

Name:

Date:

P7 - Test 4  
MAGNETISM  
Intermediate

**GCSE**

PHYSICS

AQA - Triple Science

Mark

Grade

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### Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

### Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

### Information

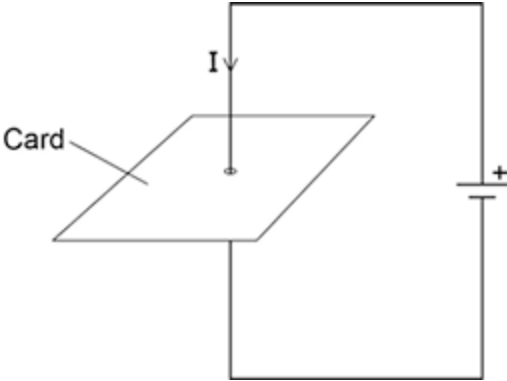
- The marks for the questions are shown in brackets

1.

Figure 1 shows a straight wire passing through a piece of card.

A current ( $I$ ) is passing down through the wire.

Figure 1



(a) Describe how you could show that a magnetic field has been produced around the wire.

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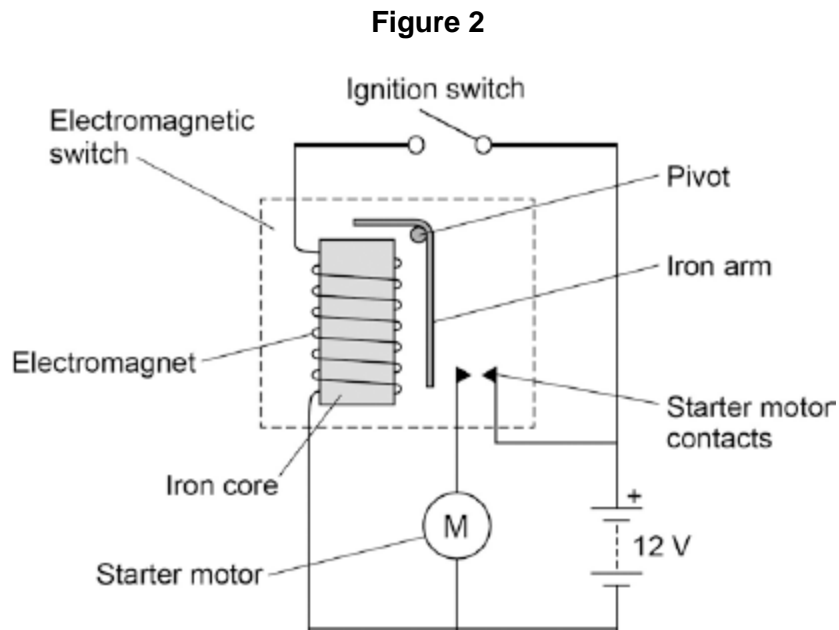
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(2)

(b) **Figure 2** shows the ignition circuit used to switch the starter motor in a car on.

The circuit includes an electromagnetic switch.



Explain how the ignition circuit works.

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(4)

(Total 6 marks)

2.

(a) Electromagnets are often used at recycling centres to separate some types of metals from other materials.

Give **one** reason why an electromagnet would be used rather than a permanent magnet.

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(1)

- (b) In this question you will gain marks for using good English, organising information clearly and using scientific words correctly.

Some students want to build an electromagnet.

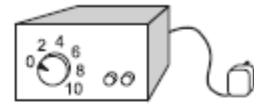
The students have the equipment shown below.



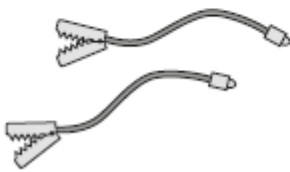
Insulated wire



Iron nail



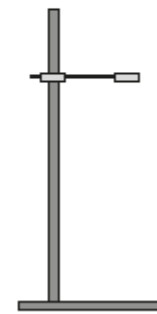
Power supply



Connecting leads



Steel paperclips



Wooden clamp and stand

Describe how the students could build an electromagnet. Include in your answer how the students should vary and test the strength of their electromagnet.

(6)

(Total 7 marks)

3.

If a fault develops in an electrical circuit, the current may become too great. The circuit needs to be protected by being disconnected.

