

Magnetic Fields



Physics Workbook Pages 126-7

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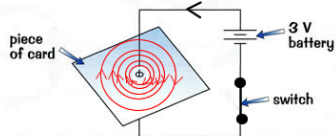
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Q1 Which **one** of the following statements is correct? Tick the box next to the correct statement.

- Magnetic fields can only be detected by another magnetic device such as a compass.
- Items made from iron, aluminium and steel are all attracted to a magnet.
- Magnetic fields can exert a force on a wire carrying a current.

Aluminium is not a magnetic material

Q2 The diagram below shows a wire carrying a current passing through a piece of flat card.



Use the right hand grip rule

Some iron filings are sprinkled onto the card. When the current is switched on, a pattern develops in the iron filings.

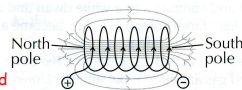
On the diagram, sketch the pattern which the iron filings make, including arrows to show the direction of the magnetic field.

Remember the direction of conventional current flow. Then use the Right-Hand Thumb Rule.

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Q3 The diagram below shows a coil of wire (a solenoid) carrying a current.

Looking 'end on' if the current goes anticlockwise you have a north pole end



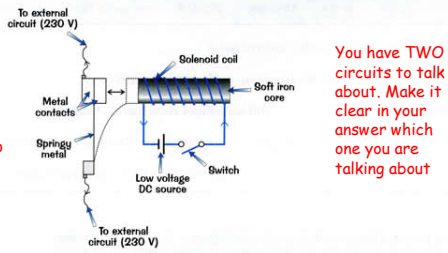
Shape is that of a bar magnet - with field lines going through the middle

- Draw the shape of the magnetic field around the coil.
- Indicate on the diagram where the north and south poles of the electromagnet would be.
- What effect would the solenoid have on a piece of soft iron placed near one of its ends?
It would attract it. The soft iron's domains would line up making it have a magnetic field around it that attracted it to the coil.
- A bar magnet is placed with its north pole nearest to the left-hand end of the coil in the diagram.
 - What force would this magnet experience?
A force of repulsion (like poles repel)
 - Suggest two different ways in which this force could be reversed.
You could turn the magnet through 180° or reverse the flow of current through the coil.

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Q4 The diagram shows how a solenoid can be used as a relay to switch an external circuit on and off.

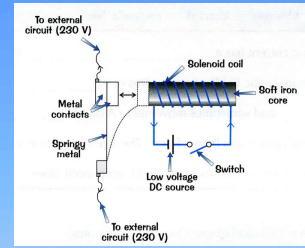
Questions like this require methodical answering. Do it step by step to avoid losing marks!



You have TWO circuits to talk about. Make it clear in your answer which one you are talking about

a) Describe what happens when the switch is closed and then opened again.

When the switch is closed (1) the circuit is complete so a current flows. (2) This makes a magnetic field form around the coil. (3) The magnetic domains inside the soft iron core line up with the coil's field and the core becomes magnetised. (4) The metal contacts are attracted to the electromagnet. (5) This breaks the 230V circuit, stopping the current flow. When the switch is opened (6) the low voltage circuit is broken so no current flows in the coil. (7) The electromagnet demagnetises and the metal contacts springs back into place. (8) The 230V circuit is then complete again and current will flow in it.



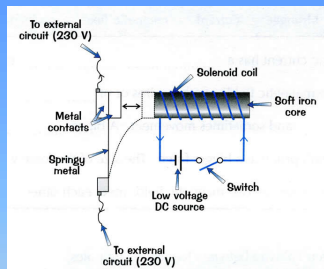
b) Give two reasons why a soft iron core is used in the solenoid.

Soft iron magnetises and demagnetises very quickly. It responds well to a change in magnetic field. It reinforces the field from the coil, it therefore makes the electromagnet much stronger.

c) Explain the effect (if any) of reversing the polarity of the low voltage DC source.

If you reverse the polarity of the supply the magnetic poles for med at each end would reverse but this would have no effect on the working of the relay switch as the metal contacts would still be attracted to the electromagnet when the switch was closed.

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d) What might you expect to happen if a low voltage AC source were used instead?

The contacts would make and break at double the frequency of the supply (each half of the cycle would pull the contact across - but to an opposite pole!) resulting in a vibration of the contact (it is how an electric bell works!)



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