SCIENCE DEPARTMENT

Year 8

Physics Friend

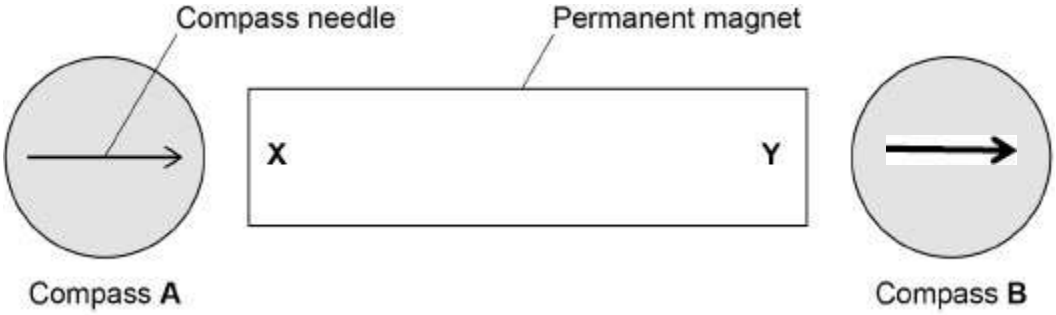
Magnetism

ANSWERS

Magnetism Basics

Page 5 questions:

The poles of the magnet are labelled **X** and **Y**.



1. The direction of the compass needle in compass ***A*** is shown.
Give the names of the poles labelled **X** and **Y**.

X **south** ***(allow S for south)***

Y **north** ***(allow N for north)***

2. Draw an arrow on compass **B** to show the direction of the magnetic field at that position.

See arrow above

3. Which of the following are magnetic materials?

Tick (✓) **two** boxes.

Aluminium	☐
Copper	☐
Iron	✓
Lead	☐
Nickel	✓
Tin	☐

Challenge: ***How are the 'northern lights', or 'Aurora Borealis' linked to Earth's magnetic field?***

The northern lights, also called the Aurora Borealis, happen when charged particles from the Sun hit the Earth's magnetic field. The Sun sends out energy and particles all the time. When some of these particles come near Earth, our magnetic field protects us by guiding them toward the North and South Poles. As the particles travel along the magnetic field lines and reach the sky near the poles, they collide with gases like oxygen and nitrogen in the atmosphere.

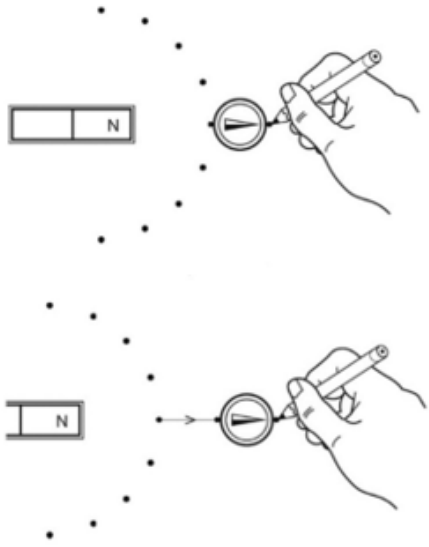
When that happens, the gases gain energy, emitting light as a result.

Magnetic Fields - Introduction

Page 6 questions:

1. Write a method for determining the shape of the field around a wire using a plotting compass.

1. Place the bar magnet in the centre of the paper and draw around it. Label the north and south poles. Draw several dots near the north pole as in the diagram below.
2. Place the plotting compass near the north pole of the magnet.
3. Mark a dot where the north pole of the **compass** points.
4. Move the compass so its **south** pole points to the dot you drew previously.
5. Mark a new dot where the north pole of the compass now points.
6. Repeat steps 4-5, five times.
7. Connect the dots to show the field lines
8. Start again from a new position near the north pole of the magnet.



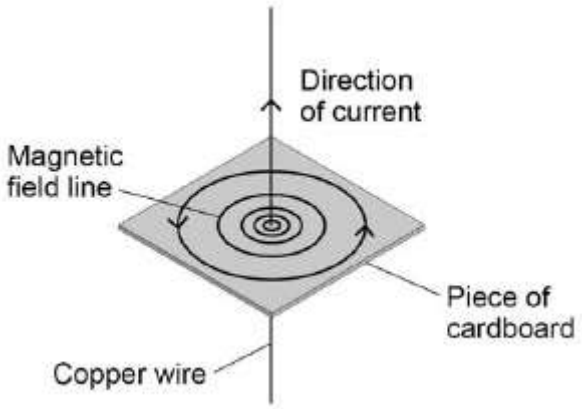
Challenge: ***Adapt your method to describe how this could be done with small pieces of magnetic material such as iron filings instead of a compass.***

- Put the bar magnet in the centre of a piece of paper. Draw around it and label the north (N) and south (S) poles.
- Sprinkle iron filings evenly over the paper, especially around the ends of the magnet.
- Gently tap or shake the paper to help the iron filings line up.
- Watch closely — the iron filings will move and form patterns called magnetic field lines. These lines show the direction of the magnet's force.
- You will see the filings create curved lines that go from the north pole to the south pole of the magnet.

