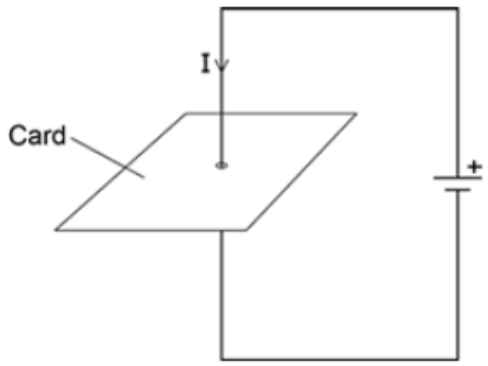
Eduqas Physics GCSE
Topic 8.2: Magnetic effects of currents and the motor effect
Questions by topic

1. **Figure 1** shows a straight wire passing through a piece of card.

A current (I) is passing down through the wire.

Figure 1



(a) Describe how you could show that a magnetic field has been produced around the wire.

.....

.....

.....

.....

(2)

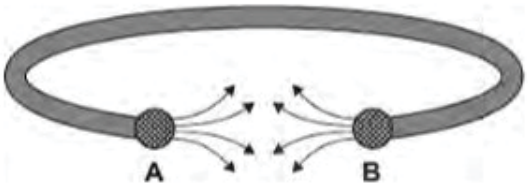
2 (part (c) (d) HIGHER).

(a) Some people wear magnetic bracelets to relieve pain.

Figure 1 shows a magnetic bracelet.

There are magnetic poles at both **A** and **B**.
Part of the magnetic field pattern between **A** and **B** is shown.

Figure 1



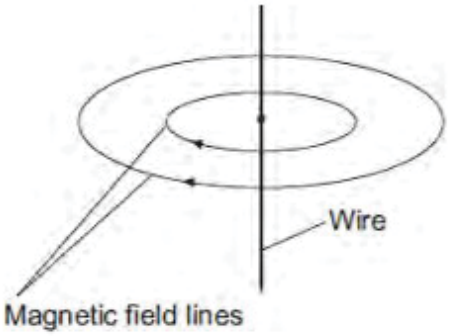
What is the pole at **A**? .....

What is the pole at **B**? .....

(1)

(b) **Figure 2** shows two of the lines of the magnetic field pattern of a current-carrying wire.

Figure 2



The direction of the current is reversed.

What happens to the direction of the lines in the magnetic field pattern?

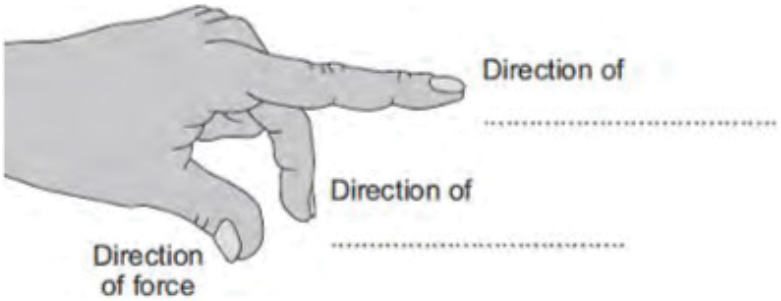
.....

(1)

(c) Fleming's left-hand rule can be used to identify the direction of a force acting on a current-carrying wire in a magnetic field.

(i) Complete the labels in **Figure 3**.

Figure 3

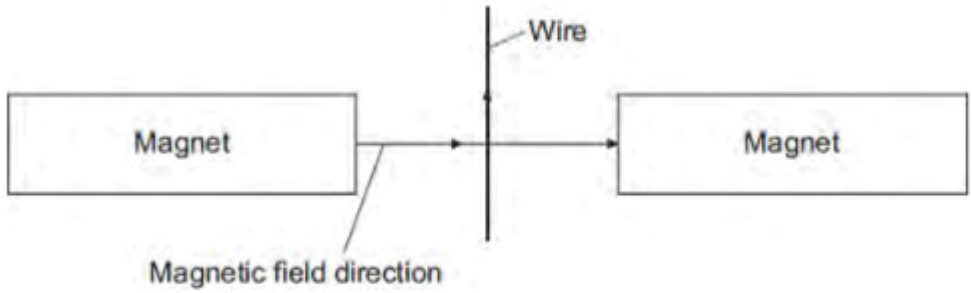


(2)

(ii) **Figure 4** shows:

- the direction of the magnetic field between a pair of magnets
- the direction of the current in a wire in the magnetic field.

Figure 4



In which direction does the force on the wire act?

.....

(1)

(iii) Suggest **three** changes that would **decrease** the force acting on the wire.

