



# **GCSE Physics**

## **Motor Effect**

### **Mark Scheme**

**Time available: 54 minutes**

**Marks available: 49 marks**

**[www.accesstuition.com](http://www.accesstuition.com)**

## Mark schemes

1

1.

- (a) at least three circles drawn

clockwise arrows on circles

*allow 1 mark for one or two circles with clockwise arrows*

1

- (b)  $4 \times 10^{-6}$

1

- (c) the sides of the coil (parallel to the magnet) experience a force (in opposite directions)

*allow the current creates a magnetic field  
ignore Fleming's Left Hand Rule*

1

the forces cause moments that act in the same (clockwise / anticlockwise) direction

**or**

the moments cause the coil to rotate (clockwise / anticlockwise)

*allow the magnetic fields interact to create a pair of forces (acting in opposite directions)*

**or**

*allow the magnetic fields interact causing the coil to rotate*

1

(each half-revolution) the two halves of the (rotating) commutator swap from one (carbon) brush to the other

1

(each half-revolution) the commutator reverses the current (in the coil)

**or**

keeping the forces in the same direction (keeping the coil rotating)

*allow keeps the current in the same direction relative to the (permanent) magnetic field*

1

[7]

2.

- (a) motor effect

1

- (b) increase the strength of the magnet

**or**

increase the current

1

- (c)  $4.8 \times 10^{-4} = F \times 8 \times 10^{-2}$

1

$$F = 6 \times 10^{-3} \text{ (N)}$$

1

$$6 \times 10^{-3} = B \times 1.5 \times 5 \times 10^{-2}$$

1

$$B = \frac{6 \times 10^{-3}}{7.5 \times 10^{-2}}$$

1

$$B = 8 \times 10^{-2} \text{ or } 0.08$$

1

*allow  $8 \times 10^{-2}$  or 0.08 with no working shown for 5 marks  
a correct method with correct calculation using an incorrect value of F gains 3 marks*

Tesla

*accept T*

1

*do not accept t*

[8]

3.

- (a) move a (magnetic / plotting) compass around the wire

1

the changing direction of the compass needle shows a magnetic field has been produced

**OR**

sprinkle iron filings onto the card (1)

tapping the card will move the filings to show the magnetic field (pattern) (1)

1

- (b) **Level 2 (3–4 marks):**

A detailed and coherent explanation is provided. The response makes logical links between clearly identified, relevant points that explain how the ignition circuit works.

**Level 1 (1–2 marks):**

Simple statements are made. The response may fail to make logical links between the points raised.

**0 marks:**

No relevant content

**Indicative content**

- closing the (ignition) switch causes a current to pass through the electromagnet
- the iron core (of the electromagnet) becomes magnetised
- the electromagnet / iron core attracts the (short side of the ) iron arm
- the iron arm pushes the contacts (inside the electromagnetic switch) together
- the starter motor circuit is complete
- a current flows through the starter motor (which then turns)

4

[6]

<b>4.</b>	<p>(a) move a (magnetic / plotting) compass around the wire</p> <p style="text-align: right;">1</p> <p>the changing direction of the compass needle shows a magnetic field has been produced</p> <p><b>OR</b></p> <p>sprinkle iron filings onto the card (1)</p> <p>tapping the card will move the filings to show the magnetic field (pattern) (1)</p> <p style="text-align: right;">1</p>
(b)	<p><b>Level 2 (3–4 marks):</b> A detailed and coherent explanation is provided. The response makes logical links between clearly identified, relevant points that explain how the ignition circuit works.</p> <p><b>Level 1 (1–2 marks):</b> Simple statements are made. The response may fail to make logical links between the points raised.</p> <p><b>0 marks:</b> No relevant content.</p> <p><b>Indicative content</b></p> <ul style="list-style-type: none"> <li>• closing the (ignition) switch causes a current to pass through the electromagnet</li> <li>• the iron core (of the electromagnet) becomes magnetised</li> <li>• the electromagnet / iron core attracts the (short side of the ) iron arm</li> <li>• the iron arm pushes the (starter motor) contacts (inside the electromagnetic switch) together</li> <li>• the starter motor circuit is complete</li> <li>• a current flows through the starter motor (which then turns)</li> </ul> <p style="text-align: right;">4</p>
<b>[6]</b>	
<b>5.</b>	<p>(a) motor</p> <p style="text-align: right;">1</p> <p>(b) increase the strength of the magnetic field</p> <p style="padding-left: 20px;"><i>accept use a stronger magnet</i></p> <p style="padding-left: 20px;"><i>use a larger / bigger magnet is insufficient</i></p> <p style="padding-left: 20px;"><i>do <b>not</b> accept move magnets closer</i></p> <p style="text-align: right;">1</p> <p>increase the (size of the) current</p> <p style="padding-left: 20px;"><i>accept use a current greater than 2 (A)</i></p> <p style="padding-left: 20px;"><i>accept increase the p.d. / voltage (of the power supply)</i></p> <p style="padding-left: 20px;"><i>increase the power supply is insufficient</i></p> <p style="text-align: right;">1</p>

- (c) any **one** from:
- (reverse the) direction of the current  
*accept swap the wires at the power supply connections*  
*swap the wires around is insufficient*
  - (change the) direction of the magnetic field  
*accept turn the magnet around*  
*do **not** accept use an a.c. supply*

1

- (d) The wire is parallel to the direction of the magnetic field.

1

[5]

6.

- (a) (i) (closing the switch makes) a current (through the wire)

1

(the current flowing) creates a magnetic field (around the wire)

1

this field interacts with the permanent magnetic field

*accept links / crosses attracts / repels is insufficient*

1

- (ii) arrow drawn showing upwards force on XY

*judge vertical by eye the arrow must be on or close to the wire XY*

1

- (iii) motor

*accept catapult*

1

- (b) (i) the wire moves up and down  
or  
the wire vibrates

*back and forth or side to side is insufficient for vibrate*

1

- (ii) the force (continually) changes direction (from upwards to downwards, on the wire)

*accept the direction of the magnetic field (of the wire) changes*

1

[7]

7.

- (a) a force

1

(b) any **two** from:

- more powerful magnet  
*do not allow 'bigger magnet'*
- reduce the gap (between magnet and coil)
- increase the area of the coil
- more powerful cell  
*do not allow 'bigger cell'*  
*accept battery for cell*  
*accept add a cell*  
*accept increase current / potential difference*
- more turns (on the coil)  
*allow 'more coils on the coil'*  
*do not allow 'bigger coil'*

2

- (c) reverse the (polarity) of the cell  
*allow 'turn the cell the other way round'*  
*accept battery for cell*

1

reverse the (polarity) of the magnet  
*allow 'turn the magnet the other way up'*

1

**[5]**

**8.**

- (a) increase the current (1)  
*credit increase the p.d./voltage*  
*credit reduce the resistance*  
*credit have thicker wiring*  
*credit add extra / more cells*

1

increase the magnetic field (strength) (1)  
*credit 'have stronger magnet(s)'*  
*do not credit 'bigger magnets' either order*

1

- (b) **either** reverse polarity  
**or** connect the battery the other way round

1

**either** reverse direction of the magnetic field

**or** put the magnet the other way round / reverse the magnet

*do **not** give any credit to a response in which both are done at the same time*

*either order*

1

- (c) **either**  
conductor parallel to the magnetic field

**or** lines of magnetic force and path of electricity do not cross

1

[5]