Field around a wire

Page 8 questions:

The diagram shows the magnetic field around a copper wire carrying a current.



1. What do the arrows on the magnetic field line represent?

Answer: the direction of the magnetic field

2. Complete the sentence.

As the distance from the copper wire increases, the magnetic field strength **decreases**.

3. Suggest how the field lines show the variation in field strength.

Answer: when the field lines is closer the lines the field is stronger

OR when the field lines are further apart the field is weaker

Challenge: ***What happens to the shape of the magnetic field if two parallel wires next to each other have currents in a) the same direction and b) opposite directions?***

a) Currents in the same direction:

In between the wires, the magnetic fields cancel out a little, but outside the wires, they add together. This makes the wires pull toward each other.

(Think of it like magnets pulling together when they have opposite poles facing.)

b) Currents in opposite directions:

The magnetic fields go in opposite directions. In between the wires, the fields add up, but outside, they cancel out a bit. This makes the wires push away from each other.

(Like magnets that push apart when you try to make the same poles touch.)

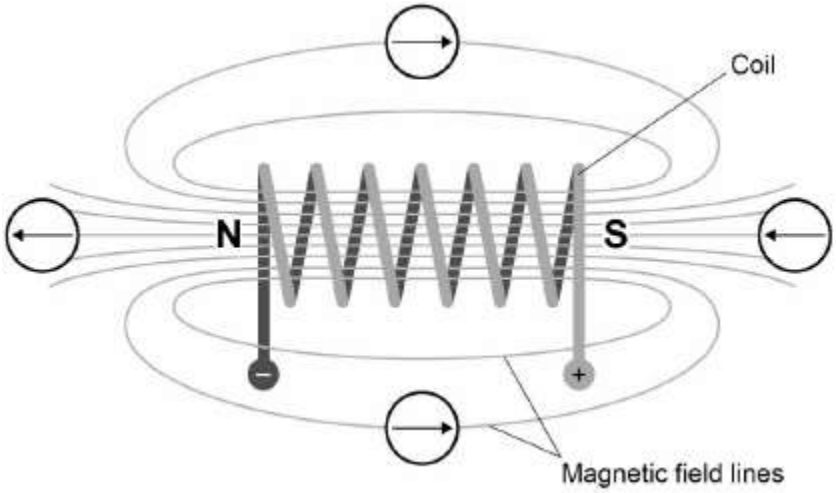
Electromagnets

Page 11 questions:

1. Which statement describes the magnetic field around the coil?
Answer: The field is strongest at the ends of the coil.

2. Draw **one** arrow in **each** circle to show the direction of the magnetic field at that

all arrows in the correct direction

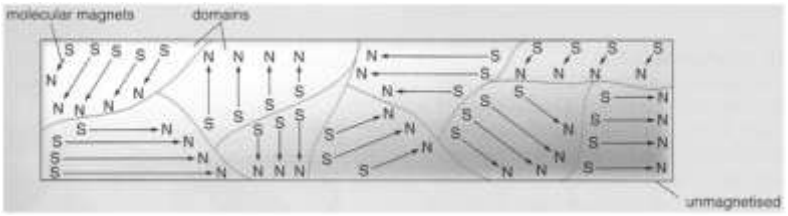


Challenge: ***Why might striking a permanent magnet many times with a hammer demagnetise it?***

Answer: A permanent magnet works because all the magnetic domains are lined up in the same direction.

But if you hit the magnet a lot with a hammer, it can shake and mix up those domains.

When the domains get jumbled up and stop pointing the same way, the magnet loses its strength — or even stops being a magnet at all.



So, hammering a magnet can mess up the internal structure, and that's why it might get demagnetised.

Making Electromagnets

Page 12 questions:

1. What is the independent variable in this investigation?
   Answer: The number of turns in the electromagnet

2. What is the dependent variable?
   Answer: The number of paper clips that could be picked up

3. Suggest one control variable (something that must be kept the same throughout).
   Answer: Current through electromagnet/voltage or power of battery/presence of iron nail

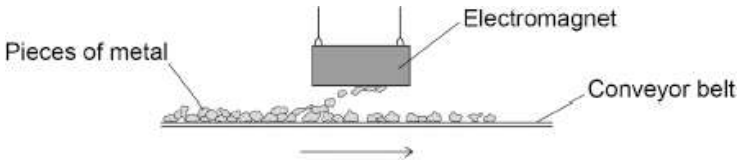
4. Suggest one possible hazard involved in this experiment.
   Answer: Electromagnet may get hot when current is on/Risk of electric shock

