

## **A level Physics B**

**H557/02** Scientific literacy in physics

### **Question Set 16**

1

This question is about electrons showing wave-like properties.

- (a) (i) An electron is accelerated through a p.d. of 4.3 kV. Calculate the velocity of the accelerated electron. Ignore relativistic effects.

velocity = .....ms<sup>-1</sup> [2]

- (ii) Explain whether it is reasonable to ignore relativistic effects in the calculation in (a)(i). Include a calculation in your explanation.

[3]

- (iii) Calculate the de Broglie wavelength of the accelerated electron.

wavelength = .....m [1]

- (b) Accelerated electrons can be diffracted by layers of graphite in a very similar way to light diffracted through a grating. When electrons are accelerated in a glass vessel and pass through graphite, they diffract and form circular rings on a fluorescent screen. Each electron striking the screen emits a tiny flash of light.

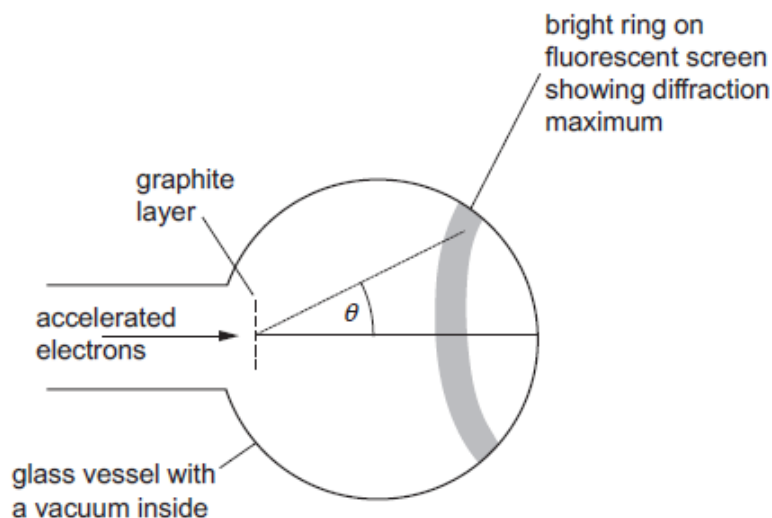


Fig. 1.1

Explain why the rings on the screen become smaller and brighter when the accelerating p.d. the electrons pass through is increased.

[3]

- (c)\* Explain how this demonstration shows that electrons can be considered as 'quantum particles' showing both wave-like and particle-like behaviour.

Your answer should describe which aspects of the demonstration show each type of behaviour and explain how diffraction effects can be explained using ideas about phasors.

[6]

**Total Marks for Question Set 16: 15**

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