

# The Motor Effect

## Question Paper

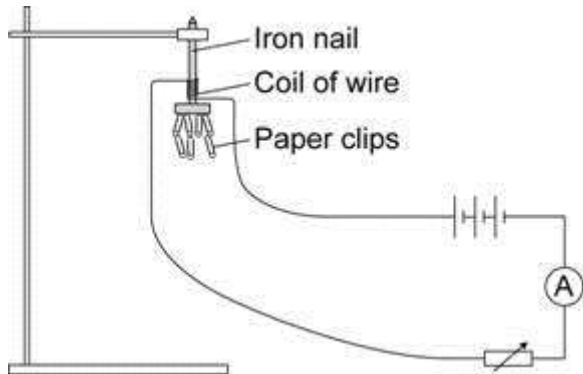
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|------------------|------------------|
| Level            | GCSE             |
| Subject          | Physics          |
| Exam Board       | AQA              |
| Unit             | P3               |
| Topic            | The Motor Effect |
| Difficulty Level | Silver Level     |
| Booklet          | Question Paper   |

**Time Allowed:** 58 minutes

**Score:** /58

**Percentage:** /100

**Q1.** The diagram shows the equipment used by a student to investigate the strength of five different electromagnets.



The stronger the electromagnet, the more paper clips it will hold.

(a) Why is it important that the paper clips used in the investigation are all the same size?

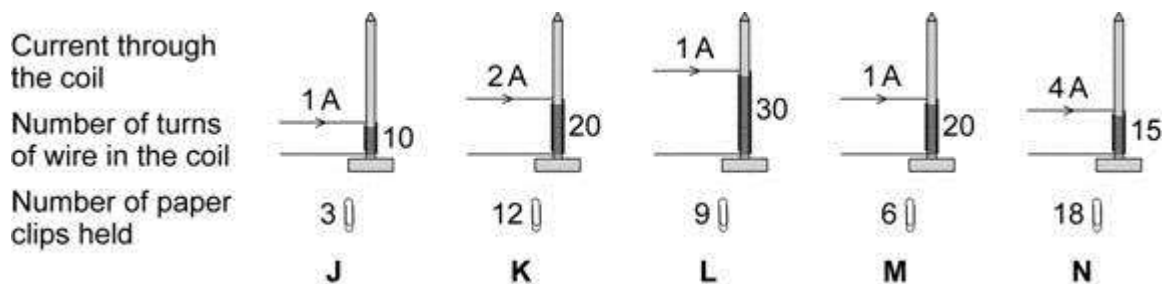
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(1)

(b) The five electromagnets, **J**, **K**, **L**, **M** and **N**, used by the student are shown below. Each electromagnet was made by wrapping lengths of insulated wire around identical iron nails.



The student wants to find out how the strength of an electromagnet depends on the number of turns of wire in the coil.

Which electromagnets should the student compare in order to do this?

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(1)

(c) The student concluded:

“The strength of an electromagnet is always directly proportional to the number of turns on the coil.”

(i) Explain how the data from the investigation supports the student’s conclusion.

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(2)

(ii) The student makes one more electromagnet by winding 100 turns onto a nail.

Before testing the electromagnet, the student predicted the number of paper clips that the electromagnet would hold when the current is 1 amp.

How many paper clips should the student predict that the electromagnet would hold?

Show clearly how you work out your answer.

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number of paper clips = .....

(2)

(iii) When the student tested the electromagnet it held 20 paper clips. This is not what the student predicted.

Explain what the student should do when new data does not seem to support the prediction that was made.

