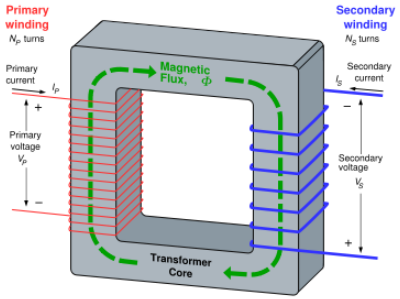
Transformers

An alternating current will generate a changing magnetic field. This changing magnetic field can be used to induce a voltage in a secondary wire. This is an effect commonly used in transformers.

The relationship between the primary and secondary voltages is given by the equation:



$$\frac{\text{Input voltage}}{\text{Output voltage}} =$$

$$\frac{V_p}{V_s} =$$

Since energy must be conserved, the input power must equal the output power.

$$P_{in} = P_{out}$$
$$V_p \times I_p = V_s \times I_s$$

Therefore, an increase (step-up) in voltage must be accompanied by a decrease in current.

Explain why a decrease in current is desirable when transmitting electricity through the national grid.

_____

_____

A transformer has 200 turns on its primary coil and 800 coils on its secondary coil. What will the voltage across the secondary coil be for a 3 V input voltage?

_____

Assuming the transformer is 100% efficient, what will the current in the second coil be if the current in the primary coil is 1 A?

_____

Magnetism & Electromagnetism Revision Booklet

Name: Class:

Magnets can attract objects made from magnetic materials. Classify the following as magnetic or non-magnetic materials:

Copper Iron Plastic Steel
Carbon Glass Wood Cobalt
Nickel Rubber

Magnetic	Non-magnetic

Domains Before Magnetization

Domains After Magnetization

Use the diagram to explain magnetism in terms of domains.

_____

_____

How can a magnetic material be magnetised?

_____

_____

Magnetic Fields

What do the terms 'magnetically soft' and 'magnetically hard' mean?

_____

_____

A magnetic field is the volume of space around a magnet where _____ can be detected. Magnetic fields point from _____ to _____. The magnetic field is _____ when the lines are _____ together.

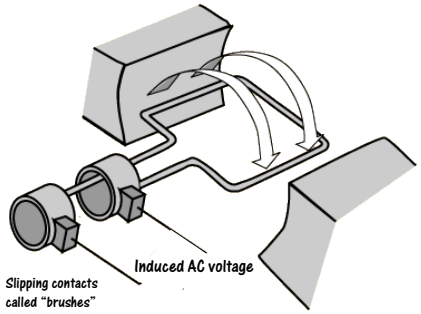
Words:	south	closest	north	strongest	magnetism

Draw the magnetic fields around the different arrangements of bar magnets.

When north and south poles are placed near each other there is an almost uniform field between the poles - the field lines are equidistant.

Generating Electricity

Explain why this generator will generate alternating current.



_____

_____

_____

_____

The diagram to the right shows the voltage induced at 90° intervals.

Explain the size and sign of the voltage at:

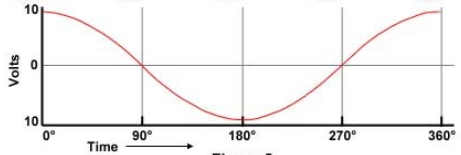


Figure 5

0° _____

_____

180° _____

_____

270° _____

_____

Frequency

The frequency of the UK mains supply is 50 Hz. This means that the coil inside the generator rotates __ times per second.

Direct Current

Draw onto the diagram how a 5 V direct current power supply would be displayed.

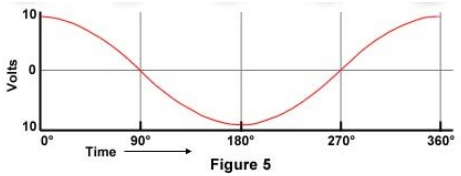
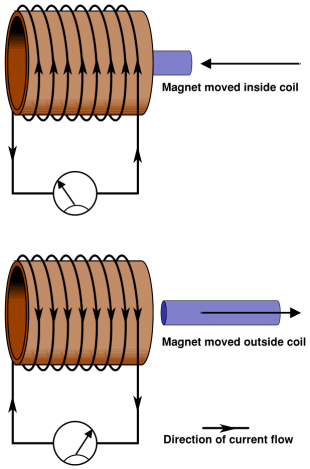


Figure 5

Electromagnetic Induction

Generators are used to transform kinetic energy into electrical energy. They do this via a process called electromagnetic induction.



If a wire cuts through magnetic field lines a _____ is induced in the wire. If the wire is part of a circuit this causes a _____ to flow. The _____ of the current can be changed by changing the direction of the movement, or using the other _____ of the magnet.

Words:	direction	voltage	pole	current

The size of the induced voltage can be increased by:

1.

2.

3.

4.

Michael Faraday showed that the induced voltage depended on the rate at which the magnetic field lines were cut.

