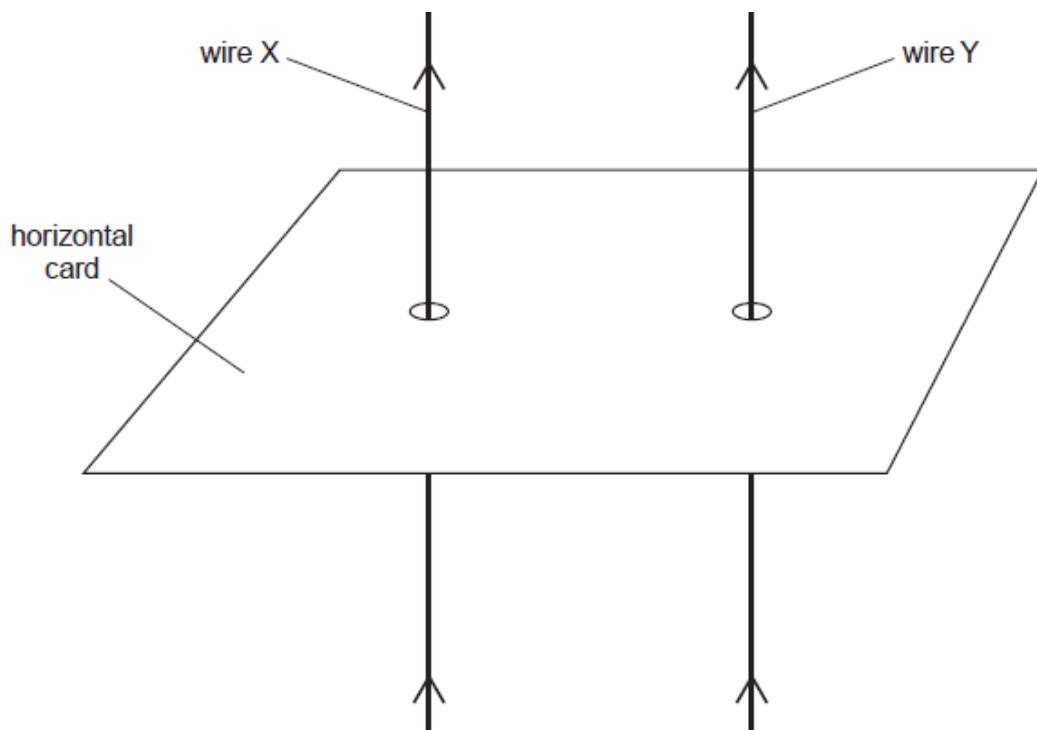


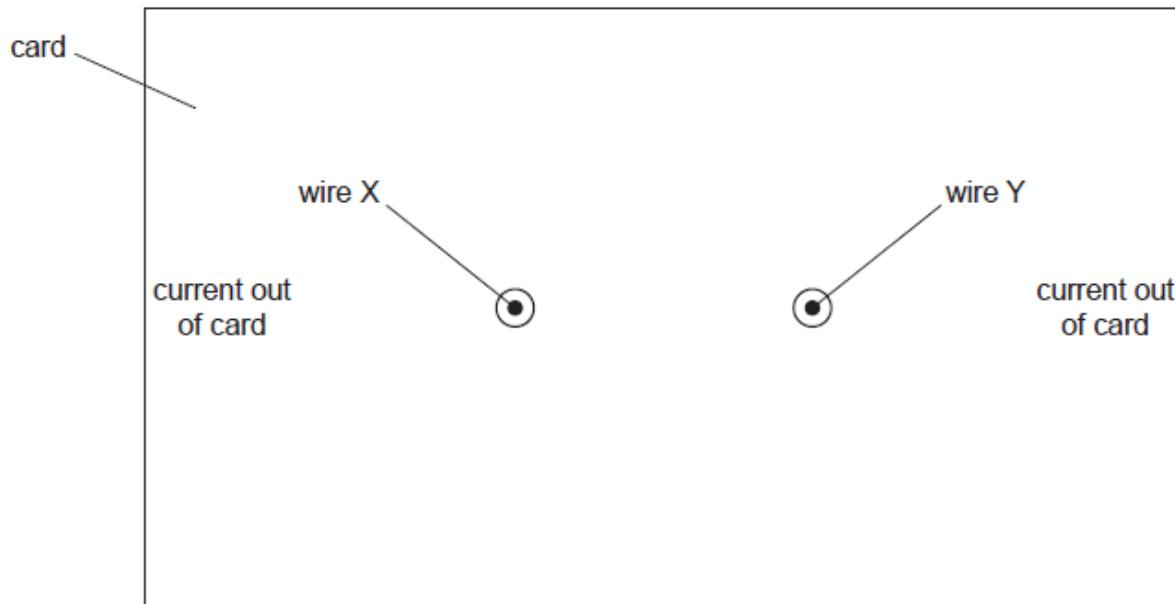
- 4 Two long straight vertical wires X and Y pass through a horizontal card, as shown in Fig. 4.1.



**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,

- (i) draw four field lines to represent the pattern of the magnetic field around wire X due solely to the current in wire X, [2]
- (ii) 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.

$$\text{force per unit length} = \dots \text{N m}^{-1} \quad [3]$$

- (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]