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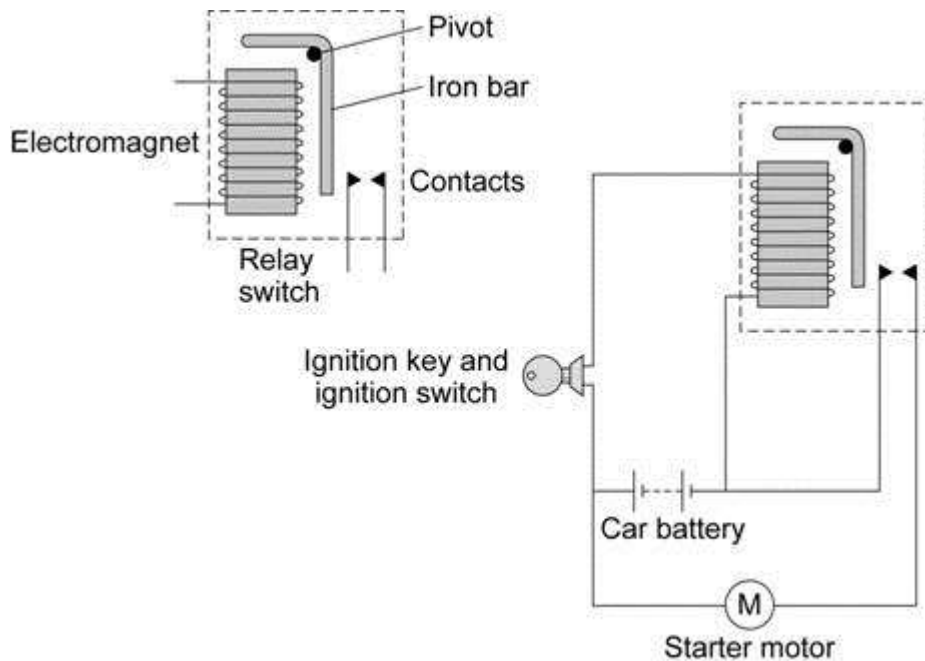
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(3)  
(Total 9 marks)

**Q2.** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The diagrams show a relay switch and how it is used in a car ignition circuit.



Turning the ignition key closes the ignition switch.  
Explain how this causes the starter motor to operate.

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(Total 6 marks)

**Q3.** 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

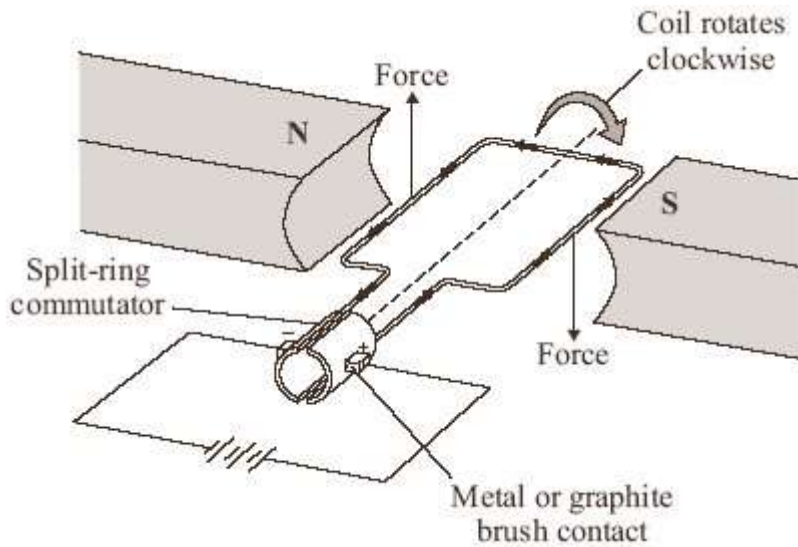
electric iron

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 .....

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2 .....

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(2)

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

1 .....

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2 .....

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(2)

(Total 6 marks)

**Q4.** (a) Name a material that could be used to make the outside case of the plug.

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Give a reason for your choice.