1 .....

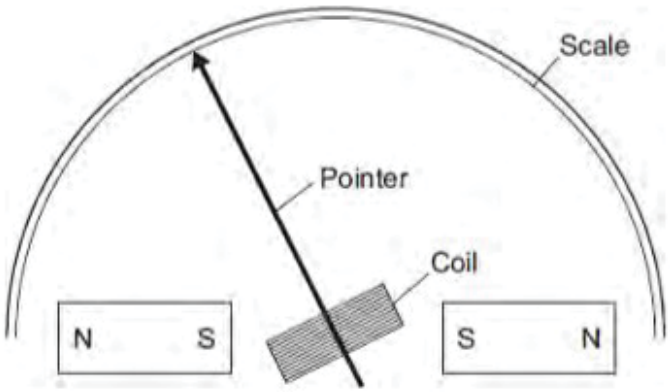
2 .....

3 .....

(d) **Figure 5** shows part of a moving-coil ammeter as drawn by a student.

The ammeter consists of a coil placed in a uniform magnetic field.
When there is a current in the coil, the force acting on the coil causes the coil to rotate and the pointer moves across the scale.

Figure 5



(i) The equipment has **not** been set up correctly.

What change would make it work?

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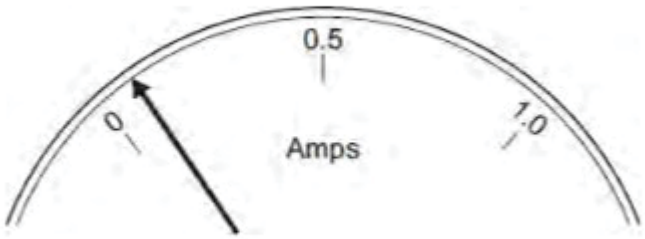
.....

(1)

(ii) **Figure 6** shows the pointer in an ammeter when there is no current.

Figure 6



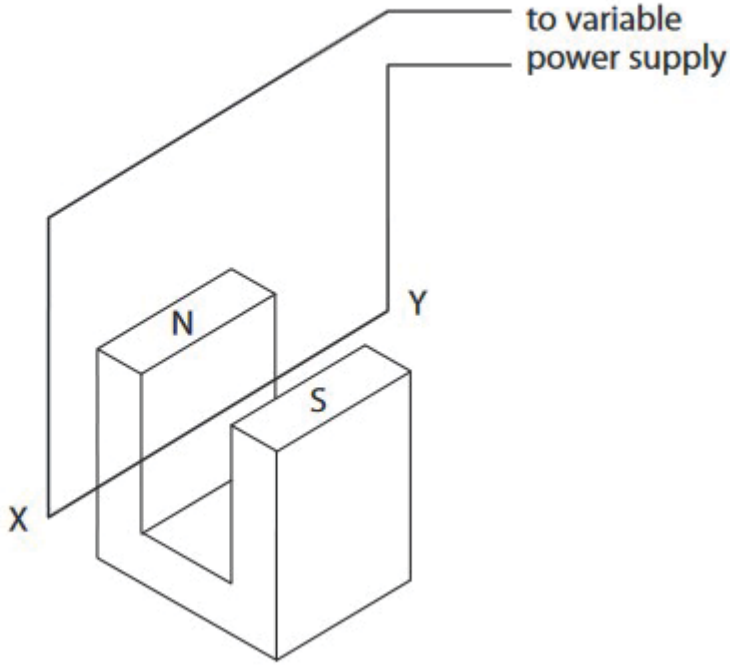
What type of error does the ammeter have?

.....

(1)
(Total 10 marks)

2 (part (b) HIGHER).

Diagram 1 shows some of the apparatus used to investigate the force on a current-carrying wire, XY, in a magnetic field.



(a) Diagram 2 shows the poles of the magnet viewed from above.

Draw the uniform magnetic field between the poles.

(2)

(b) The current-carrying wire XY is at right angles to the magnetic field.

The current in the wire is 10 A.

(i) Suggest why the wire used in this investigation must be thick.

(1)

.....

.....

(ii) Explain why the wire XY experiences a force when there is a current in the circuit.

(3)

.....

.....

.....

.....

.....

.....

(iii) State two ways in which this force can be reduced.

(2)

1 .....

