Revision Pack Topic 7- Magnetism & Electromagnetism

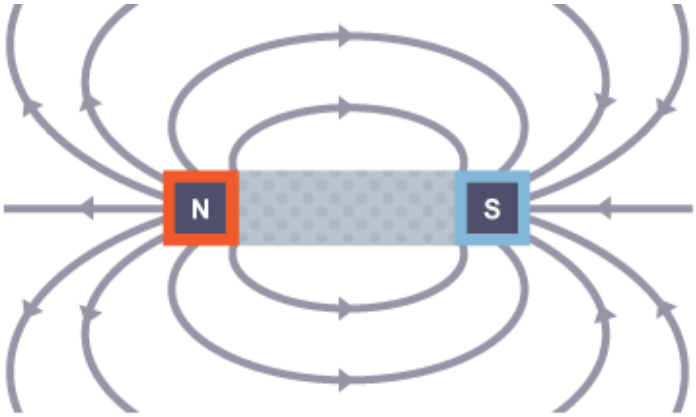
Permanent and induced magnetism, magnetic forces and fields	**R/A/G**
Poles of a magnet	
The poles of a magnet are the places where the magnetic forces are strongest. When two magnets are brought close together they exert a force on each other. Two like poles repel each other. Two unlike poles attract each other. Attraction and repulsion between two magnetic poles are examples of non-contact force.	
A permanent magnet produces its own magnetic field. An induced magnet is a material that becomes a magnet when it is placed in a magnetic field. Induced magnetism always causes a force of attraction. When removed from the magnetic field an induced magnet loses most/all of its magnetism quickly.	
Magnetic fields	
The region around a magnet where a force acts on another magnet or on a magnetic material (iron, steel, cobalt and nickel) is called the magnetic field.	
The force between a magnet and a magnetic material is always one of attraction. The strength of the magnetic field depends on the distance from the magnet. The field is strongest at the poles of the magnet.	
The direction of the magnetic field at any point is given by the direction of the force that would act on another north pole placed at that point. The direction of a magnetic field line is from the north (seeking) pole of a magnet to the south (seeking) pole of the magnet.	
A magnetic compass contains a small bar magnet. The Earth has a magnetic field. The compass needle points in the direction of the Earth's magnetic field.	
Electromagnetism	
When a current flows through a conducting wire a magnetic field is produced around the wire. The strength of the magnetic field depends on the current through the wire and the distance from the wire	
Shaping a wire to form a solenoid increases the strength of the magnetic field created by a current through the wire. The magnetic field inside a solenoid is strong and uniform. The magnetic field around a solenoid has a similar shape to that of a bar magnet. Adding an iron core increases the strength of the magnetic field of a solenoid. An electromagnet is a solenoid with an iron core.	
When a conductor carrying a current is placed in a magnetic field the magnet producing the field and the conductor exert a force on each other. This is called the motor effect.	
For a conductor at right angles to a magnetic field and carrying a current: *f orce = magnetic f lux density × current × length* $F = B\,I\,l$ force, *F*, in newtons, N magnetic flux density, *B*, in tesla, T current, *I*, in amperes, *A* (amp is acceptable for ampere)	

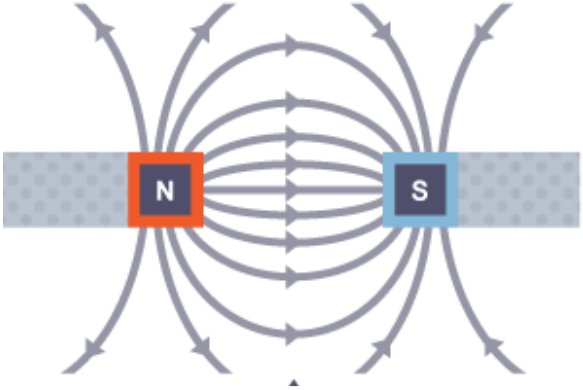
Revision Pack Topic 7- Magnetism & Electromagnetism

