AQA GCSE Physics | 8463

SPECIFICATION POINT 4.7.2.3

# Electric motors (HT only)

## Past-paper questions

| | |
|---|---|
| Tier | **Higher** |
| Question groups | **6** |
| Available paper years | **2004–2025** |

## Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

**Name:** _____ **Date:** _____

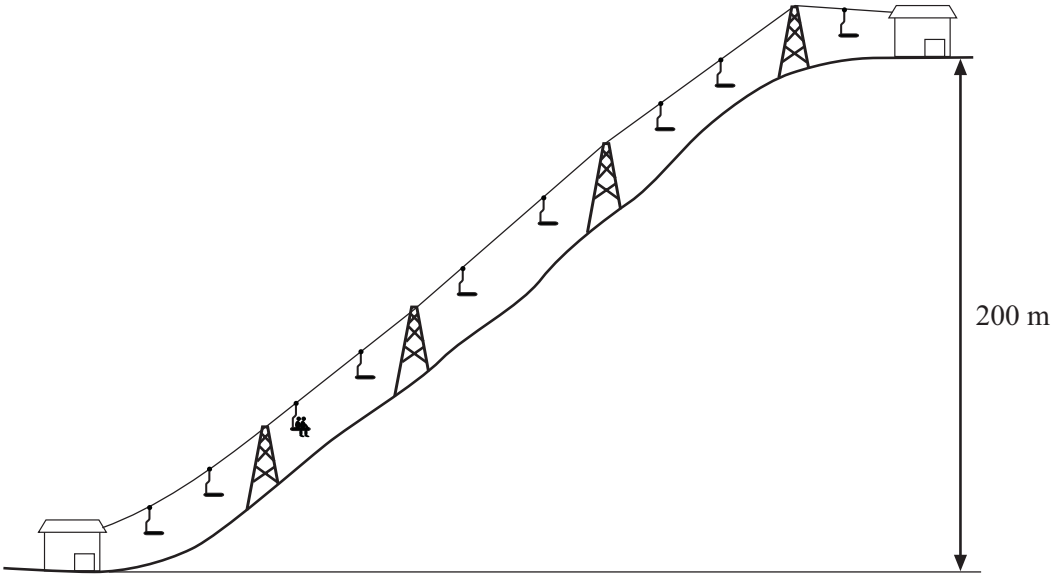
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

### 4.7.2.3 Electric motors (HT only)

**Question 01**

June 2004 | 3451H | Original Q6 | Legacy

**6** (a) A chair lift carries two skiers, Greg and Jill, to the top of a ski slope. Greg weighs 700 N and Jill weighs 500 N.




(i) Write down the equation that links distance moved, force applied and work done.

.....

*(1 mark)*

(ii) Calculate the work done to lift Greg and Jill through a vertical height of 200 m.
Show clearly how you work out your answer and give the unit.

.....

.....

.....

work done =.....

*(3 marks)*

**4.7.2.3 Electric motors (HT only)**

**Question 01 · continued**





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(b) The chair takes 5 minutes to move from the bottom to the top of the ski slope.

Use the following equation to calculate the power required to lift Greg and Jill to the top of the ski slope. Show clearly how you work out your answer.

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

.....

.....

power = .....watts

*(2 marks)*

(c) The chair lift is driven by an electric motor.

(i) Why would the power output of the electric motor need to be larger than your answer to part (b)?

.....

.....

*(1 mark)*

(ii) Complete the following sentence.

When the ski lift is working ..... energy supplied to the motor is usefully transferred as gravitational ..... energy. *(1 mark)*

