8 **(a)** Define *magnetic flux density*.

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.....

..... [2]

(b) A long air-cored solenoid is connected to a power supply, so that the solenoid creates a magnetic field. Fig. 8.1 shows a cross-section through the middle of the solenoid.

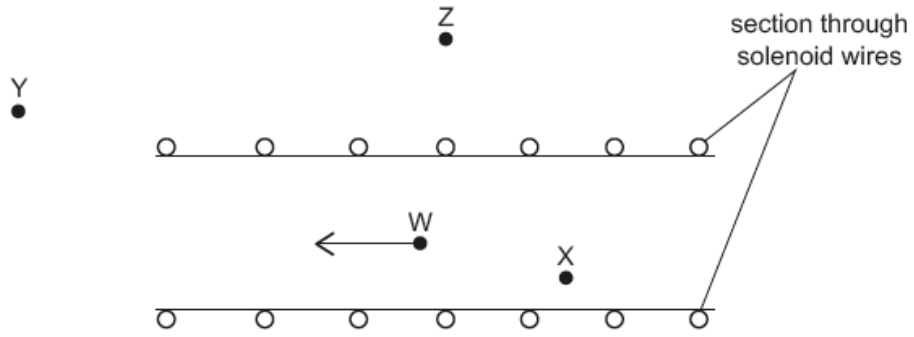

Fig. 8.1

The direction of the magnetic field at point W is indicated by the arrow. Three other points are labelled X, Y and Z.

(i) On Fig. 8.1, draw arrows to indicate the direction of the magnetic field at each of the points X, Y and Z. [2]

(ii) Compare the magnitude of the flux density of the magnetic field

1. at X and at W

.....

.....

2. at Z and at W

.....

.....

[2]

(c) Two long parallel current-carrying wires are placed near to each other in a vacuum. Explain why these wires exert a magnetic force on each other. You may draw a labelled diagram to illustrate your answer.

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.....

..... [3]

(d) A magnet produces a uniform magnetic field of flux density *B* in the space between its poles. A rigid copper wire carrying a current is balanced on a pivot. Part PQLM of the wire is between the poles of the magnet, as illustrated in Fig. 8.2.

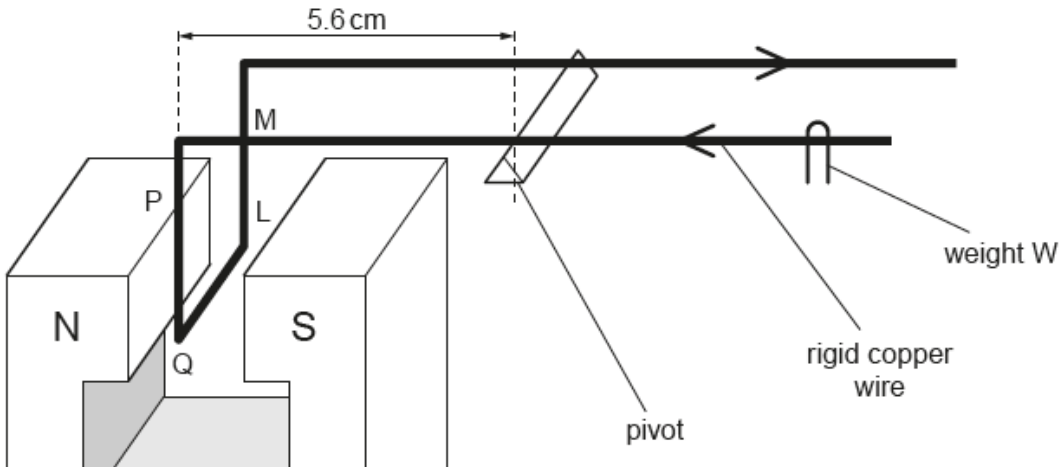

Fig. 8.2

The wire is balanced horizontally by means of a small weight W.

(i) The current in section QL is situated midway between the two magnetic poles as shown in Fig, 8.3. The current in QL is flowing into the page.

Sketch the resultant magnetic field pattern around the current.

Fig. 8.3

[2]

(ii) Explain why section QL of the wire give rise to a moment about the pivot.

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..... [2]

(iii) Explain why sections PQ and LM of the wire do not give rise to a moment about the pivot.

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..... [2]

(iv) Section QL of the wire has length 0.85 cm.

The perpendicular distance of QL from the pivot is 5.6 cm.

When the current in the wire is changed by 1.2 A, W is moved a distance of 2.6 cm along the wire in order to restore equilibrium. The mass of W is 1.3×10^{-4} kg.

1. Show that the change in moment of W about the pivot is 3.3×10^{-5} N m.

[2]

2. Hence, or otherwise, determine the magnetic flux density *B* between the poles of the magnet.

B = ... T [3]

[Total: 20]