1 An extremely violent nuclear reaction is taking place at the centre of the Sun. It is this reaction that enables the Sun to emit both a very large quantity of energy and an extremely large number of charged particles.

(a) Name the type of nuclear reaction taking place in the Sun.

.....[1]

(b) Many of the charged particles produced by the Sun are emitted from its surface at high speeds and travel out into space.

(i) Explain why these particles constitute an electric current.

.....

.....[1]

(ii) State the equation that relates the electric current I to the charge Q that is flowing. Define any other terms in the equation.

.....

.....[1]

(c) Some of the particles emitted by the Sun travel straight towards the Earth until they enter the Earth's magnetic field. Because they constitute a current, they experience a force and are deflected.

(i) Describe the relationship between the direction of the force and

1. the direction of the current,

.....[1]

2. the direction of the magnetic field.

.....[1]

(ii) A negatively charged particle is travelling in a magnetic field. This is represented in Fig. 9.1. The direction of the magnetic field is into the page.

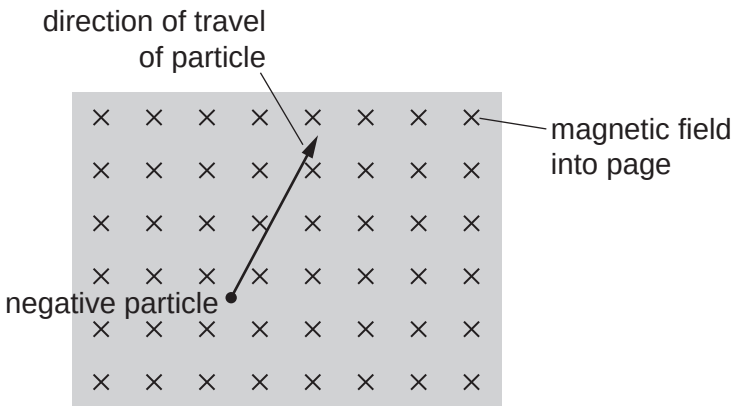


Fig. 9.1

On Fig. 9.1, draw an arrow, labelled F, to show the direction of the force that acts on the particle. [1]

[Total: 6]

2 **(a)** A very sensitive, centre-zero voltmeter is connected to the two terminals of a solenoid (long coil). Fig. 9.1 shows the S pole of a cylindrical magnet being inserted into the solenoid.

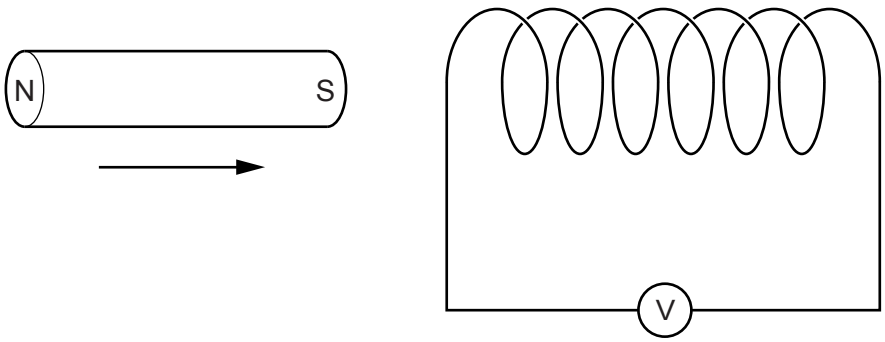


Fig. 9.1

As the magnet is inserted into the left-hand end of the solenoid, the needle of the voltmeter deflects.

(i) Explain why the needle deflects as the magnet is inserted.

.....

..... [2]

(ii) State and explain the effect of inserting the magnet more slowly.

.....

..... [2]

(iii) State what is observed when the magnet is withdrawn from the left-hand end of the solenoid.

..... [1]

(b) A transformer consists of a primary coil and a secondary coil on an iron core. An alternating voltage is connected to the primary coil.

Describe and explain the operation of the transformer.

.....

.....

.....

.....

.....

..... [4]

[Total: 9]

3 In the laboratory demonstration shown in Fig. 11.1, a copper rod rolls at a steady speed down the sloping parallel copper rails. The rails are in the region of a strong magnetic field that acts vertically downwards.

