9 Worksheet 1

Intermediate level

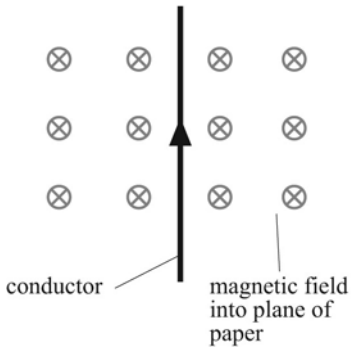
1 Explain what is meant by electromagnetism. [1]

2 Explain why a current-carrying conductor placed in an external magnetic field experiences a force. [1]

3 In Fleming's left-hand rule, the se**C**ond finger shows the direction of the Current. What type of current is it? [1]

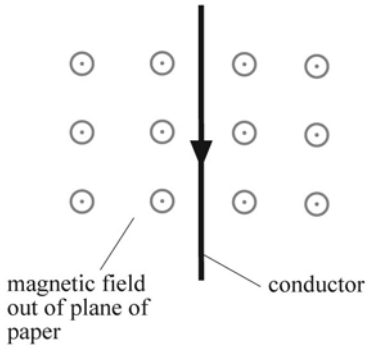
4 A current-carrying conductor is placed in an external magnetic field. In each case below, use Fleming's left-hand rule to predict the direction of the force on the conductor.

a



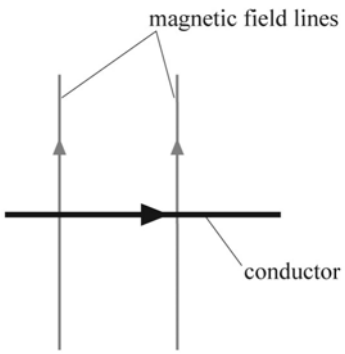
[1]

b



[1]

c



[1]

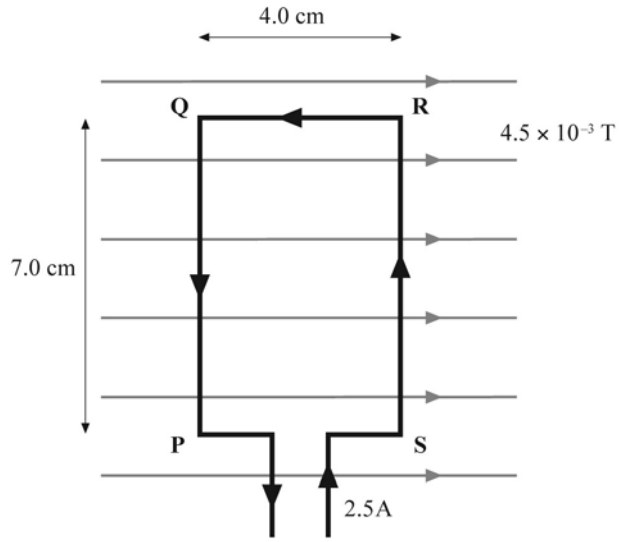
5 The unit of magnetic flux density is the tesla. Show that:

$1\ T = 1\ N\ A^{-1}\ m^{-1}$ [2]

6 Calculate the force per centimetre length of a straight wire placed at right angles to a uniform magnetic field of magnetic flux density 0.12 T and carrying a current of 3.5 A. [3]

Higher level

7 The diagram shows a rectangular metal frame **PQRS** placed in a uniform magnetic field.



The magnetic flux density is 4.5×10^{-3} T. The current in the metal frame is 2.5 A.

a Calculate the force experienced by side **PQ** of the frame. [3]

b Suggest why side **QR** does not experience a force. [1]

c Describe the motion of the frame immediately after the current in the frame is switched on. [2]

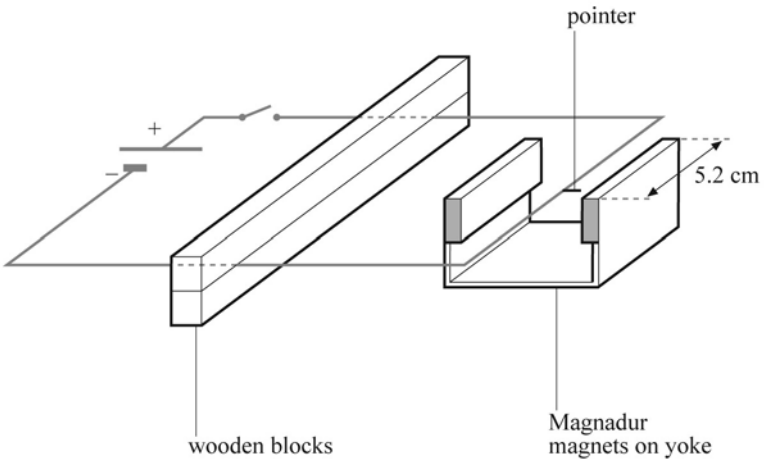
8 A current-carrying conductor placed at right angles to a uniform magnetic field, experiences a force of 4.70×10^{-3} N. Determine the force on the wire when, separately:

a the current in the wire is increased by a factor of 3.0 [2]

b the magnetic flux density is halved [2]

c the length of the wire in the magnetic field is reduced to 40% of its original length. [2]

9 The diagram shows a current-carrying wire frame placed between a pair of Magnadur magnets on a yoke.



A small pointer is connected to a section of the wire in the magnetic field. The position of the pointer is noted.
A current of 8.5 A in the wire causes the pointer to move vertically upwards.
A small paper tape is attached on to the pointer.
Using a pair of scissors, its length is shortened until the pointer returns back to its original position. The paper tape is found to have a mass of 60 mg. The section of the wire between the poles of the magnetic has a length of 5.2 cm.

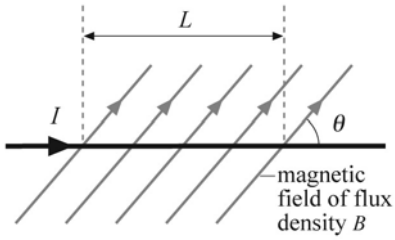
a What is the direction of the magnetic field? [1]

b Calculate the force on the wire due to the magnetic field when it carries a current of 8.5 A. [2]

c Calculate the magnetic flux density of the magnetic field between the poles of the magnet. [3]

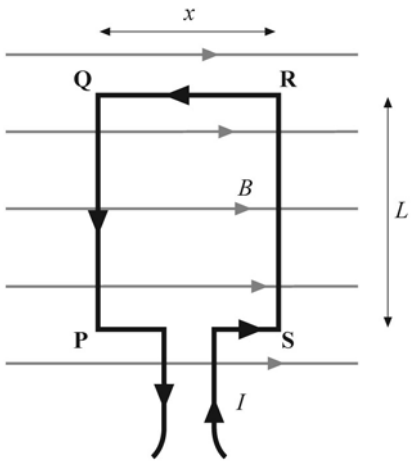
Extension

10 The diagram shows a current-carrying conductor placed at an angle to a uniform magnetic field.



Magnetic flux density is a vector. Use this idea to derive an equation for the force F acting on the wire in terms of the magnetic flux density B, the current I, the length L of the wire in the field and the angle θ between the magnetic field and the wire. [3]

11 The diagram shows the rectangular loop **PQRS** of a simple electric motor placed in a uniform magnetic field of flux density B.



The current in the loop is I. The lengths **PQ** and **RS** are both L and lengths **QR** and **SP** are both x.
Show that the torque of the couple acting on the loop for a given current and magnetic flux density is directly proportional to the area of the loop. [5]

Total: _____ Score: %
37