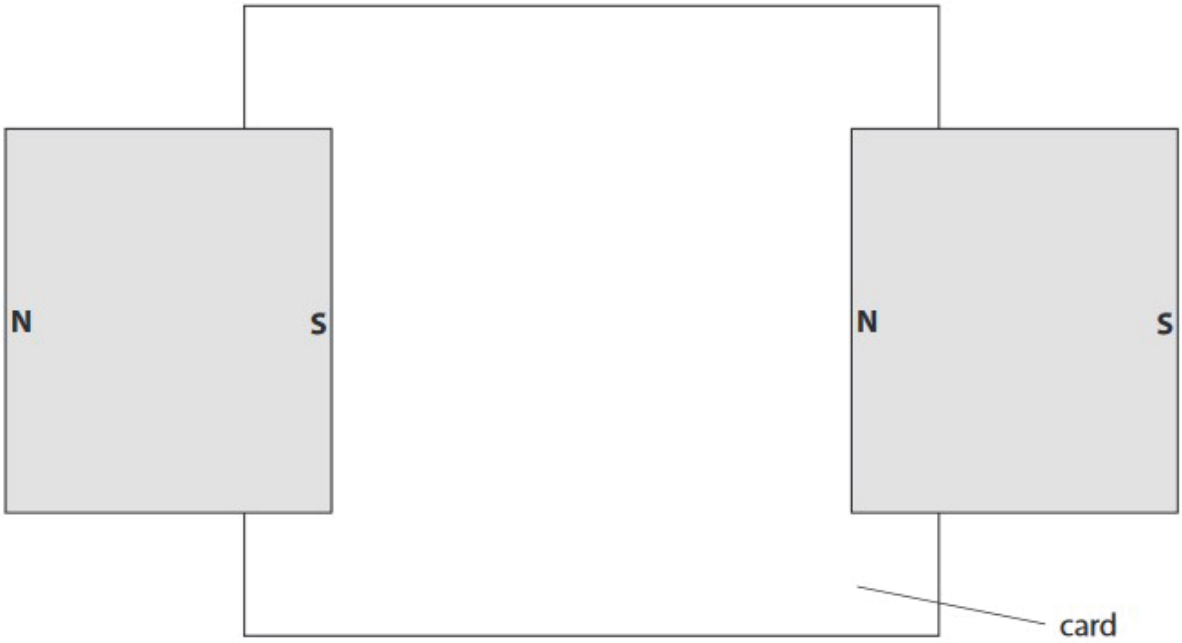
.....

2 .....

.....

3 (part (b) HIGHER).

The diagram shows a piece of card and two wide bar magnets.



(a) (i) Add to the diagram to show the shape and direction of the magnetic field pattern between the magnets.

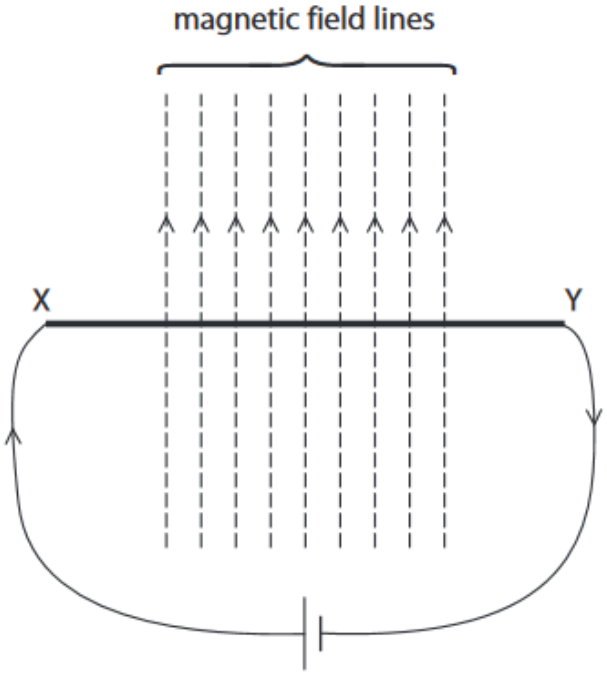
(3)

(ii) Describe how to investigate the shape and direction of the magnetic field between the magnets.

(3)

(b) A metal rod, X Y, is placed in a magnetic field as shown.

Wires from a cell are connected to the ends of the rod so that there is a current from X to Y.



Describe the effect on the rod.

(2)

4 (HIGHER).

(a) Fig. 2.1 shows a horizontal current-carrying wire placed in a uniform magnetic field.