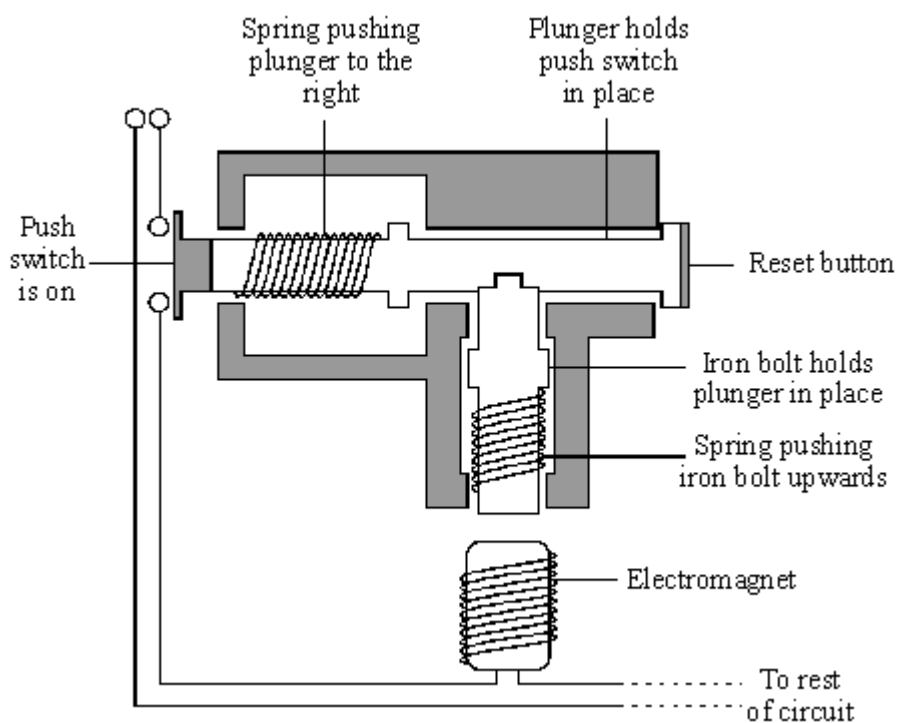
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(2)

(b) *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Some electrical circuits are protected by a circuit breaker. These switch the circuit off if a fault causes a larger than normal current to flow. The diagram shows one type of circuit breaker. A normal current (15 A) is flowing.



Source: adapted from V. PRUDEN and K. HIRST, AQA GCSE Science

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Explain what happens when a current larger than 15A flows. The answer has been started for you.

When the current goes above 15 A, the electromagnet becomes stronger and

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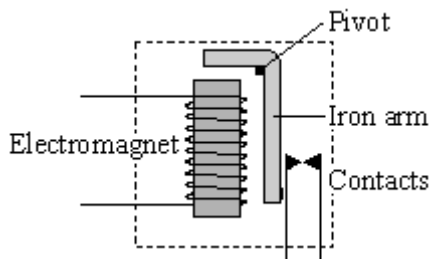
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(3)  
(Total 5 marks)

**Q5.** The diagram shows a switch that is operated by an electromagnet.



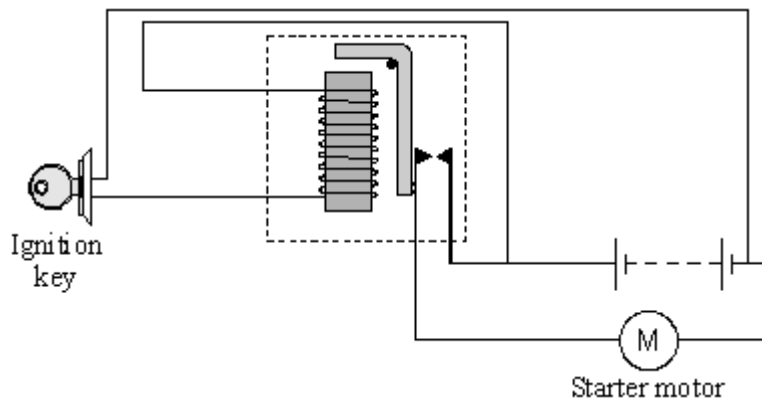
(i) What is this type of switch called?



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(1)

(ii) The switch is used in a car starter motor circuit.