Faraday's Law of Electromagnetic Induction states that:

Generators used in power stations generate alternating current, or AC.

Electromagnets

Current Carrying Wires

A current carrying wire will generate a magnetic field around it. The direction of the field can be determined using the right-hand grip rule.

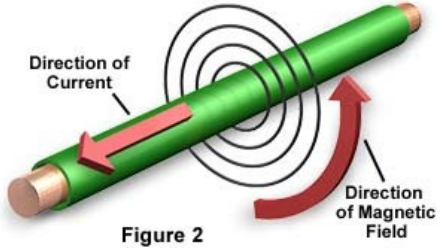


Figure 2

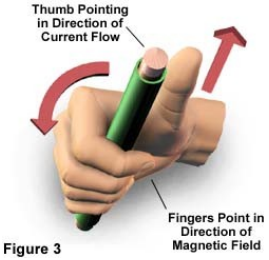
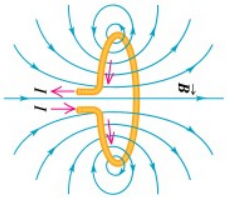


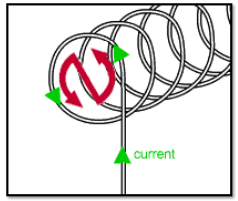
Figure 3

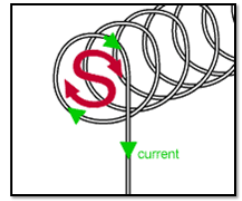
When using the right-hand grip rule we must use the direction of conventional current, i.e. From _____ to _____.



The strength of the magnetic field can be made stronger by:

1. Increasing the current.
2. Wrapping the wire into a coil or a solenoid.





Solenoids

The polarity of a solenoid can be found using the clock rule.

Anticlockwise - North Clockwise - South

The strength of a solenoid can be increased using the three Cs

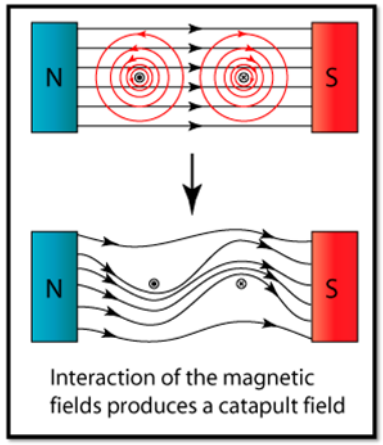
1.

2.

3.

Motor Effect

When a current carrying wire is placed in an external magnetic field, the two magnetic fields interact with each other. When the two fields are in the same direction they reinforce each other. When they are in opposite directions they oppose each other, producing a weaker field. Indicate on the diagram where the field is strongest, and hence deduce the direction of movement of the wire.



Fleming's Left-Hand Rule

The direction of force can be predicted using Fleming's left-hand rule. Use the diagram to determine which finger relates to which variable.

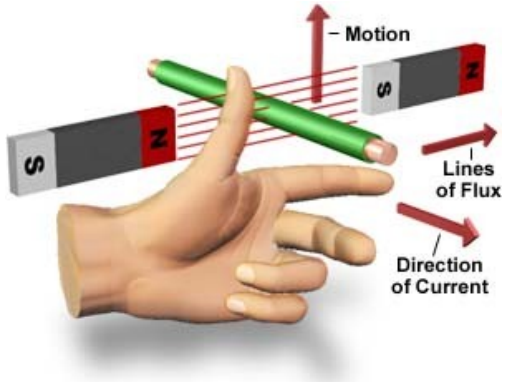


Figure 9

Thumb: _____

First Finger: _____

Second Finger: _____

What would happen to the direction of the force if:

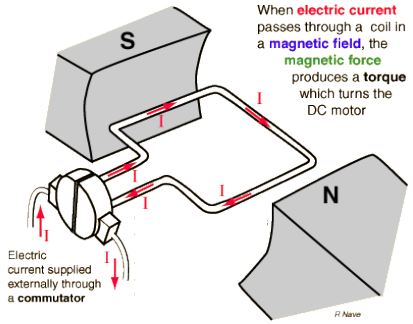
1. The current changes direction? _____
2. The field direction is reversed? _____
3. Both current and field change direction? _____

_____

Electric Motors

The force acting on a current carrying wire in a magnetic field can be used to drive an electric motor.

Why does the motor spin?



_____

What is the function of the split-ring commutator?

_____

What would happen if the split-ring commutator was not there?

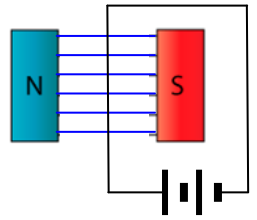
_____

On the diagram to the right:

Draw the direction of the magnetic field, label it B.

Draw the direction of the current, label it I.

Predict the direction of the force on the wire, label it F.



The rate at which the motor spins can be increased by:

1.

2.

3.

Explain simply how the effect is used in loudspeakers.

_____

_____

_____

_____