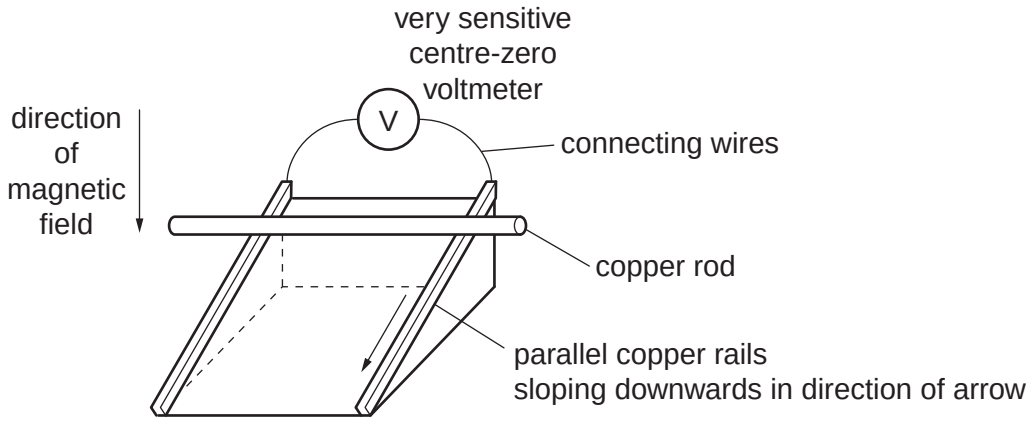


Fig. 11.1

(a) Explain why the voltmeter shows a deflection.

.....

.....

.....

..... [2]

(b) State, with reasons, the effect on the voltmeter deflection of the following changes:

(i) increasing the strength of the magnetic field,

deflection .....

reason .....

.....

.....

(ii) slightly increasing the slope of the copper rails,

deflection .....

reason .....

.....

.....

(iii) changing the direction of the magnetic field so it is parallel to the copper rails and directed down the slope.

deflection .....

reason .....

.....

.....

[4]

[Total: 6]

4 **(a)** Fig. 9.1 illustrates the left hand rule, which helps when describing the force on a current-carrying conductor in a magnetic field.

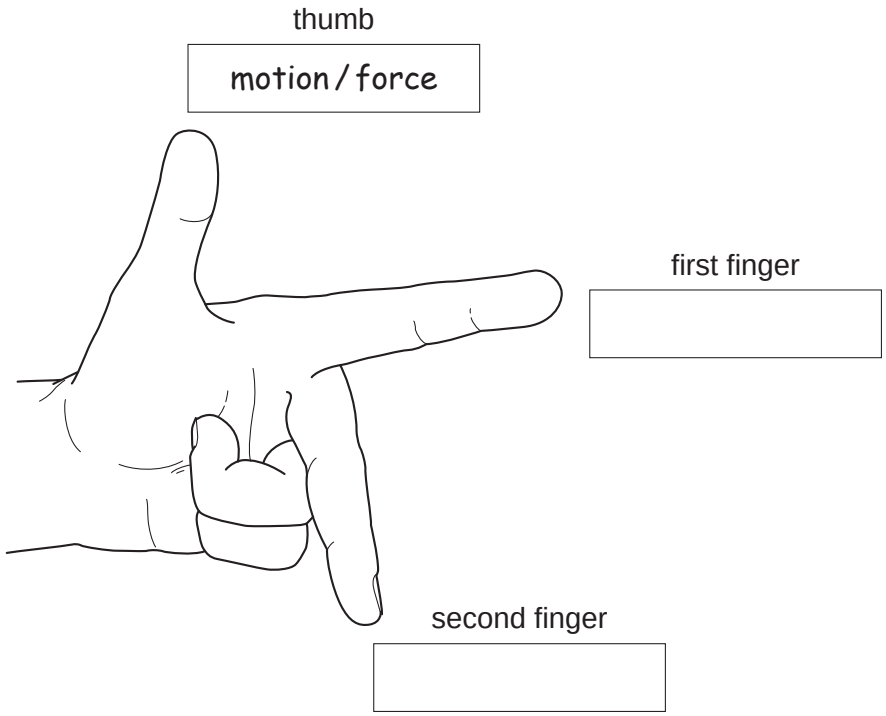


Fig. 9.1

One direction has been labelled for you.

In each of the other two boxes, write the name of the quantity that direction represents.

[1]

(b) Fig. 9.2 shows a simple d.c. motor connected to a battery and a switch.

