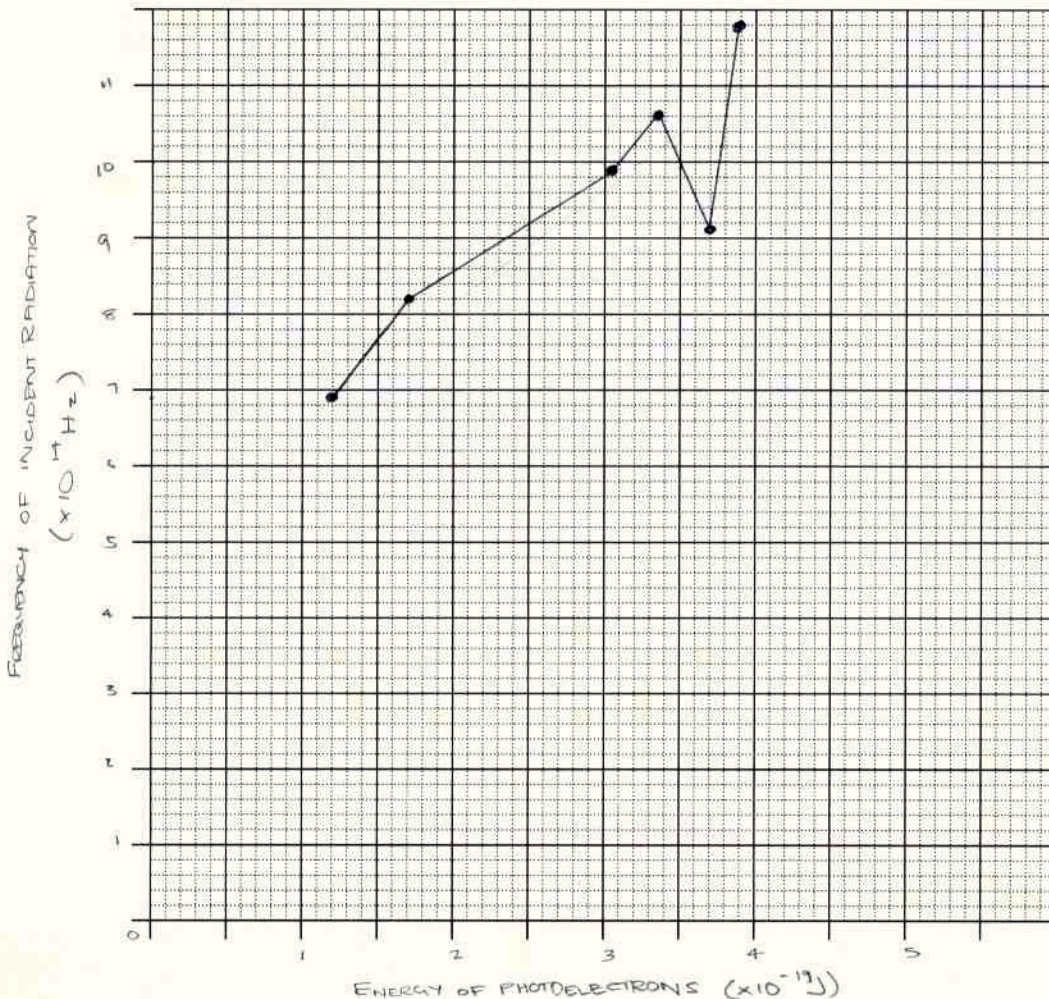
**Marks**

## 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 $(\times 10^{14}\,\text{Hz})$ | Energy of photoelectrons $(\times 10^{-19}\,\text{J})$ |
| --- | --- |
| 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



ENERGY OF PHOTOELECTRONS $(\times 10^{-19}\,\text{J})$

FREQUENCY OF INCIDENT RADIATION $(\times 10^{14}\,\text{Hz})$

**Question 25 continues on page 23**

**Marks**

Question 25 (continued)

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

By repeating the experiment numerous times
to ensure the readings/results are
correct.

## Question 26 (8 marks)

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

In a semiconductor, the path that electrons take
Through the material tells each resistor that is
composed of the semiconducting material, what
to do. Around an atom in the semiconductors
structure there are the covalent electrons that
Bond the atoms together when the outer
shell of these covalent electrons is not full.
There is the space for another electron. This is
called a hole. These holes are what allows
current, (or a path of electrons) to flow. An
electron can move into this hole and the
spot that the electron moved from now becomes
the hole, in a sense the hole moves backwards
from the flow of electrons.