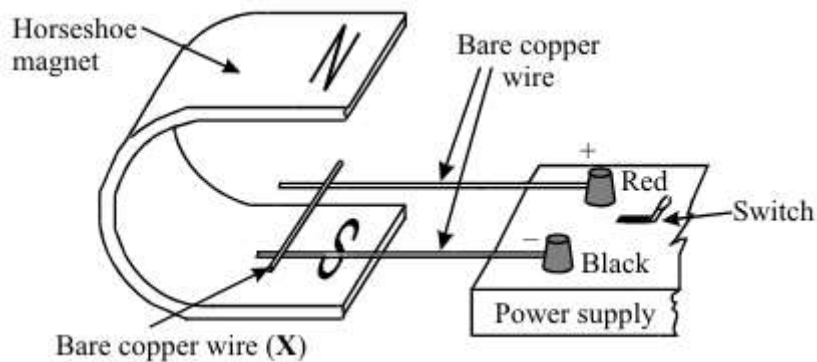
Explain how turning the ignition key makes a current flow in the starter motor. The explanation has been started for you.

When the ignition key is turned .....

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(3)  
(Total 4 marks)

**Q6.** The diagram shows apparatus used to demonstrate the motor effect. **X** is a short length of bare copper wire resting on two other wires.



- (a) (i) Describe what happens to wire **X** when the current is switched on.

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- (ii) What difference do you notice if the following changes are made?

A The magnetic field is reversed.

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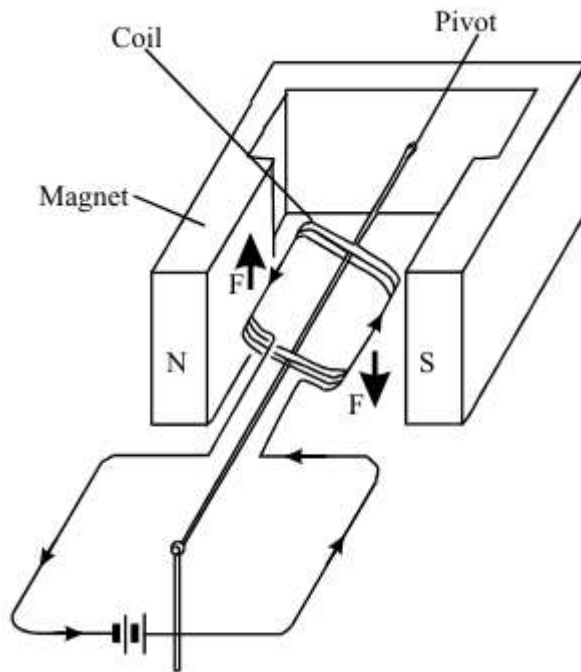
B The current is increased.

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(3)

- (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 .....

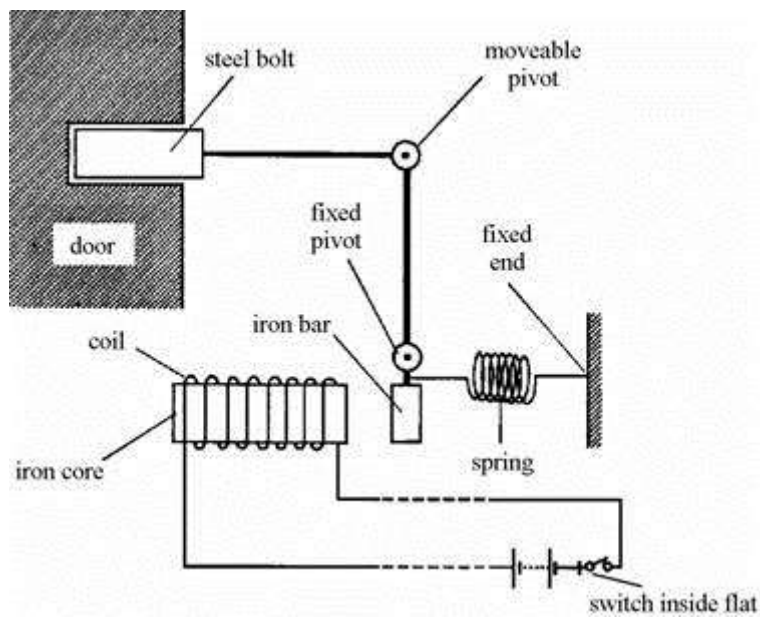
2 .....