5. What type of graph would be suitable for recording the results?
   Answer: Bar chart (because number of turns is a discrete variable)

Uses of Electromagnets

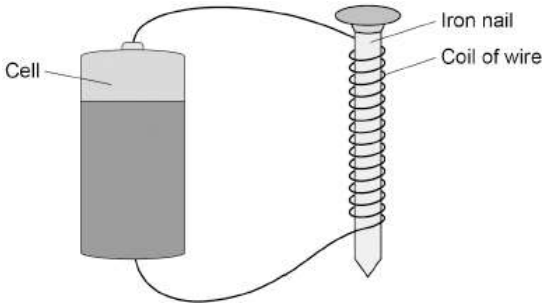
Page 14 questions:

The diagram shows an electromagnet being used to separate pieces of different types of metal on a conveyor belt.



1. What is an advantage of using an electromagnet instead of a permanent magnet to separate the types of metal?
   Answer: an electromagnet can be switched on and off

Now we see a simple electromagnet



2. What is the purpose of the iron nail inside the coil of wire?
   Answer: the iron nail makes the magnetic field stronger

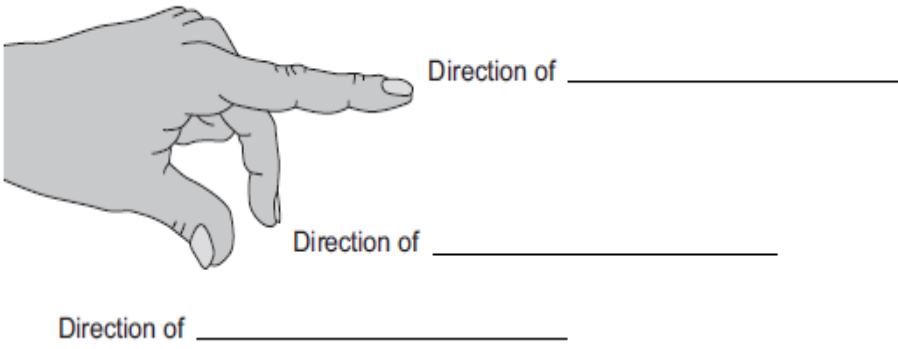
3. Which of the following would increase the strength of the electromagnet?
   Answer: use a greater current

The Motor Effect

Page 17 questions:

Use words from the box to label **Figure 1**.

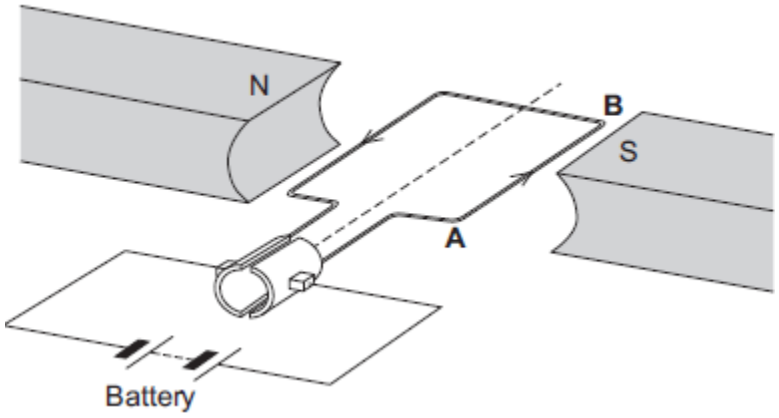
Figure 1



1. correct order only
field
current
force (accept motion or thrust)

The diagram shows an electric motor.

Figure 2



1.

2. Draw an arrow to show the direction of the force acting on the wire **AB**.

   arrow pointing vertically downwards

   Challenge: ***Suggest two changes that would increase the force acting on the wire AB.***

   1. increase current / p.d. *(accept voltage for p.d.)*
   2. increase strength of magnetic field

   (accept move poles closer together)

   Challenge: ***Suggest two changes that would reverse the direction of the force acting on the wire AB.***

   1. reverse (poles of) magnets
   2. reverse battery / current

Revision questions

Pages 18-22 questions:

Diagram 1 shows a magnetic closure box when open and shut. It is a box that stays shut, when it is closed, due to the force between two small magnets.

These boxes are often used for jewellery.