A fuse or a circuit breaker may be used to protect the circuit.

One type of circuit breaker is a Residual Current Circuit Breaker (RCCB).

- (a) (i) Use the correct answer from the box to complete the sentence.

earth	live	neutral
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A fuse is connected in the \_\_\_\_\_ wire.

(1)

- (ii) Use the correct answer from the box to complete the sentence.

are bigger	are cheaper	react faster
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RCCBs are sometimes preferred to fuses because they \_\_\_\_\_.

(1)

(iii) RCCBs operate by detecting a difference in the current between two wires.

Use the correct answer from the box to complete the sentence.

earth and live	earth and neutral	live and neutral
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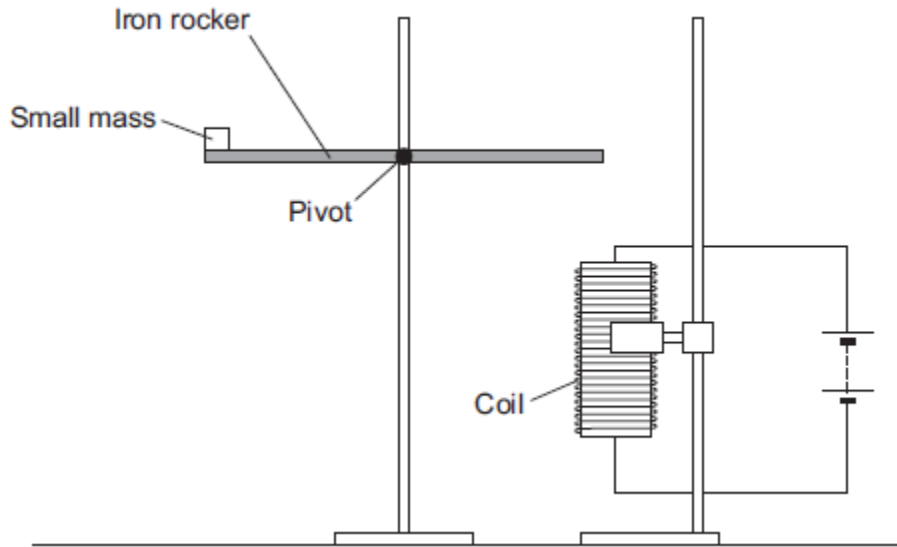
The two wires are the \_\_\_\_\_ wires.

(1)

(b) An RCCB contains an iron rocker and a coil.

A student investigated how the force of attraction, between a coil and an iron rocker, varies with the current in the coil.

She supported a coil vertically and connected it in an electrical circuit, part of which is shown in the figure below .



She put a small mass on the end of the rocker and increased the current in the coil until the rocker balanced. She repeated the procedure for different masses.

Some of her results are shown in the table below.

Mass in grams	Current needed for the rocker to balance in amps
5	0.5
10	1.0
15	1.5
20	2.0

- (i) State **two** extra components that must have been included in the circuit in the figure above to allow the data in the above table to be collected.

Give reasons for your answers.

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**(4)**

- (ii) A teacher said that the values of current were too high to be safe.

Suggest **two** changes that would allow lower values of current to be used in this investigation.

Change 1 \_\_\_\_\_

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Change 2 \_\_\_\_\_

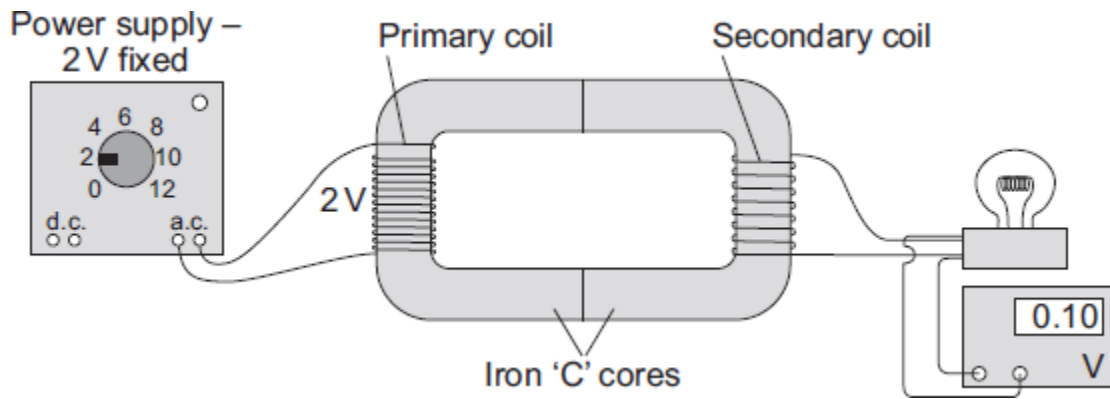
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**(2)**

**(Total 9 marks)**

4.