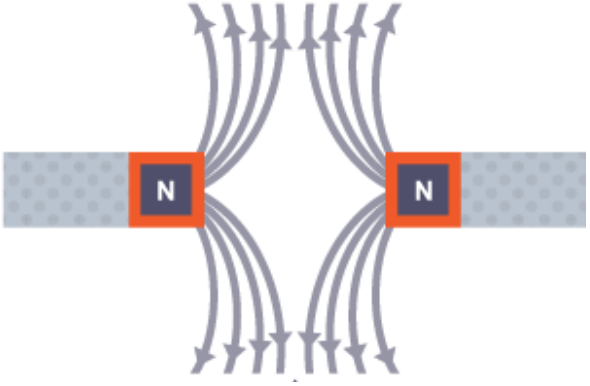
length, *l*, in metres, m	
Electric motors (HT only)	
A coil of wire carrying a current in a magnetic field tends to rotate. This is the basis of an electric motor	

Permanent and Induced Magnets

Annotate the below diagrams to explain what they show.







Explain how the magnetic field lines show the:

a) Strength of the magnetic field?
b) Direction of the magnetic field?

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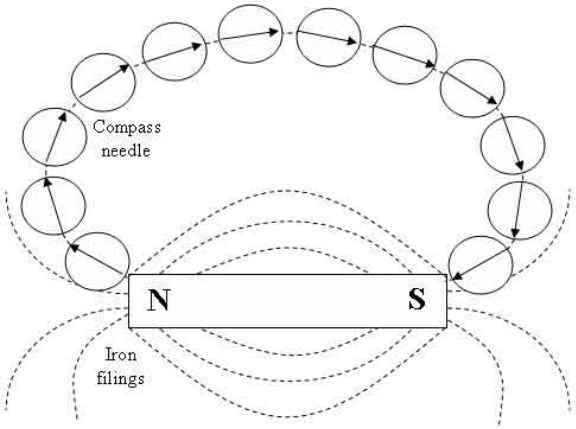
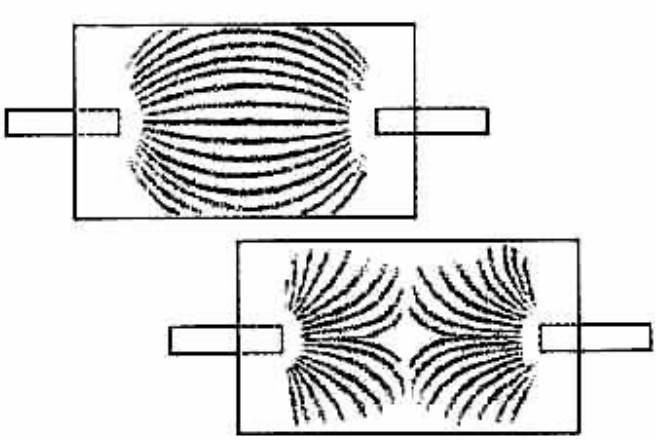
Use the diagrams to explain how a magnetic field can be investigated using:

a) A compass



b) Iron filings



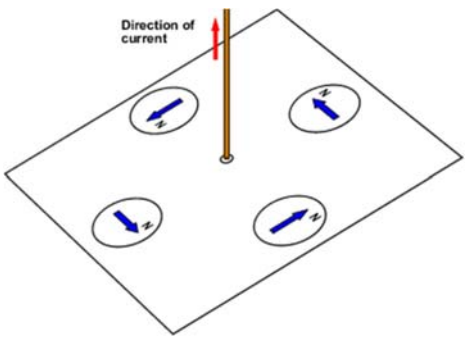
What is the difference between a **permanent** and **induced** magnet?

_____

_____

_____

Electromagnetism



A moving charge produces a magnetic field.
The **strength** of the magnetic field produced **changes** with the **current and the distance** from the wire.

The _____ the current through the wire, or the ____ _____to the wire you are, the to the wire you are, the _____ the field is.

