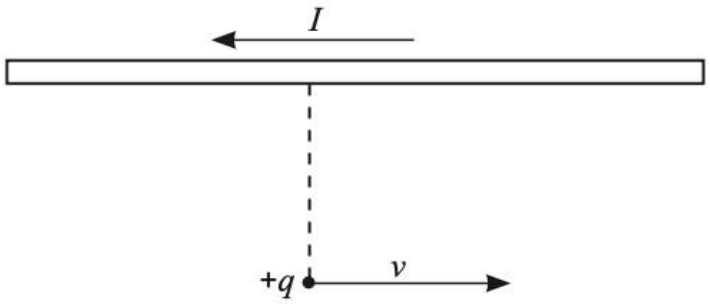
Question 13 **(17 marks)**



A positive charge of 4.80×10^{-19} C is 35.0 cm below an extremely long straight wire carrying a current of 2.51 A to the left. The positive charge is moving parallel to the wire with a velocity of 1.57×10^{4} m s^{-1} to the right, at the instant shown in the diagram above.

(a) Calculate the strength of the magnetic field 35.0 cm from the wire. (3 marks)

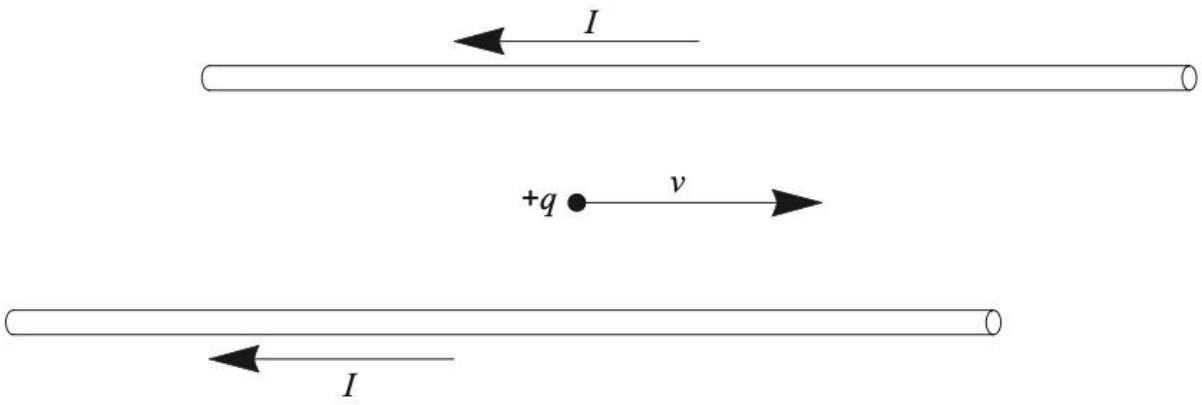
(b) Calculate the force experienced by the particle as it moves through this magnetic field. Include the direction of the force in your answer. If you could not obtain an answer to part (a), use 2.51×10^{-6} T. (3 marks)

Answer: _____ N Direction: _____

(c) With reference to **two** relevant equations on the data sheet, discuss why the path the particle takes is not circular. (5 marks)

Question 13 (continued)

(d) The particle is now moving midway between two wires with equal currents flowing in the same direction. In this position, the particle experiences no net force.



(i) The diagram below shows the view of the wires from the front left. The current is flowing out of the page. Draw the composite magnetic field generated by the two current-carrying wires. Indicate clearly the location of the charge q on your diagram. (4 marks)

A spare diagram is provided at the end of this booklet. If you need to use it, cross out this attempt and indicate that you have redrawn it on the spare diagram.

(ii) Describe why the charge q experiences no net force in this position. (Ignore any gravitational effects.) (2 marks)

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