The diagram shows the apparatus used by a student to investigate a transformer.



- (a) The transformer made by the student would not have worked if the core had been made from aluminium and not iron.

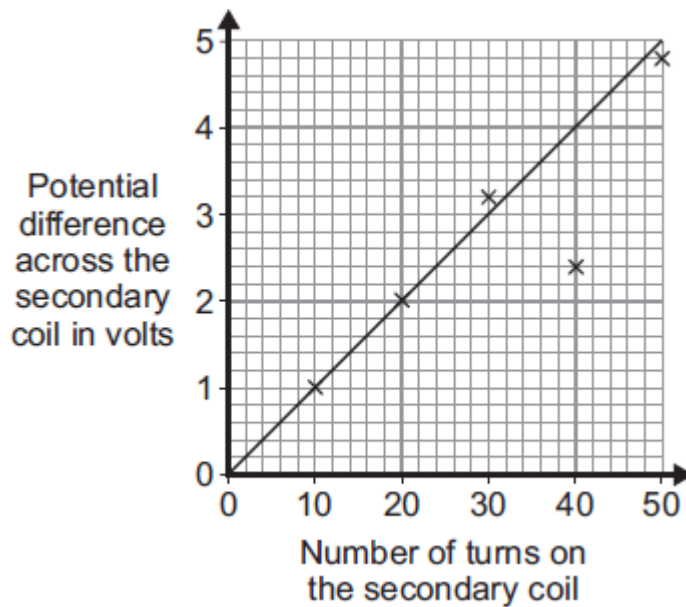
Why?

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(1)

- (b) The student made changes to the number of turns used to make the secondary coil. He then measured the potential difference across the secondary coil after each change. The graph shows the student's results.



- (i) What range of values was used for the number of turns on the secondary coil?

From \_\_\_\_\_ to \_\_\_\_\_

(1)

(ii) When he drew the line of best fit, the student ignored one of the data points.

Why?

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(1)

(iii) What is the minimum number of turns needed on the secondary coil for the transformer to act as a step-up transformer?

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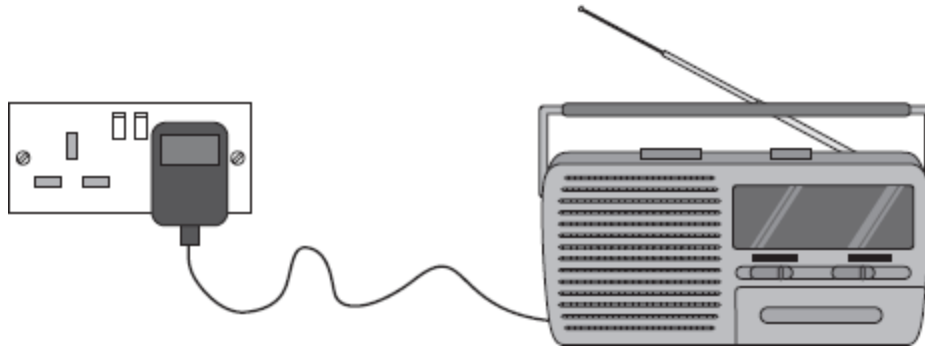
Give a reason for your answer.

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(2)

(c) A radio can be used with a 9 V battery or it can be plugged into the 230 V mains electricity supply using an adapter. The mains adapter contains a transformer.



Why must the mains adapter contain a transformer?

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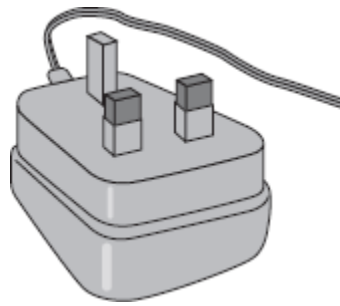
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(1)

(Total 6 marks)



5. (a) The drawing shows the plug for operating a radio from the mains.



