4 Part of a long current-carrying conductor (wire) is shown in Fig. 4.1. The conductor is normal to and passes through a horizontal plane.

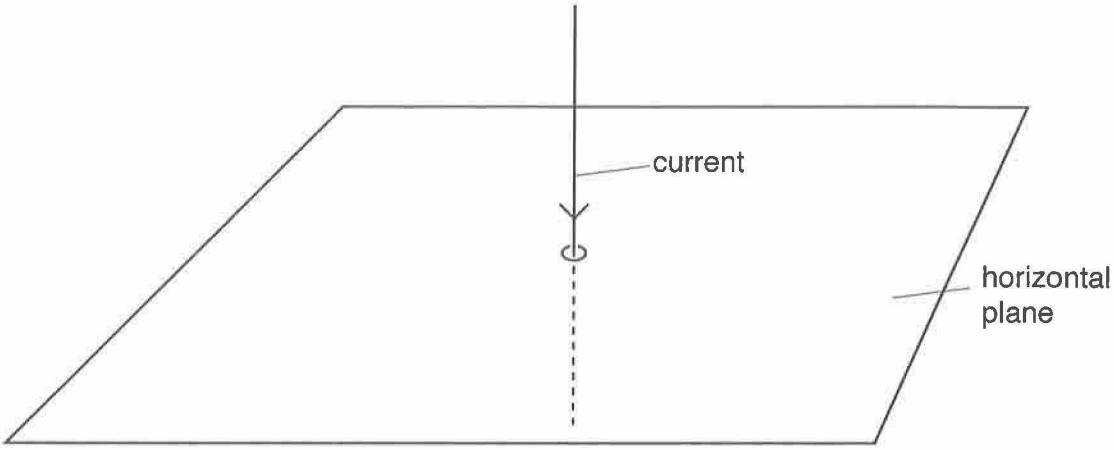

Fig. 4.1

Fig. 4.2 shows the current in the wire directed perpendicularly into the plane of the paper.

(a) On Fig. 4.2, draw lines to represent the magnetic field in the horizontal plane around the long wire.

Fig. 4.2

[2]

(b) The current in the wire in **(a)** is 8.5 A.

Calculate the magnetic flux density B due to the current in the wire at a distance of 19 cm from the centre of the wire in the horizontal plane.

B = ... T [2]

(c) The current in the wire is switched off and a small compass is placed 19 cm due North of the wire, as shown in Fig. 4.3a.

The current of 8.5 A is then switched on and the needle deflects by 12° of the compass as shown in Fig. 4.3b.

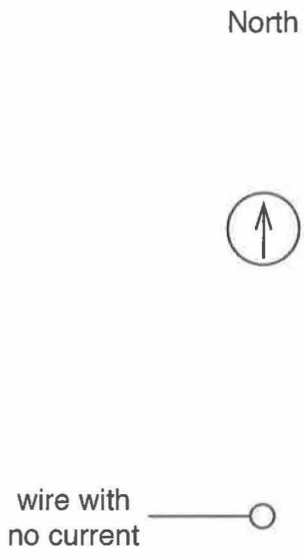

Fig. 4.3a

Fig. 4.3b

(i) Use your answer in **(b)** to calculate the horizontal component B_H of the magnetic flux density due to the Earth's magnetic field at this location.

B_H = ... T [2]

(ii) On Fig. 4.3b, mark with a letter X the position where the resultant horizontal magnetic flux density is zero.

Explain your reasoning.

....

....

....[2]