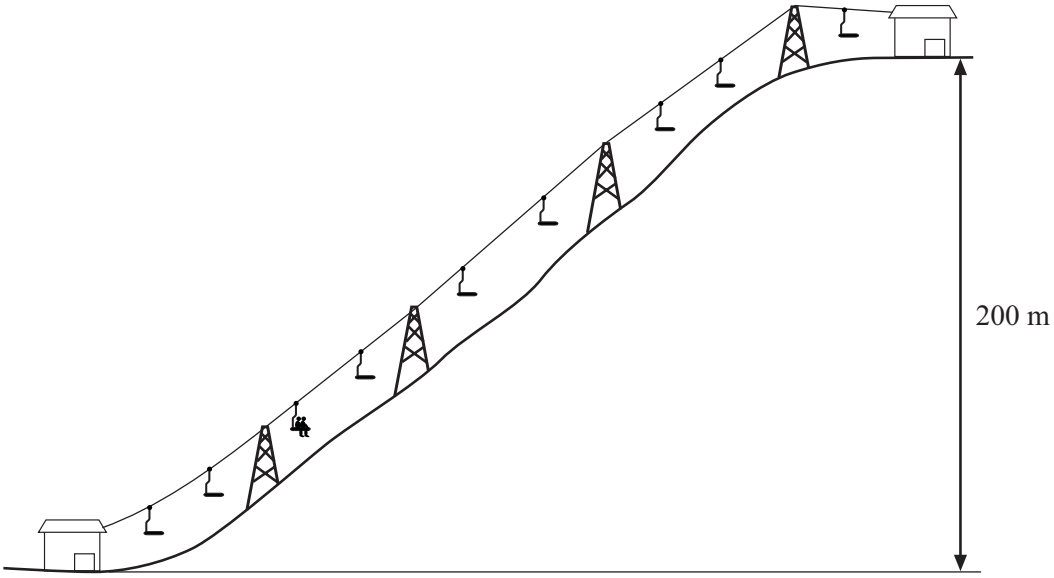
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### 4.7.2.3 Electric motors (HT only)

**Question 02**

June 2004 | 3462H3 | Original Q6 | Legacy

**6** (a) A chair lift carries two skiers, Greg and Jill, to the top of a ski slope. Greg weighs 700 N and Jill weighs 500 N.




(i) Write down the equation that links distance moved, force applied and work done.

.....

*(1 mark)*

(ii) Calculate the work done to lift Greg and Jill through a vertical height of 200 m.
Show clearly how you work out your answer and give the unit.

.....

.....

.....

work done =.....

*(3 marks)*

**4.7.2.3 Electric motors (HT only)**

**Question 02 · continued**





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(b) The chair takes 5 minutes to move from the bottom to the top of the ski slope.

Use the following equation to calculate the power required to lift Greg and Jill to the top of the ski slope. Show clearly how you work out your answer.

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

.....

.....

power = .....watts

*(2 marks)*

(c) The chair lift is driven by an electric motor.

(i) Why would the power output of the electric motor need to be larger than your answer to part (b)?

.....

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*(1 mark)*

(ii) Complete the following sentence.

When the ski lift is working ..... energy supplied to the motor is usefully transferred as gravitational ..... energy. *(1 mark)*

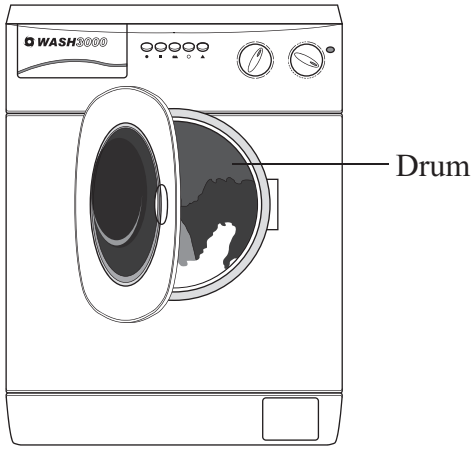
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### 4.7.2.3 Electric motors (HT only)

**Question 03**



**2** The picture shows a new washing machine. When the door is closed and the machine switched on, an electric motor rotates the drum and washing.




**2** (a) Complete the following sentences.

**2** (a) (i) An electric motor is designed to transform electrical energy into

..... energy.

*(1 mark)*

**2** (a) (ii) Some of the electrical energy supplied to the motor is wasted as

..... energy and ..... energy.

*(1 mark)*

**2** (b) What happens to the energy wasted by the electric motor?

.....

.....

*(1 mark)*

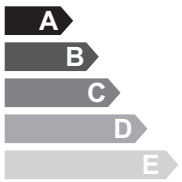
4.7.2.3 Electric motors (HT only)

Question 03 · continued



*for mark*

**2** (c) The diagram shows the label from the new washing machine.

<table>
<tr><td colspan="2">Model – Wash 3000<br>Energy A</td></tr>
<tr><td>More efficient<br>

Less efficient</td><td>
</td></tr>
<tr><td>Energy consumption kWh/wash cycle (based on 40 °C wash)</td><td>1.1</td></tr>
</table>

An ‘A’ rated washing machine is *more energy efficient* than a ‘C’ rated washing machine.