This plug contains a transformer. There are 4600 turns on its primary coil and 200 turns on its secondary coil. The plug is used on the mains supply and has a potential difference (p.d.) of 230 V across its primary coil.

Use the equation in the box to calculate the p.d. across the secondary coil of the transformer.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

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p.d. across secondary = \_\_\_\_\_ V

(2)

- (b) The coils of the transformer are made of insulated wire.

Why is the wire insulated?

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(1)

- (c) (i) What material is the core of a transformer made from?

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(1)

(ii) Why is the core made from this material?

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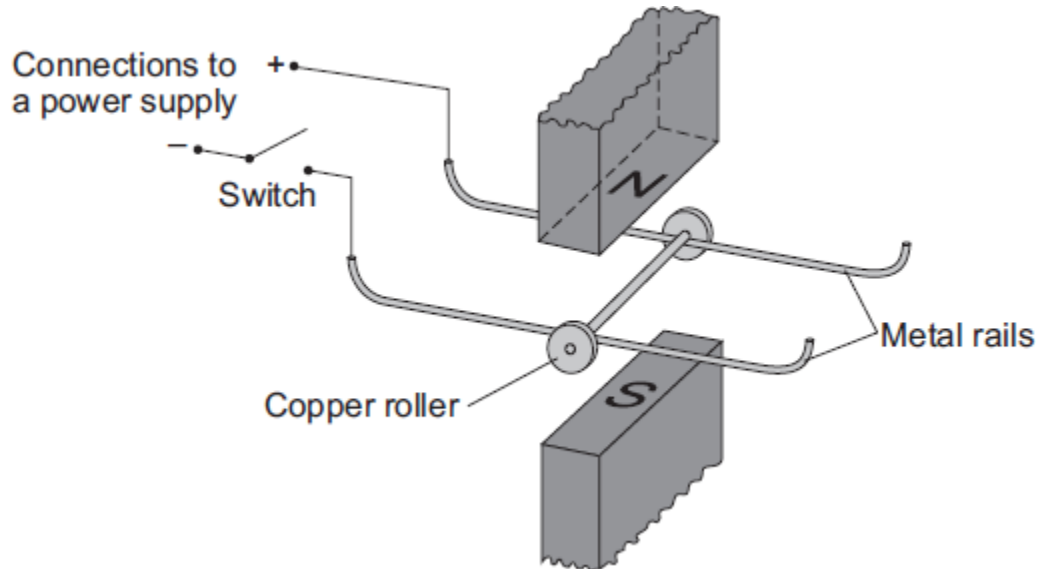
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(1)

(Total 5 marks)

6.

(a) A science technician sets up the apparatus shown below to demonstrate the motor effect. He uses a powerful permanent magnet.



The copper roller is placed across the metal rails. When the switch is closed, the copper roller moves to the right.

(i) Complete the sentence by drawing a ring around the correct line in the box.

This happens because copper is

- |                          |
|--------------------------|
| an electrical conductor. |
| an electrical insulator. |
| a magnetic material.     |

(1)

(ii) Suggest **one** change that the technician can make which will cause the copper roller to move faster.

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(1)

(iii) Suggest **two** changes which the technician can make, each of which will separately cause the copper roller to move to the left.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

(2)

(b) Many electrical appliances, such as vacuum cleaners, drills and CD players, contain electric motors. As more electrical appliances are developed, more electricity needs to be generated. Generating electricity often produces pollutant gases.

(i) Complete the sentence by drawing a ring around the correct line in the box.

Generating more electricity to power the increasing number of electrical

appliances used raises

an ethical

an environmental

a political

issue.

(1)

(ii) The number of electrical appliances used in the world's richest countries is increasing yet many people in the world's poorest countries have no access to electricity.

What type of issue does this inequality between people in different countries raise?