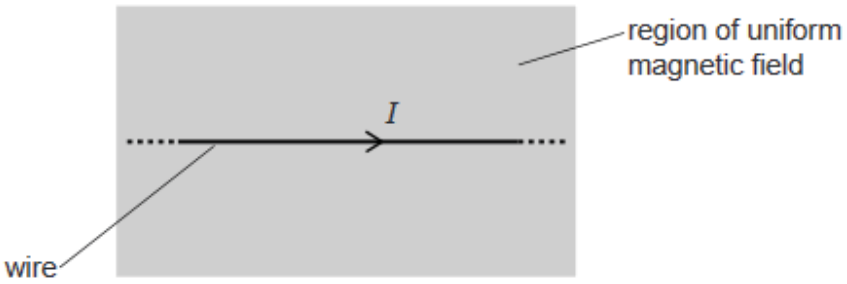


Fig. 2.1

The magnetic field of flux density 0.070 T is at right angles to the wire and into the plane of the paper. The weight of a 1.0 cm length of the wire is 6.8×10^{-5} N. The current I in the wire is such that the vertical upward force on the wire due to the magnetic field is equal to the weight of the wire.

(i) Calculate the current I in the wire.

I = ... A **[2]**

5 (HIGHER).

Fig. 5.1 shows a rigid, straight metal rod **XY** placed perpendicular to a magnetic field. The magnetic field is produced by two magnets that are placed on a U-shaped steel core. The steel core sits on a digital balance.

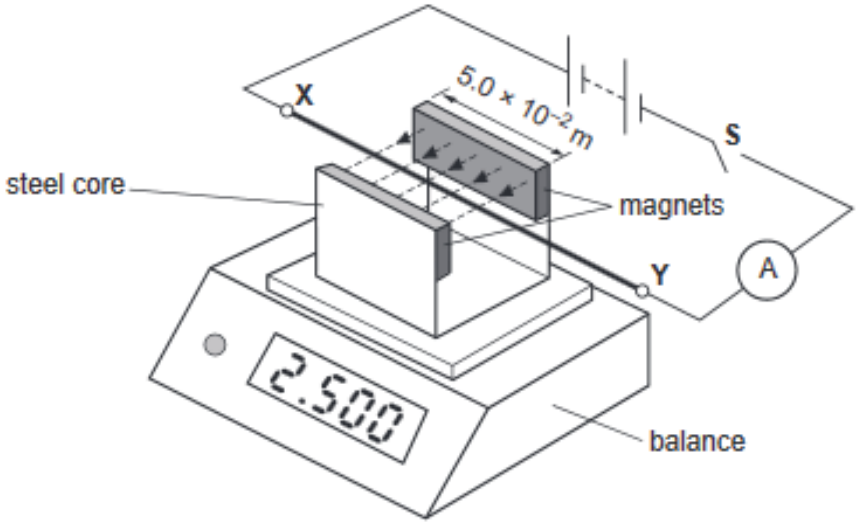


Fig. 5.1

The weight of the steel core and the magnets is 2.500 N. The rod is clamped at points **X** and **Y**. The rod is connected to a battery, switch and ammeter as shown in Fig. 5.1. The direction of the magnetic field is perpendicular to the rod.

Switch **S** is closed.

(a) State the direction of the force that now acts on the rod due to the magnetic field.

..... **[1]**

(b) State how you determined the direction of the force.

.....

.....

..... **[1]**

(c) The length of the rod in the magnetic field is 5.0×10^{-2} m and the current in the rod is 4.0 A. Assume that the magnets provide a uniform magnetic field of magnetic flux density 0.080 T.

(i) Calculate the force acting on the rod due to the magnetic field.

force = ... N **[1]**

(ii) State and explain the new reading on the balance.

reading on balance = ... N

.....

.....

.....

.....

..... [3]

6.
Draw a diagram showing the magnetic field pattern around a plane coil

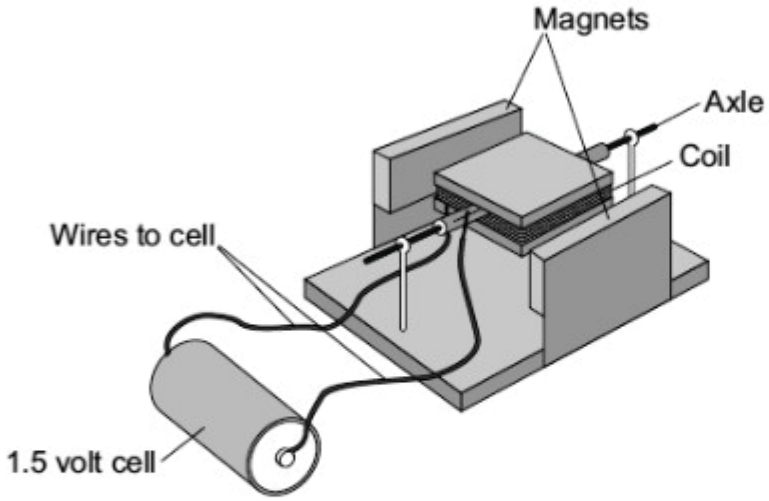
[3 marks]

7.
Draw a diagram showing the magnetic field pattern around a solenoid

[3 marks]

8 (HIGHER).