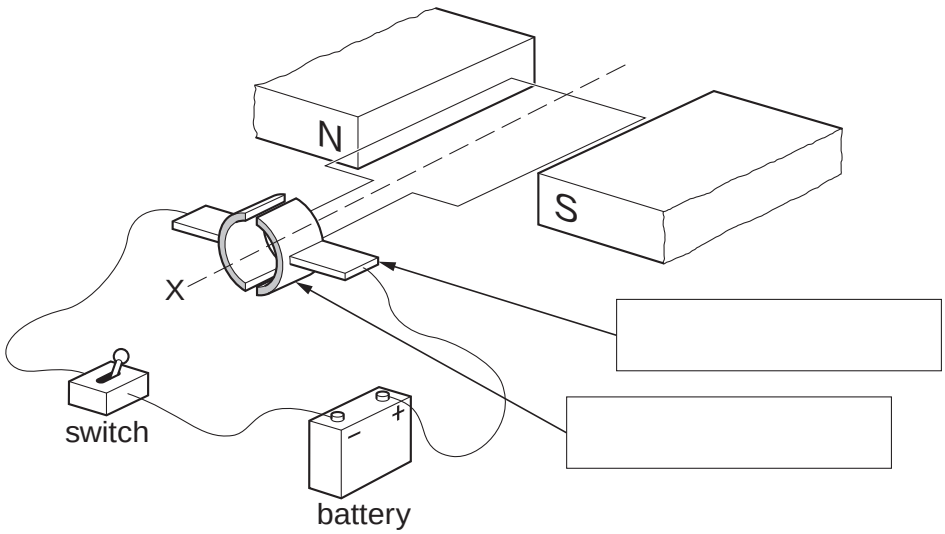


Fig. 9.2

(i) On Fig. 9.2, write in each of the boxes the name of the part of the motor to which the arrow is pointing. [2]

(ii) State which way the coil of the motor will rotate when the switch is closed, when viewed from the position X.

..... [1]

(iii) State two things which could be done to increase the speed of rotation of the coil.

1. .....

2. ..... [2]

[Total: 6]

5 Fig. 10.1 and Fig. 10.2 show two views of a vertical wire carrying a current up through a horizontal card. Points P and Q are marked on the card.

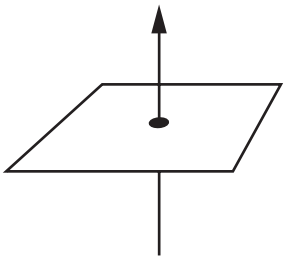
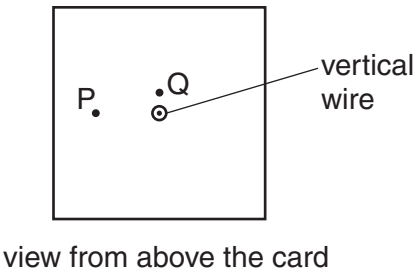


Fig. 10.1



view from above the card

Fig. 10.2

(a) On Fig. 10.2,

(i) draw a complete magnetic field line (line of force) through P and indicate its direction with an arrow,

(ii) draw an arrow through Q to indicate the direction in which a compass placed at Q would point.

[3]

(b) State the effect on the direction in which compass Q points of

(i) increasing the current in the wire,

.....

(ii) reversing the direction of the current in the wire.

.....

[2]

(c) Fig. 10.3 shows the view from above of another vertical wire carrying a current up through a horizontal card. A cm grid is marked on the card. Point W is 1 cm vertically above the top surface of the card.

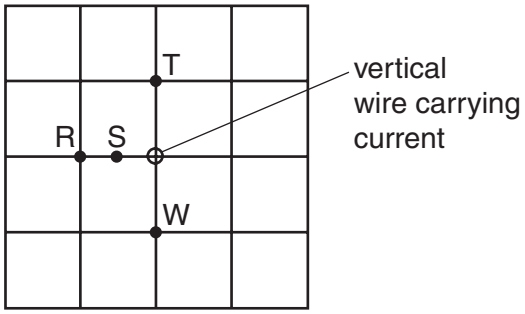


Fig. 10.3

State the magnetic field strength at S, T and W in terms of the magnetic field strength at R. Use one of the alternatives, **weaker**, **same strength** or **stronger** for each answer.

at S .....

at T .....

at W..... [3]

[Total : 8]