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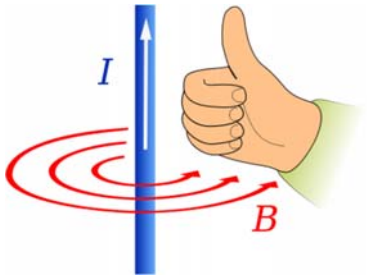
Explain the right hand rule:



_____
_____
_____
_____

How can you increase the strength of the magnetic field that a wire produces?

_____
_____

Define the term **electromagnet.**

_____
_____

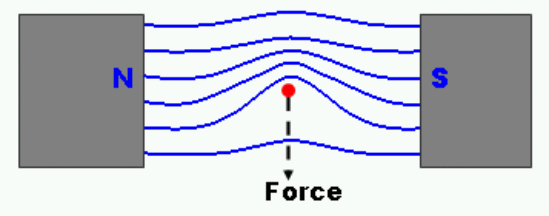
To increase the strength of an electromagnet:

C-

C-

C-

The Motor Effect



Use the diagram above to explain the motor effect.

At which angle must the wire run in relation to the magnetic field?

What factors can increase the magnetic strength of the force?

Which equation is used to find the size of the force in the motor effect? What are the units?

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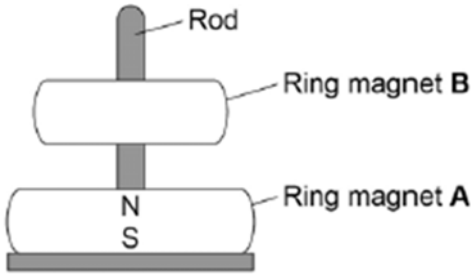
Practice Exam Questions

Q1.A magnetic toy uses ring-shaped magnets.

Look at **Figure 1**.

The magnets can move up and down the rod. Ring magnet **B** appears to float.

Figure 1



(a) The magnetic poles are labelled on ring magnet **A**.

Label the magnetic poles on ring magnet **B**.

(1)

(b) What would happen if ring magnet **B** was turned upside down?

.....

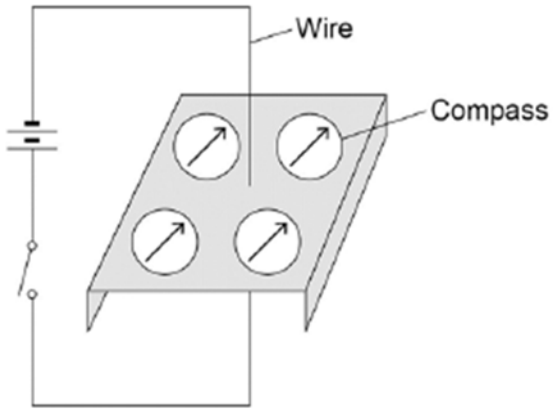
.....

(1)

(c) **Figure 2** shows four plotting compasses arranged around a wire.

The needle of a compass is a magnet.

Figure 2



In **Figure 2** the switch is open and there is no current in the wire.

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Explain why the compass needles all point in the same direction.

.....

.....

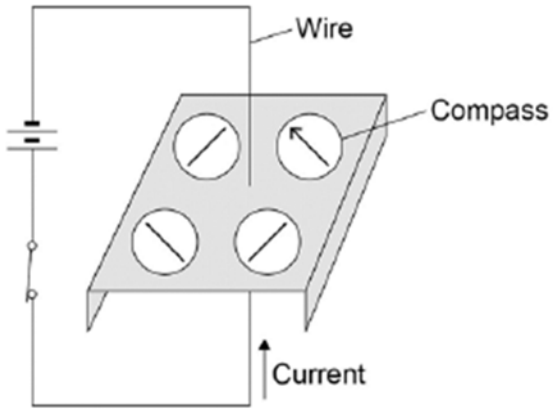
.....

.....

(2)

(d) **Figure 3** shows the switch closed.

Figure 3



There is now a current in the wire.

The compass needles change direction.

On **Figure 3** draw arrowheads on the three incomplete compass needles to show their direction.

(1)

(e) What would happen to the direction of the compass needles if the current was reversed?

.....

.....

