16.1 Figure **16.11** shows four permanent magnets arranged to form a square.

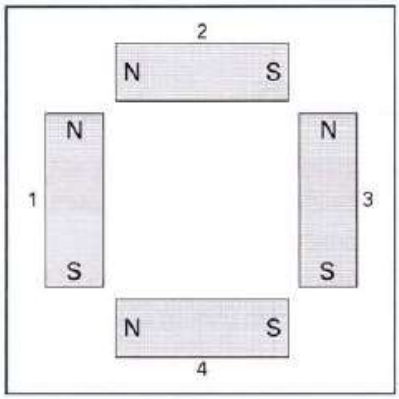


Figure 16.11 For Question **16.1**.

a Copy the diagram and indicate which pairs of magnets will attract one another and which will repel. [4]

b Draw a second diagram in which the four magnets are arranged in a square so that each magnet attracts the two other magnets to which it is closest. [2]

16.2 An electromagnet is a coil of wire through which a current can be passed.

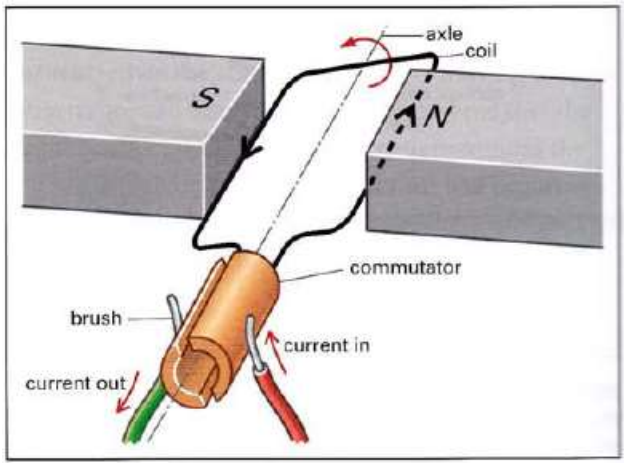
a State **three** ways in which the strength of the electromagnet can be increased. [3]

b An electromagnet can be switched on and off. Suggest **one** situation where this would be an advantage over the constant field of a permanent magnet. [1]

16.3 **a** What is the difference between a **hard** magnetic material and a **soft** magnetic material? [3]

b Explain which you would choose for a permanent magnet. [2]

c Explain which you would choose for the core of an electromagnet. [2]



6 Look at the motor shown in Figure **20.6** and the explanation of how it works. Suppose that the two magnets were turned round so that there was a magnetic north pole on the left. Explain how the coil would move.

7 **a** In a d.c. motor, why must the current to the rotor coil be reversed twice during each rotation?

b What device reverses the current?

8 Describe how the turning effect of a d.c. motor will change if the current flowing through the motor coil is increased.

9 List **two** ways to reverse the force on a current-carrying conductor in a magnetic field.

21.1 A student holds a bent piece of wire in a horizontal magnetic field, as shown in Figure **21.14**. She moves the wire downwards through the field, and then upwards.

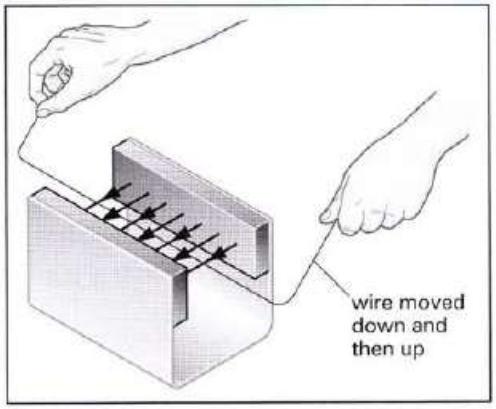


Figure 21.14 For Question **21.1**.

a Explain why an e.m.f. is induced between the ends of the wire. [1]

b How will the e.m.f. differ between moving the wire downwards and moving it upwards? [1]

c Suggest how she could move the wire to induce a bigger e.m.f. across its ends. [1]

d She now moves the wire horizontally from side to side in the magnetic field. Will an e.m.f. be induced? Give a reason to support your answer. [2]

21.2 Figure **21.15** shows a simple a.c. generator.

a Name the parts labelled X, Y and Z. [3]

b Describe the essential difference between alternating current and direct current. Include a diagram to support your answer. [3]

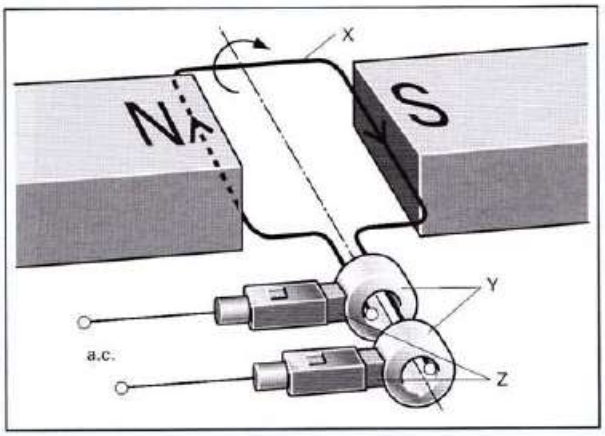


Figure 21.15 For Questions **21.2** and **21.4**.

21.3 Electrical power is often transmitted over long distances in high-voltage power lines (cables). Transformers are used to increase the voltage provided by the power station, and to reduce the voltage for the final user.

a Explain why electricity is transmitted at high voltages like this. [1]

b A transformer has 10 turns of wire on its primary coil, and 200 turns on its secondary coil. If the p.d. across the primary coil is 3 V a.c., what will the e.m.f. across the secondary be? [3]

c How could the same transformer be used as a step-down transformer? [1]

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21.4 Look again at the generator shown in Figure **21.15** on page 237.

a Suggest two ways in which the coil could be altered to induce a bigger e.m.f. [2]

b Suggest two other ways in which the e.m.f. could be increased. [2]

21.5 A transformer is used to transform a 230 V mains supply to 12 V for a computer games console.

a The primary coil has 5 000 turns. How may turns should there be on the primary coil? [3]

b In normal use, a current of 0.40 A flows in the secondary coil. What current flows in the primary coil? Assume that there are no power losses in the transformer. [3]