3 .....

(3)

(Total 9 marks)

**Q7.** The diagram below shows a door lock which can be opened from a flat inside a building.



(a) Explain how the door is unlocked when the switch is closed.

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.....

(4)

(b) State **two** changes which would increase the strength of the electromagnet.

1 .....

2 .....

(2)

(c) Why is the spring needed in the lock?

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(1)

(d) The connections to the coil were accidentally reversed. Would the lock still work?

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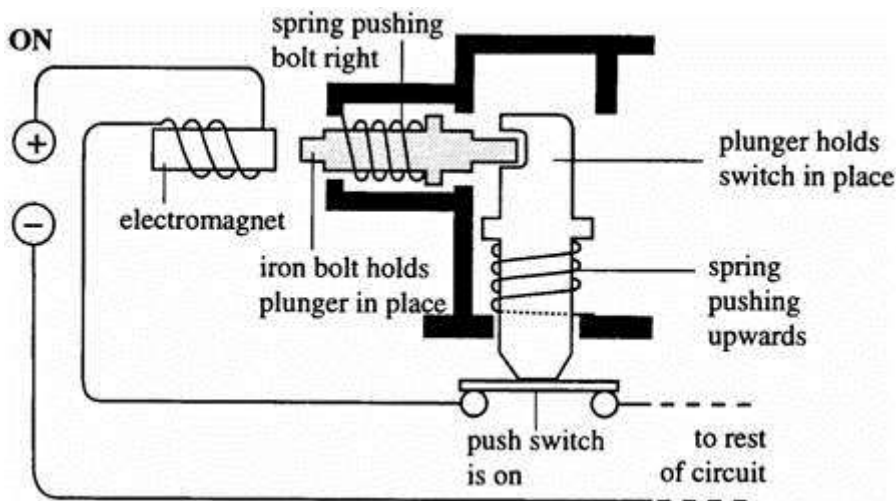
Explain your answer.

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(2)

(Total 9 marks)

**Q8.** A fault in an electrical circuit can cause too great a current to flow. Some circuits are switched off by a circuit breaker.



One type of circuit breaker is shown above. A normal current is flowing. Explain, in full detail, what happens when a current which is bigger than normal flows.

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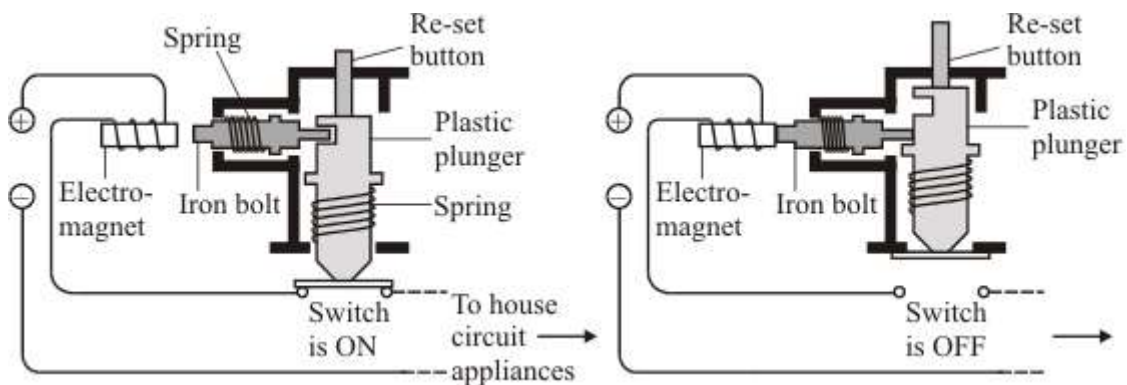
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(Total 4 marks)

**Q9.** Circuit breakers help to make the electricity supply in homes safer. A circuit breaker is an automatic safety switch. It cuts off the current if it gets too big.



Describe, in as much detail as you can, how this circuit breaker works.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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**(Total 6 marks)**