(1)

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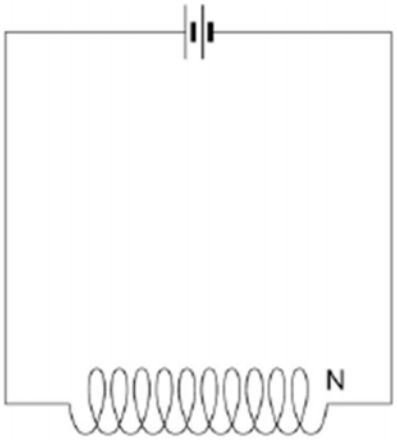
(f) **Figure 4** shows a coil of wire in a circuit.

Figure 4



On **Figure 4** draw the magnetic field due to the current in the coil.

(3)
(Total 9 marks)

Q2. The area around a magnet is called the magnetic field.

(a) The Earth has a magnetic field.

What causes the Earth's magnetic field?

Tick **one** box.

The movement of liquid iron in the Earth's outer core ☐

The gravitational field of the Earth ☐

The permanent magnet in the Earth's core ☐

(1)

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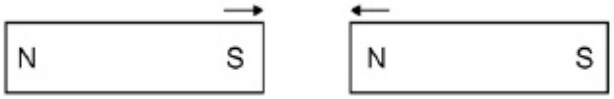
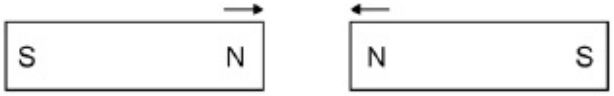
(b) Look at **Figure 1**.

Figure 1

Opposite poles brought together



Same poles brought together



What will happen in each case when the poles of two magnets are brought close together?

Opposite poles brought together .....

.....

Same poles brought together .....

.....

(2)

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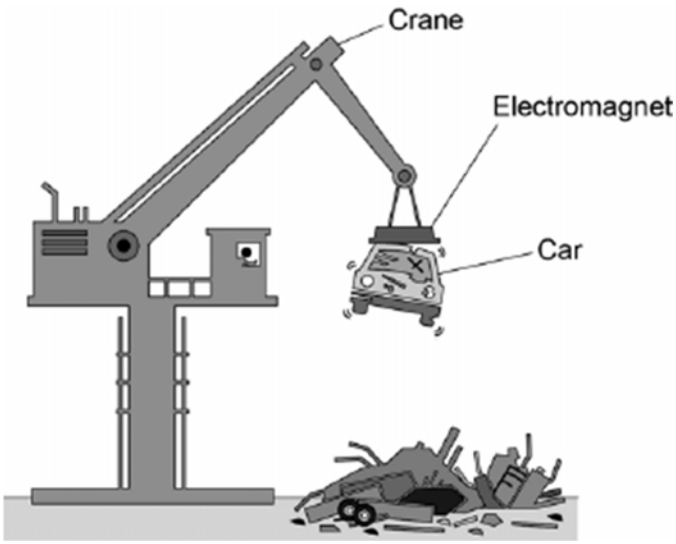
(c) **Figure 2** shows an electromagnet being used to lift a car in a scrapyard.

Figure 2



An electromagnet is a solenoid.

Explain why it is better to use an electromagnet rather than a permanent magnet in a scrapyard.

You should include a comparison of the properties of electromagnets and permanent magnets in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

(4)
(Total 7 marks)

Q3. When a conductor carrying an electric current is placed in a magnetic field a force may act on