Explain what being *more energy efficient* means.

.....

.....

.....

.....

*(2 marks)*

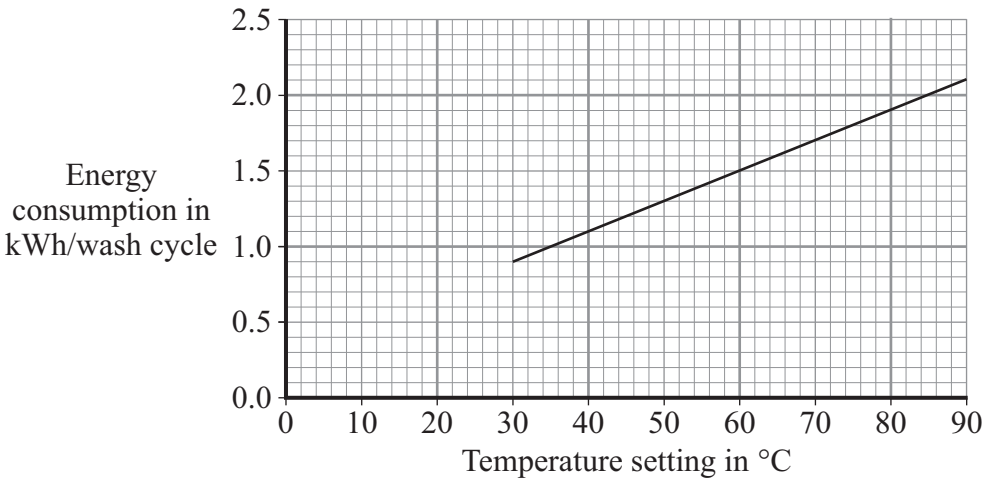
**Question 2 continues on the next page**

**4.7.2.3 Electric motors (HT only)**



*for mark*

**2** (d) The graph shows that washing clothes at a lower temperature uses less energy than washing them at a higher temperature. Using less energy will save money.




**2** (d) (i) Electricity costs 12 p per kilowatt-hour (kWh).
The temperature setting is turned down from 40 °C to 30 °C.

Use the graph and equation in the box to calculate the money saved each wash cycle.

| total cost = number of kilowatt-hours × cost per kilowatt-hour |
|---|

Show clearly how you work out your answer.

.....

.....

Money saved = ..... p

*(2 marks)*

**2** (d) (ii) Suggest why reducing the amount of energy used by washing machines could reduce the amount of carbon dioxide emitted into the atmosphere.

.....

.....

*(1 mark)*

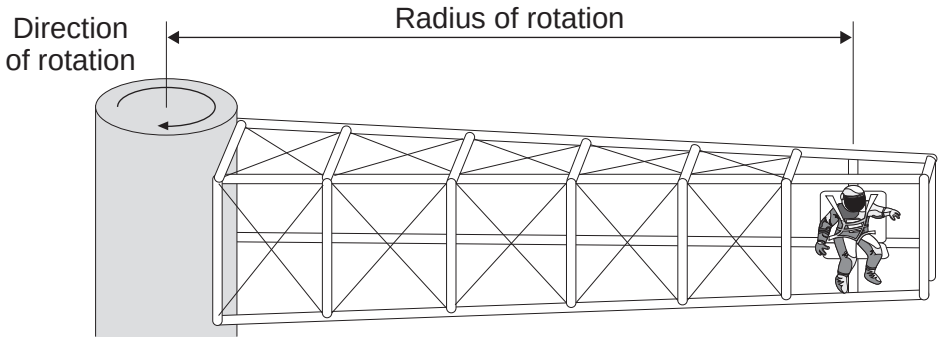
**8**

### 4.7.2.3 Electric motors (HT only)

**Question 04**

June 2013 | PH3HP | Original Q5 | Legacy

**5** The diagram shows a 'G-machine'. The G-machine is used in astronaut training.




The G-machine moves the astronaut in a horizontal circle.

**5 (a)** When the G-machine is rotating at constant speed, the astronaut is accelerating.

State the name and direction of the force causing the astronaut to accelerate.

Name of force .....

Direction of force .....

.....

