

GRADE 7 TECHNOLOGY: TERM 3

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TOPIC 1: ELECTRICAL SYSTEMS AND CONTROL

What is magnetism?

Magnetism is the force that pulls (attracts) or pushes (repels) an object which contains metal towards, or away from, a magnet. A magnet has an area around it over which it can exert a force on objects. The further away the object is from the magnet, the weaker the force. This area is called the magnetic field.

A **permanent magnet** is a piece of magnetic material that retains or keeps its magnetism after it is removed from a **magnetic field**. In other words its magnetism is always there – it is permanent.



Find more information on the history of magnets by looking at the following website:

www.howmagnetismwork.com/history.html

Watch a video on you tube titled *Magnets and Magnetism* by following the link:

www.youtube.com/watch?v=eYSG5aeTy-Y

Activity 1: Practical Investigation

Find out which substances will stick to a permanent magnet. Record your findings on a table such as the one below.

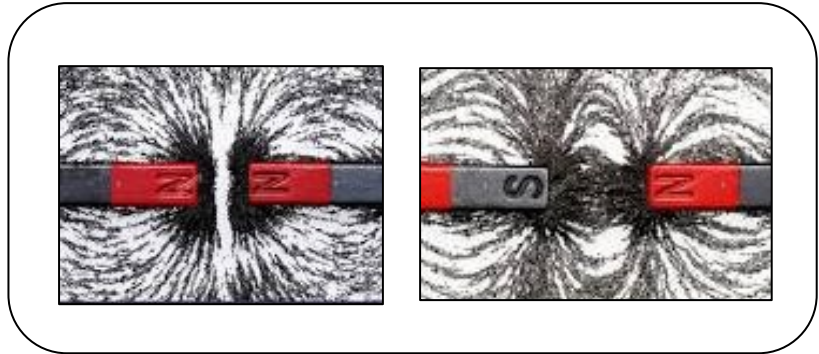
SUBSTANCE	Magnetic	Non-magnetic
Wood		
Plastic		
Iron		
Paper		
Copper		
Rubber shoe sole		
Aluminium or foil		
Silver coin		

Activity 2: The magnetic field

In the image below iron filings are used to illustrate the pattern that a magnetic field exerts.



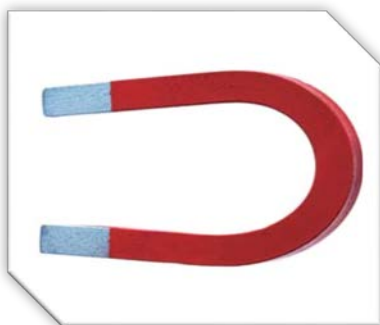
Iron filings on the bottom of a horseshoe magnet.



Iron filings showing the magnetic field created by magnets. Can you sport the reason for the difference in patterns?

1. The iron filings would be placed on a sheet of paper.
2. The magnet would be placed under the paper.
3. You will use your finger to push the filings gently over the page. What do you think happens? **A magnetic field forms.**
4. Try to identify the North and South Poles as indicated on the left and on the right of the image above.
5. Write two sentences explaining what you think is happening in the images above.
6. Answer the following questions:
 - a. Why is it useful to be aware of magnetism? (1)
 - b. Do all magnets have a South and a North Pole? Why do you say so? (2)
 - c. Are all materials attracted to a magnet? Give a reason. (2)
 - d. What materials would not be attracted to a magnet? (2)
 - e. Make a freehand sketch, in your book, showing how a magnetic field forms around a single magnet. (3)

Total: 10



A Horseshoe magnet

TOPIC 2: RECYCLING

What is recycling?

Recycling is the process of making or manufacturing new products from a product that has served its original purpose. If these used products are disposed of in an appropriate, environmentally friendly way, the process of recycling has been set in motion. Recycling is an excellent way to save energy and conserve the environment.



DID YOU KNOW?

- One recycled tin can save enough energy to power a TV for three hours.
- One recycled glass bottle would save enough energy to power a computer for 25 minutes.
- One recycled plastic bottle would save enough energy to power a 60-watt light bulb for three hours.
- 70% less energy is required to recycle paper compared to making it from raw materials.
- A great deal of waste that could be recycled ends up in landfill sites. This is harmful to the environment.

Some interesting facts

- Up to 60% of the rubbish that ends up in the dustbin could be recycled.
- On average, 16% of the money you spend on a product pays for the packaging, which ultimately ends up in the rubbish.
- As much as 50% of waste in the average dustbin could be made into compost.
- Up to 80% of a motor vehicle can be recycled.
- 9 out of 10 people would recycle more if it was made easier.



Activity 3: Recycling scheme for your school

Work in a group of 4-6 learners. Discuss and write down some suggestions that you can think of to raise funds for your school, by recycling the waste on your school grounds.