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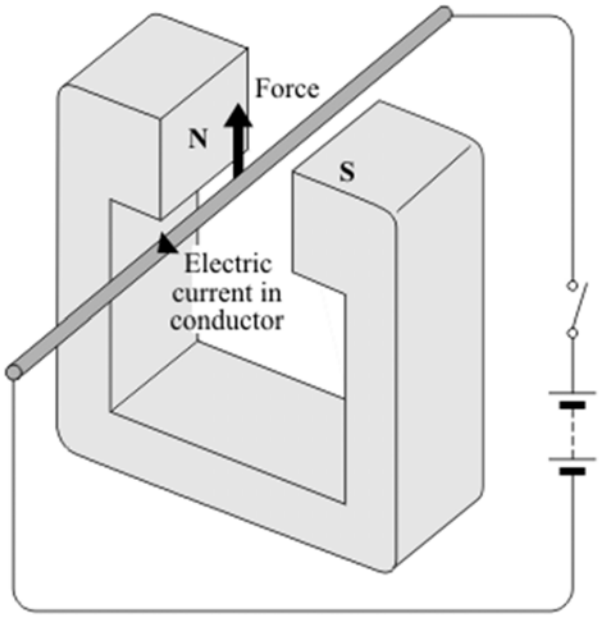
it.



(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?

.....

.....

(1)

(Total 5 marks)

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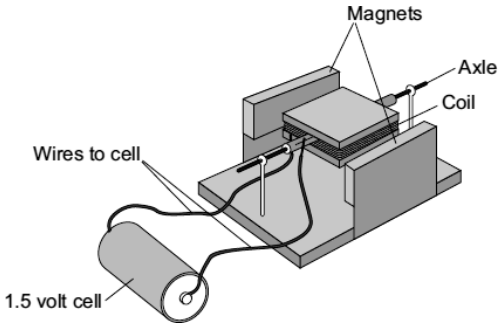
Q4. (a) Complete the description of the device shown below by drawing a ring around the correct line in each box.



(i) The device is being used as

an electric motor.
a generator.
a transformer.

(1)

(ii) The coil needs a flick to get started. Then one side of the coil is pushed by the

cell
coil
force

and the other side is pulled, so that the coil spins.

(1)

(b) Suggest **two** changes to the device, each one of which would make the coil spin faster.

1 .....

.....

2 .....

.....

(2)

(c) Suggest **two** changes to the device, each one of which would make the coil spin in the opposite direction.

1 .....

.....

2 ..... **(2)**

(Total 6 marks)

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Markscheme

M1.(a) S – top, N – bottom

1

(b) touch / attracted to magnet **A**

1

(c) the magnetic needles point to the north pole

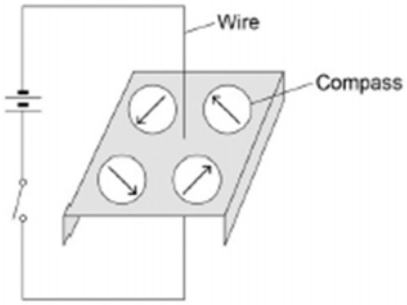
1

because The Earth has a magnetic field

1

*accept the needles align to the Earth's magnetic field for **2** marks*

(d)



1

(e) point in the opposite direction

change direction is insufficient

1

(f) uniform field lines through the wire coil.

1

field lines curving round the top and bottom of the wire coil.

1

arrows indicating direction from N to S

*do **not** accept conflicting arrows*

1

[9]

M2.(a) The movement of liquid iron in the Earth's outer core

1

(b) will attract

1

will repel**1**

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c) **Level 2 (3–4 marks):**
A detailed explanation is provided that includes a coherent comparison of the properties of the types of magnet and presents a clear argument to support the use of electromagnets. Logical links are made between relevant points and use in a scrapyard

Level 1 (1–2 marks):
Relevant points made about the properties of the magnets. An attempt at comparison may be made, but logic is unclear and unstructured and links to use in scrapyard may not be present

0 marks:
No relevant content.

Allow steel or iron for car body throughout

Indicative content

- an electromagnet can be switched on and off
- so it can be used to lift a car body
- and release a car body
- so it can easily be used to move car bodies from one place to another in the scrapyard
- a permanent magnet cannot be switched off to release a car body
- so would not be as useful in the scrapyard
- the strength of the magnetic field of an electromagnet can be varied
- so an electromagnet can lift different masses
- so can deal with different vehicles
- but the strength of the magnetic field of a permanent magnet cannot be varied or is fixed
- so a permanent magnet can only lift up to a certain mass

4

[7]

M3. (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]

M4. (a) (i) an electric motor

1

(ii) 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[6]