



answer = \_\_\_\_\_ J

(1)

- (iii) Calculate the kinetic energy of an electron with a de Broglie wavelength of  $1.24 \times 10^{-12}$  m.  
Give your answer to an appropriate number of significant figures.

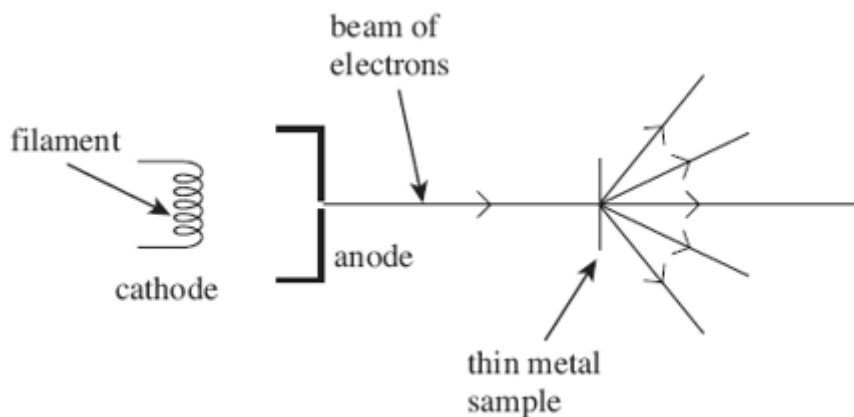
answer = \_\_\_\_\_ J

(2)

(Total 11 marks)

## Q2.

In the figure below, a beam of monoenergetic electrons is produced by thermionic emission from a wire filament in an evacuated tube. The beam is directed at a thin metal sample at normal incidence and it emerges from the sample in certain directions only, including its initial direction.



- (a) (i) Name the physical process occurring at the thin metal sample in the figure above which shows the electrons behaving as waves.

\_\_\_\_\_  
\_\_\_\_\_

(1)

- (ii) Explain why the electrons need to be monoenergetic in order for them to emerge in certain directions only.

\_\_\_\_\_

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(2)

(b) A transmission electron microscope (TEM) operating at an anode potential of 25kV is used to observe an image of a thin sample.

- (i) Calculate the momentum of the electrons emerging from the anode, stating an appropriate unit.

answer = \_\_\_\_\_

(4)

- (ii) Describe and explain how the resolution of the image would change if the anode potential were increased.

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(3)

(Total 10 marks)