\_\_\_\_\_

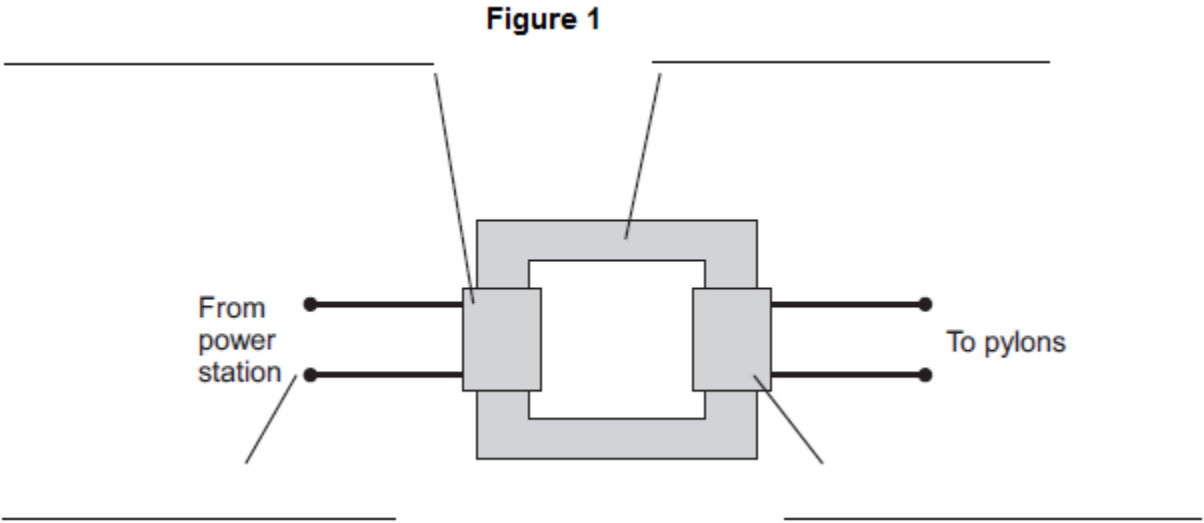
(1)

(Total 6 marks)

7.

Transformers are used to change potential differences (p.d.) in the National Grid.

Figure 1 shows a step-up transformer that is used at a power station.



(a) (i) Use words from the box to label **Figure 1**.

<b>Input p.d.</b>	<b>Iron core</b>	<b>Output p.d.</b>
<b>Primary coil</b>		<b>Secondary coil</b>

(4)

(ii) One of the coils in **Figure 1** has a p.d. of 25 kV across it and has 1000 turns.

The other coil has a p.d. of 400 kV across it.

Calculate the number of turns on this other coil.

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Number of turns = \_\_\_\_\_

(2)

(iii) Explain why a step-up transformer is used at a power station.

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(3)

(b) **Figure 2** shows a mobile phone charger.

**Figure 2**



The charger contains a step-down transformer. A switch mode transformer is used rather than a traditional transformer.

Describe the advantages of using a switch mode transformer in the charger rather than a traditional transformer.

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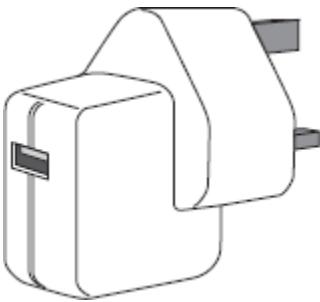
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(3)

(Total 12 marks)

8.

The diagram shows a USB power adapter which plugs into a 230 V a.c. mains socket.



The adapter contains a small step-down transformer.

- (a) The core of the transformer is made of laminated soft iron.

Why is iron used?

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(1)

- (b) The coils of the transformers are made of insulated copper wire.

Why is the wire insulated?

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(1)

- (c) There are 500 turns on one coil of the transformer and 20 000 turns on the other coil.

Use the equation in the box to calculate the p.d. across the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer and give the unit.

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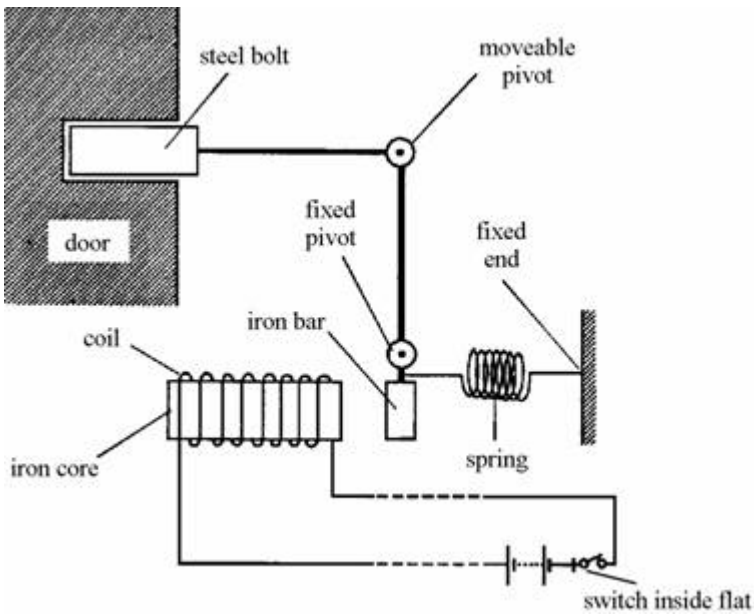
p.d. across the secondary = \_\_\_\_\_