*(2 marks)*

4.7.2.3 Electric motors (HT only)

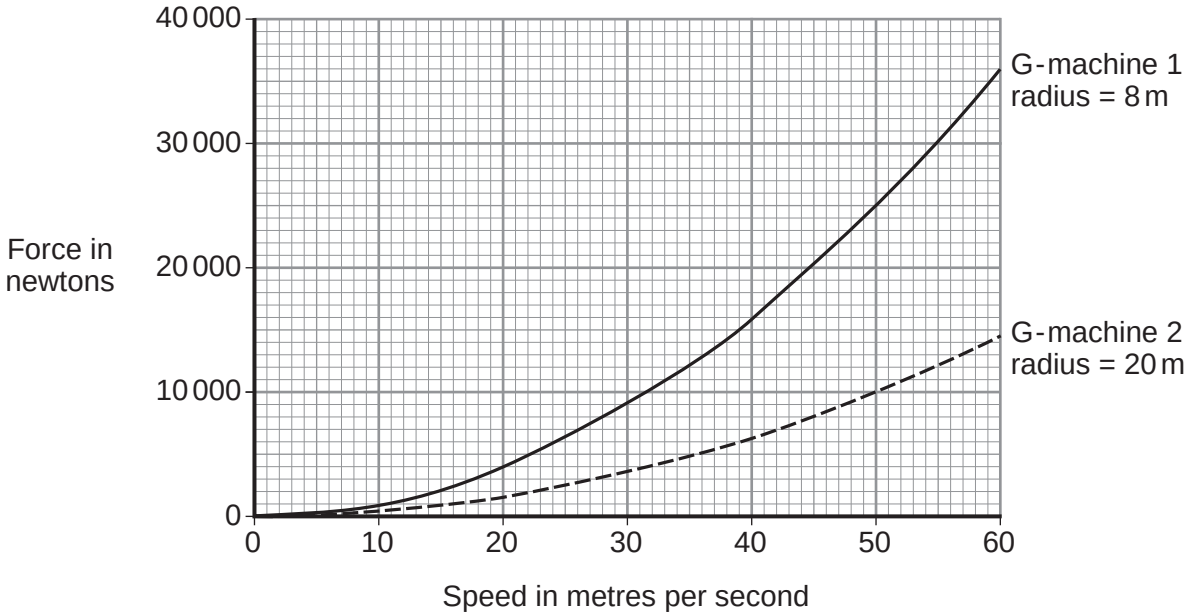
Question 04 · continued



**5 (b)** The force causing the astronaut to move in a circle is measured.

The graph shows how the speed of the astronaut affects the force causing the astronaut to move in a circle for two different G-machines.

The radius of rotation of the astronaut is different for each G-machine.




**5 (b) (i)** State **three** conclusions that can be made from the graph.

1 .....

.....

2 .....

.....

3 .....

.....

*(3 marks)*

**5 (b) (ii)** The speed of rotation of G-machine 1 is increased from 20 m/s to 40 m/s.

Determine the change in force on the astronaut.

.....

Change in force = ..... N

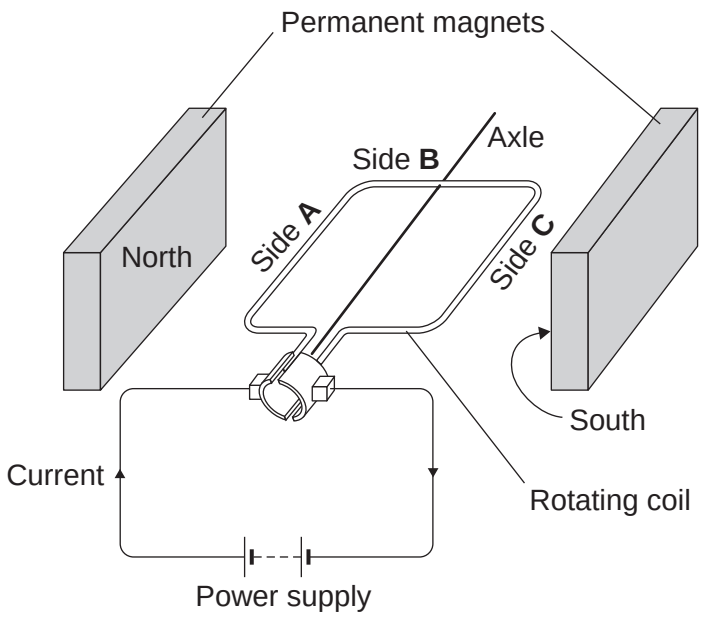
*(1 mark)*

4.7.2.3 Electric motors (HT only)

Question 04 · continued



**5 (c)** Each G-machine is rotated by an electric motor. The diagram shows a simple electric motor.




**5 (c) (i)** A current flows through the coil of the motor.

Explain why side **A** of the coil experiences a force.