Diagram 1

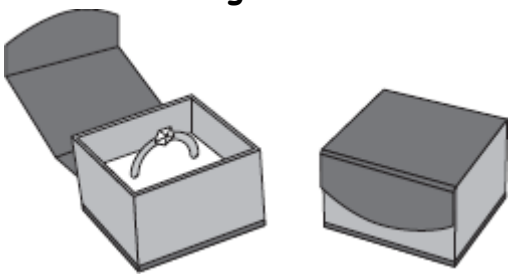
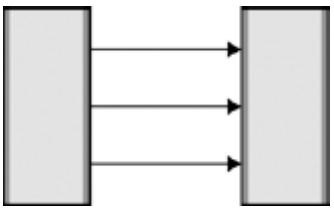


Diagram 2 shows the two magnets. The poles of the magnets are on the longer faces.

field pattern shows:
some straight lines in the gap in the direction N to S



1.(a) Draw, on **Diagram 2**, the magnetic field pattern between the two facing poles.

1.(b) The magnets in the magnetic closure box must **not** have two North poles facing each other. Explain why.

north poles repel, (so) box will not close

2. **Diagram 3** shows two bar magnets.

Diagram 3

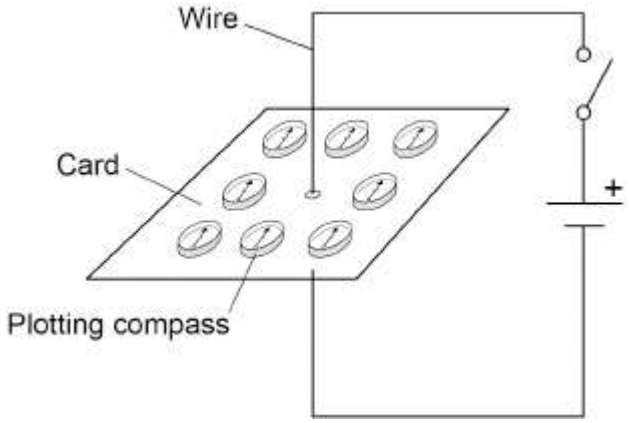
The magnets attract each other.

(a) What conclusion can be made about the two poles marked **X** and **Y**?

They are opposite poles.

3. **Diagram 4** shows some plotting compasses around a wire. There is no current in the wire.

Diagram 4



(a) Why do the plotting compasses all point in the same direction?

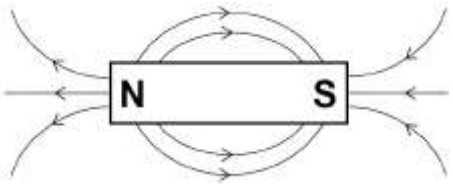
they line up with the Earth's magnetic field *(allow they all point north)*

(b) When the switch is closed there is a current in the wire.

The current creates a magnetic field.
What shape are the magnetic field lines around the wire?
Tick (✓) **one** box.

Circular	✓	Square	
Rectangular		Triangular	

4. Magnets attract some metals.
Which diagram shows the correct magnetic field pattern for a bar magnet?



5. **Diagram 5** shows an iron bar near a permanent magnet.

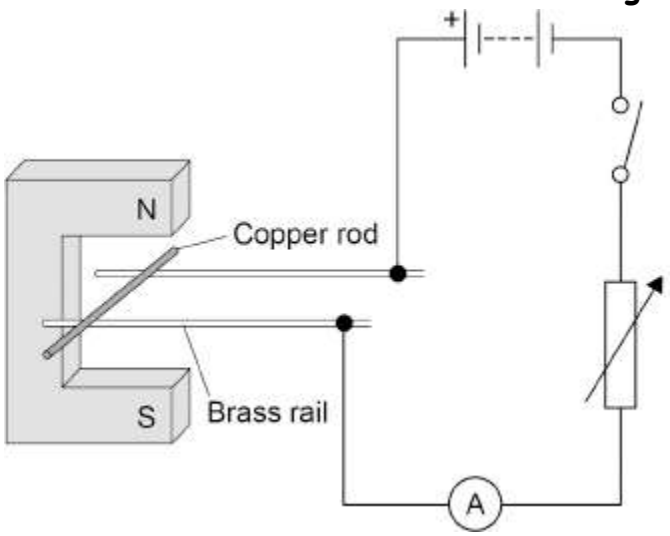
Diagram 5

The iron bar becomes an induced magnet.
(a) Label the poles on the iron bar.
(b) The magnet is turned around so that the north pole is closest to the iron bar.
Which statement about the iron bar is true?

the iron bar experiences a magnetic force of attraction

6. A teacher demonstrated the motor effect.
Diagram 6 shows the equipment used. The equipment includes a permanent magnet.

Diagram 6



When the switch is closed the copper rod accelerates.
(a) In which direction will the copper rod accelerate?

→

(b) Explain one way the teacher could increase the acceleration of the copper rod, without getting new equipment.

increase the current, so that the force increases

7. **Diagram 7** shows a magnetic compass used by walkers.

Diagram 7

Explain how a magnetic compass provides evidence that the Earth has a magnetic field.

the compass needle always points in the same direction

(allow the compass (needle always) points north)

because it aligns itself with the Earth's magnetic field