

- 4 Two long straight vertical wires X and Y pass through a horizontal card, as shown in Fig. 4.1.

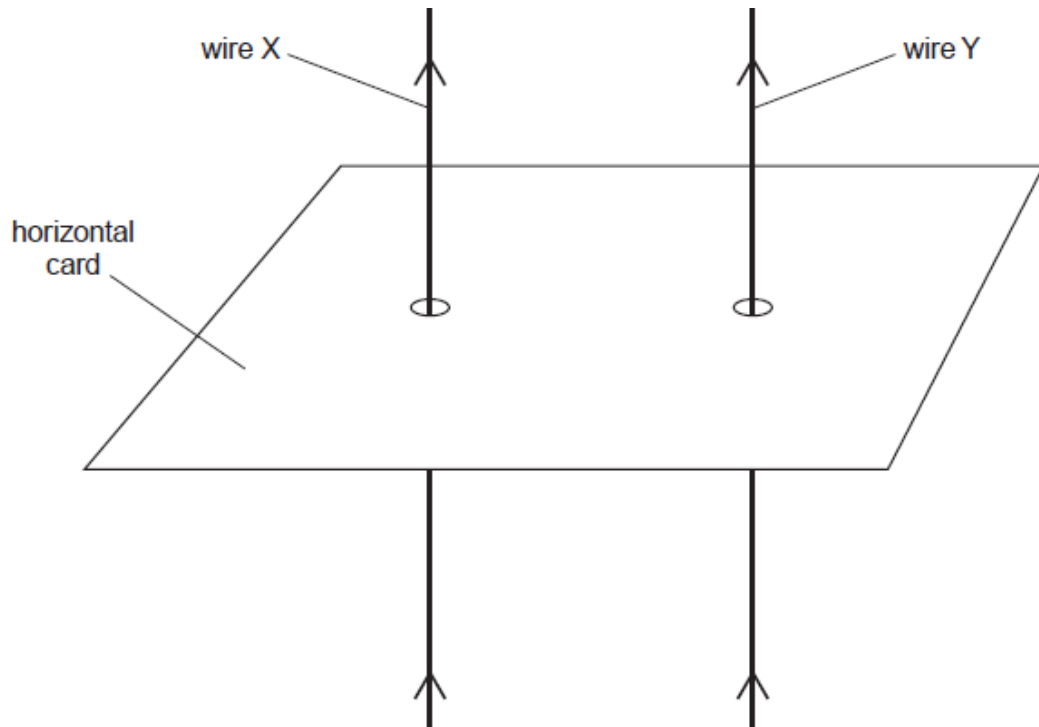


Fig. 4.1

The current in each wire is in the upward direction.

The top view of the card, seen by looking downwards at the card, is shown in Fig. 4.2.

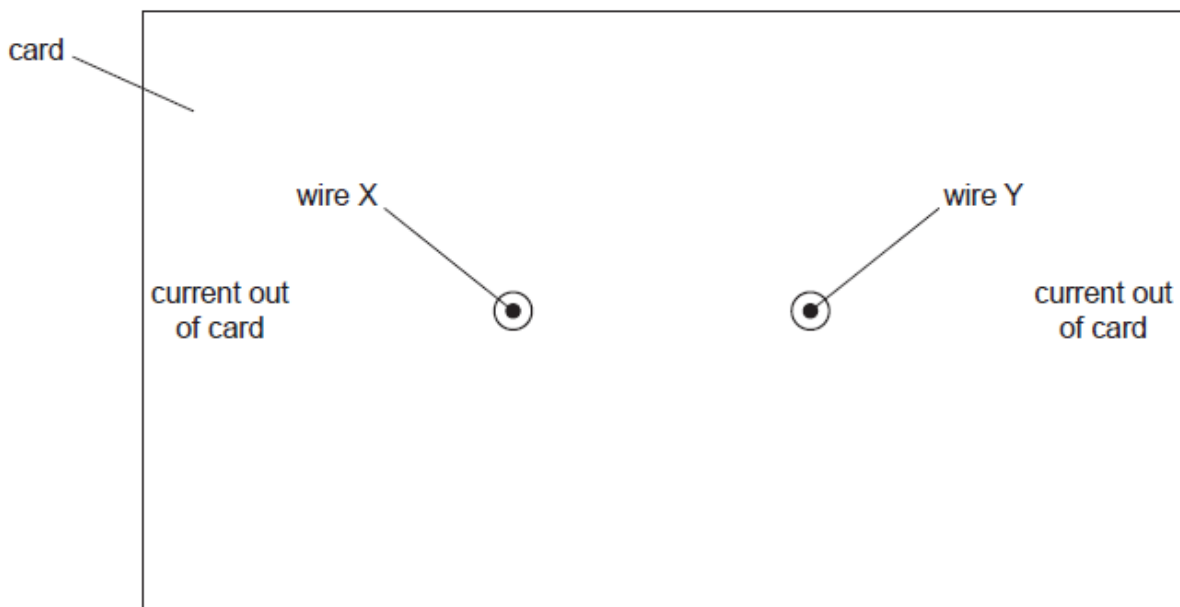


Fig. 4.2 (not to scale)

- (a) On Fig. 4.2,
- draw four field lines to represent the pattern of the magnetic field around wire X due solely to the current in wire X, [2]
 - draw an arrow to show the direction of the force on wire Y due to magnetic field of wire X. [1]

- (b) The current in the wire X is 5.0 A and that in wire Y is 7.0 A. The separation of the wires is 2.5 cm.
- (i) Calculate the force per unit length on the wire Y due to the current in wire X.

force per unit length = N m^{-1} [3]

- (ii) The currents in the wires are not equal.

State and explain whether the forces on the wires are equal in magnitude.

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 [2]

- (c) The direct currents in wires X and Y are now replaced by sinusoidal alternating currents of equal peak values. The currents are in phase.

Describe the variation, if any, of the force experienced by wire Y.

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 [2]

[Total: 10]