.....

.....

.....

.....

*(2 marks)*

**5 (c) (ii)** Draw arrows on the diagram to show the direction of the forces acting on side **A** of the coil and side **C** of the coil.

*(1 mark)*

**5 (c) (iii)** When horizontal, side **B** experiences no force.

Give the reason why.

.....

.....

*(1 mark)*

4.7.2.3 Electric motors (HT only)

Question 04 · continued



**5 (d)** While a G-machine is rotating, the operators want to increase its speed.

What can the operators do to make the G-machine rotate faster?

.....

.....

*(1 mark)*

**5 (e)** The exploration of space has cost a lot of money.

Do you think spending lots of money on space exploration has been a good thing?

Draw a ring around your answer.

**Yes** **No**

Give a reason for your answer.

.....

.....

*(1 mark)*

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### 4.7.2.3 Electric motors (HT only)

**Question 05**

June 2018 | 8463/2H | Original Q10

**1 0** The circle in **Figure 18** represents a straight wire carrying a current. The cross shows that the current is into the plane of the paper.

**Figure 18**



**1 0 . 1** Complete **Figure 18** to show the magnetic field pattern around the wire.

**[2 marks]**

**1 0 . 2** The magnetic flux density 10 cm from the wire is 4 microtesla.

Which of the following is the same as 4 microtesla?

Tick **one** box.

**[1 mark]**

$4 \times 10^{-2}$ T ☐

$4 \times 10^{-3}$ T ☐

$4 \times 10^{-6}$ T ☐

$4 \times 10^{-9}$ T ☐

**Question 10 continues on the next page**

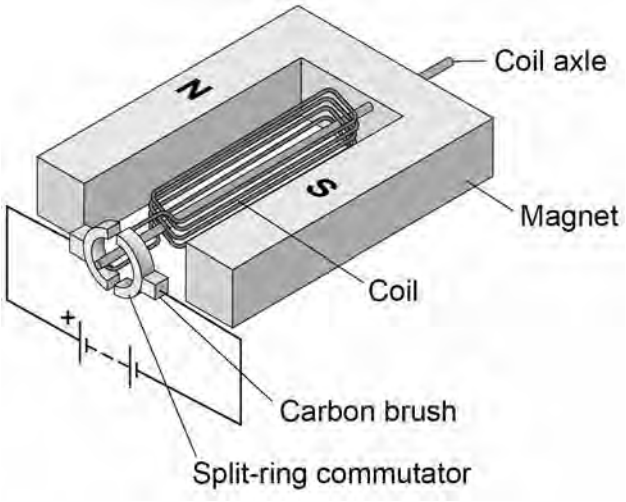
4.7.2.3 Electric motors (HT only)

Question 05 · continued



**1 0 . 3** **Figure 19** shows a simple electric motor.

**Figure 19**




When there is a current in the coil, the coil rotates continuously.

Explain why.