(a) Complete the description of the device shown below by drawing a ring around the correct line in each box.



(i) The device is being used as

an electric motor.
a generator.
a transformer.

(1)

(ii) The coil needs a flick to get started. Then one side of the coil is pushed by the

cell
coil
force

and the other side is pulled, so that the coil spins.

(1)

(b) Suggest **two** changes to the device, each one of which would make the coil spin faster.

1 .....

.....

2 .....

.....

(2)

(c) Suggest **two** changes to the device, each one of which would make the coil spin in the opposite direction.

1 .....

.....

2 .....

.....

(2)
(Total 6 marks)

9 (HIGHER).

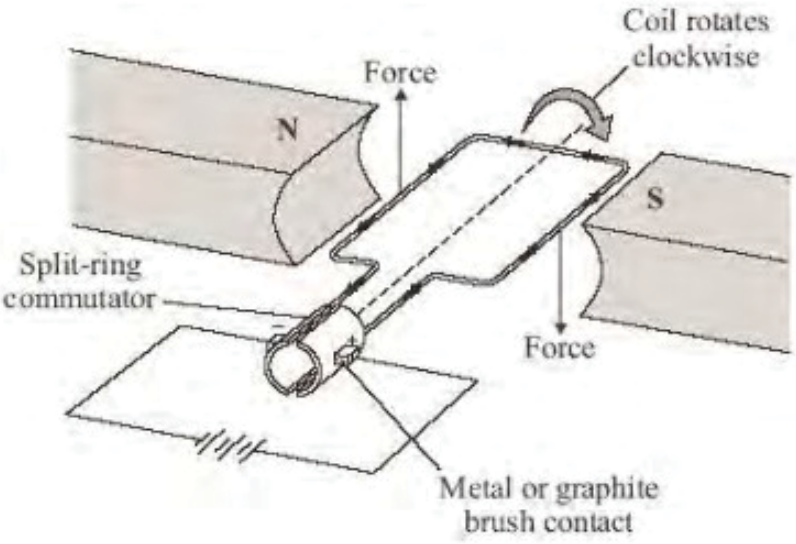
Many electrical appliances use the circular motion produced by their electric motor.

(a) Put ticks (✓) in the boxes next to **all** the appliances in the list which have an electric motor.

electric drill	☐
electric fan	☐
electric food mixer	☐
electric iron	☐
electric kettle	☐
electric screwdriver	☐

(2)

(b) One simple design of an electric motor is shown in the diagram. It has a coil which spins between the ends of a magnet.



(i) Give **two** ways of reversing the direction of the forces on the coil in the electric motor.

1 .....

.....

2 .....

.....

(2)

(ii) Give **two** ways of increasing the forces on the coil in the electric motor.

1 .....

.....

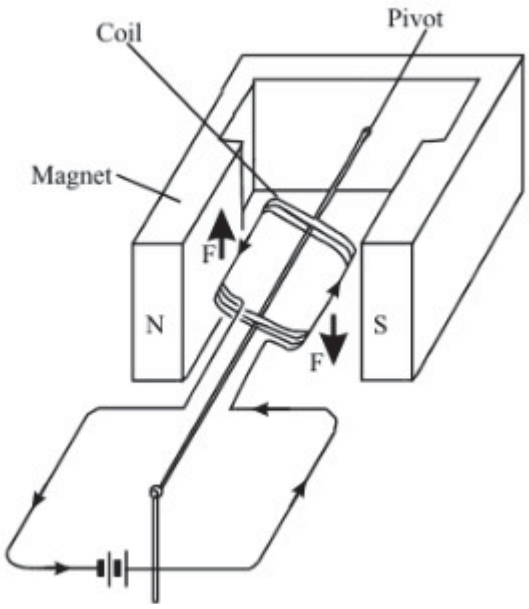
2 .....

.....

(2)
(Total 6 marks)

10 (HIGHER).

(b) The diagram shows a coil placed between the poles of a magnet. The arrows on the sides of the coil itself show the direction of the conventional current.



The arrows labelled F show the direction of the forces acting on the sides of the coil. Describe the motion of the coil until it comes to rest.

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.....

(3)

(c) Most electric motors use electromagnets instead of permanent magnets. State three of the features of an electromagnet which control the strength of the magnetic field obtained.

1 .....

2 .....

3 .....

(3)