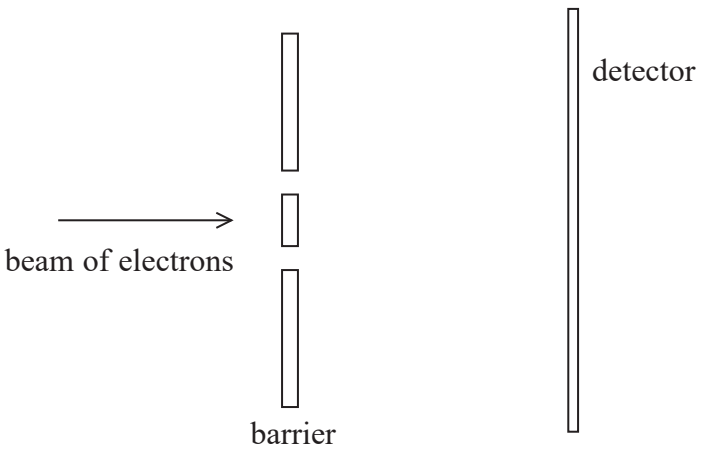
14 In 1965, Richard Feynman proposed a double slit experiment to investigate the wave properties of electrons.

The experiment was later carried out using the arrangement shown.



A beam of electrons was directed at a barrier with two slits.

The detector recorded the positions where electrons arrived after passing through the slits.

The following pattern was obtained. Black dots represent points where electrons were detected. A band where electrons were not detected has been labelled X and a band where electrons were detected has been labelled Y.

The path difference for electrons arriving at band X from the separate slits was 2.5×10^{-11} m. For electrons arriving at band Y the path difference was 5.0×10^{-11} m.

Explain why this pattern is observed when the electron energy is 9.6×10^{-17} J.

The electrons are travelling at non-relativistic speeds.

(6)

(Total for Question 14 = 6 marks)