**[4 marks]**

7

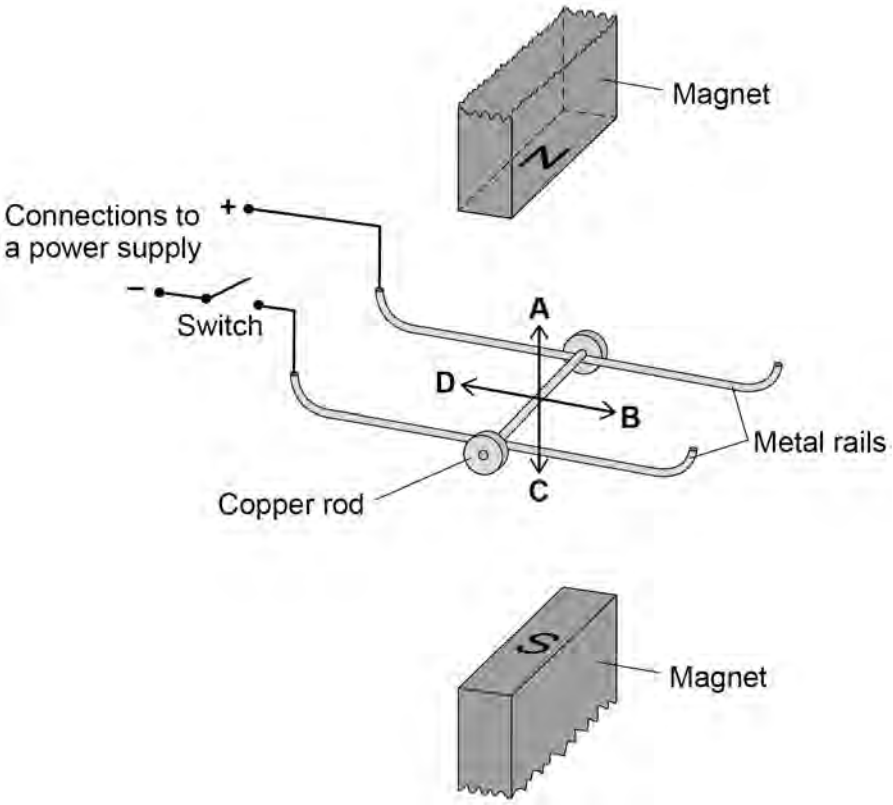
4.7.2.3 Electric motors (HT only)

Question 06



**0 7** **Figure 7** shows some apparatus used to demonstrate the motor effect.

**Figure 7**




When the switch is closed the copper rod accelerates.

**0 7 . 1** What direction is the acceleration of the copper rod?

**[1 mark]**

Tick (✓) **one** box.

**A** ☐

**B** ☐

**C** ☐

**D** ☐

4.7.2.3 Electric motors (HT only)

Question 06 · continued



**0 7 . 2** The copper rod has a mass of 5.0 g.

The length of the copper rod in the magnetic field is 0.070 m.

The magnetic flux density is 0.30 T.

Calculate the initial acceleration of the rod when the current in the rod is 2.0 A.

Use the Physics Equations Sheet.

**[5 marks]**

Initial acceleration = _____ $m/s^2$

**Question 7 continues on the next page**

Question 06 · continued

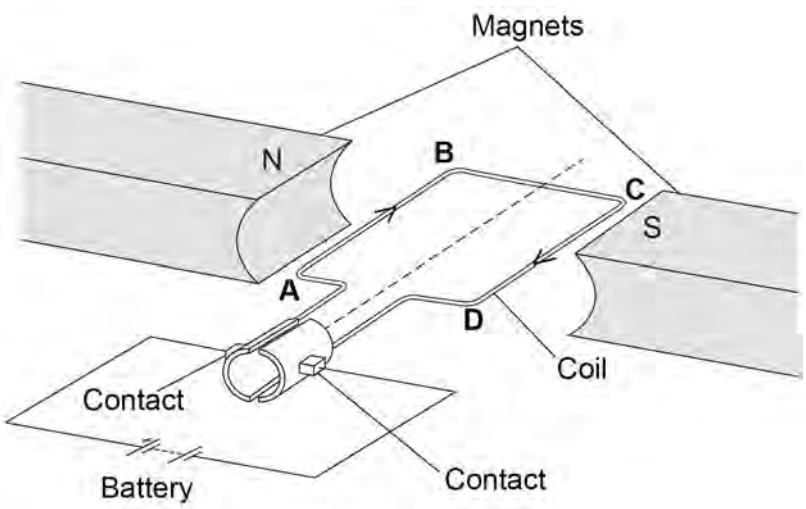


**Figure 8** shows a simple motor.

There is a magnetic field between the two permanent magnets.

When there is a current in the coil, a magnetic field is produced around the coil.

**Figure 8**




**0 7 . 3** Explain how these magnetic fields cause the coil to continuously rotate.

**[4 marks]**

4.7.2.3 Electric motors (HT only)

Question 06 · continued



**0 7 . 4** In **Figure 8** the coil of the motor is in a horizontal position.

Explain why the resultant moment on the coil is zero when the coil is in a vertical position.

**[2 marks]**

12

**Turn over for the next question**