(3)

(Total 5 marks)

9.

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.

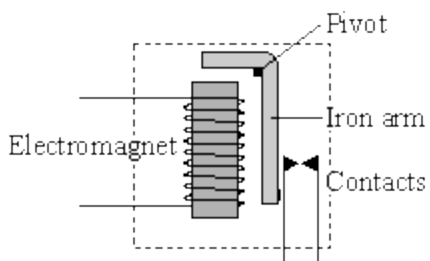
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(2)  
(Total 9 marks)

10.

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

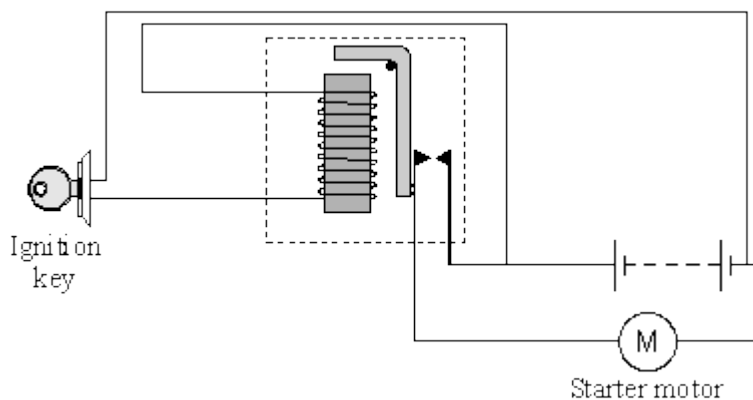


(i) What is this type of switch called?

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(1)

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





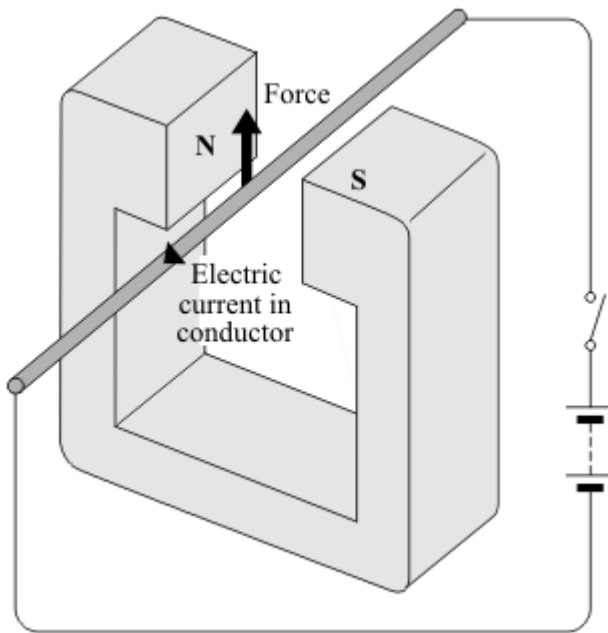
Explain how turning the ignition key makes a current flow in the starter motor. The explanation has been started for you.

When the ignition key is turned \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(3)  
(Total 4 marks)

11.

When a conductor carrying an electric current is placed in a magnetic field a force may act on it.



(a) State **two** ways in which this force can be increased.

1. \_\_\_\_\_
2. \_\_\_\_\_

(2)

(b) State **two** ways in which this force can be made to act in the opposite direction.

1. \_\_\_\_\_
2. \_\_\_\_\_

(2)

- (c) In what circumstance will **no** force act on a conductor carrying an electric current and in a magnetic field?

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(1)

(Total 5 marks)