1. Choose a **NAME** for your group of **RECYCLERS**. Use your **INITIATIVE** and make it **INTERESTING**.
2. Draw a **LOGO** for your group and make up a **SLOGAN** which you will present to the rest of the class.
3. Answer the questions below. Write these answers in your books or on your poster.
 - a. Where will you find containers to keep the different waste in? (2)
 - b. Can the containers be placed at any place on the school grounds or do you have to work out a plan for placing them? (2)
 - c. Who will empty the containers? (2)
 - d. Will they be emptied at a specific time of the day or during school? (2)
 - e. Can you think of a recycler who will pay your school for collecting the waste? (2)
 - f. How can the school use the profit money gained through the scheme? (2)

Total: 12

RECYCLE

RE-USE

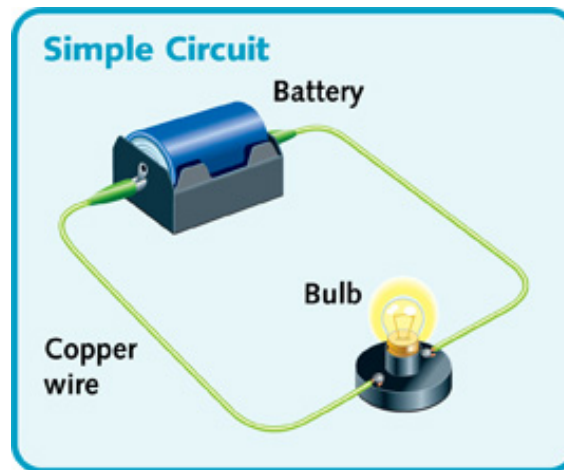
REDUCE



TOPIC 3: ELECTRICITY AND ELECTRICAL SYSTEMS

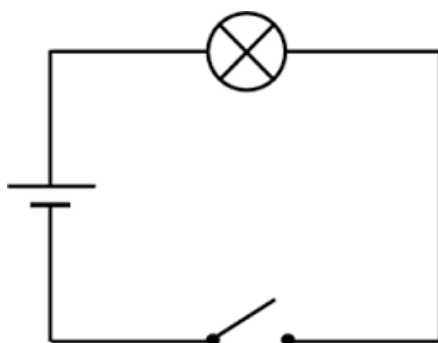
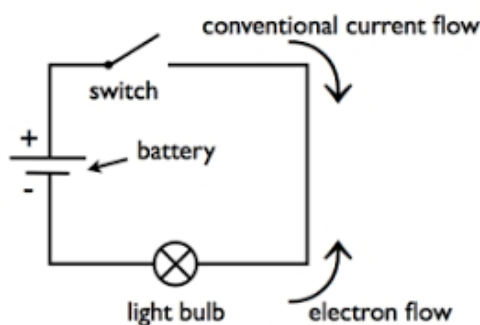
Simple Electric Circuits

The simplest form of electrical circuit is when an energy source (such as a battery) is connected to a load, such as a light bulb or a resistor, as is in the image below.



Activity 4: Drawing a simple circuit

Draw a circuit in your book, similar to the circuits below. Use the correct symbols for labelling your components and say what each of the symbols mean, e.g. a battery is used to connect to the electrical wire.



—	Connecting wire		Resistor
	Lamp or light globe		Ammeter
	Battery		Voltmeter
	Switch		Electric bell
	Electric motor		

Electromagnets

An **electromagnet** is a type of magnet in which the flow of electric current produces a magnetic field. The magnetic field disappears when the current is turned off. **Electromagnetism** is the foundation of a wide range of modern technology.

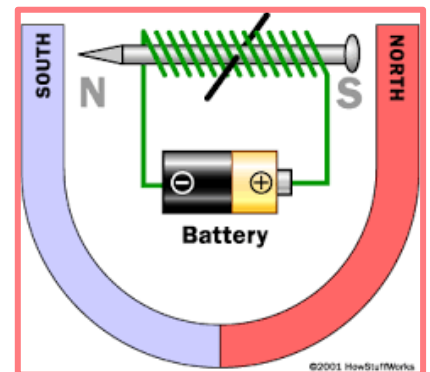
You can make a simple electromagnet by winding **insulated** copper wire around an iron nail. The coiled copper wire is called a **solenoid**. When an electric current flows through the solenoid, it creates a **magnetic field**. The iron core **amplifies** this **magnetic core**. When we switch the current off, the magnetic field fades away.

Something to try at home: Making an electromagnet

Please ask an adult to assist you if you try this at home. If you want to make an electromagnet, these are the steps you must follow:

You will need:

- A large iron nail (approximately 50mm or 60mm long)
- Thinly coated copper wire
- A dry-cell battery, e.g. a penlight battery
- Electrical tape
- A pair of scissors or a wire cutter
- Iron filings, paper clips and other magnetic items.



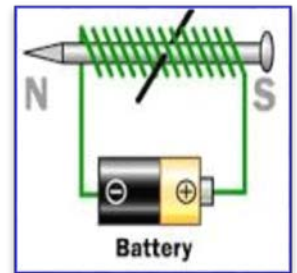
Method:

1. Wrap the thinly coated copper wire around the nail.
2. Use the scissors, or wire cutter, to cut the excess wire.
3. Leave at least 5mm of wire uncovered at both ends of the nail.
4. The wires must not overlap when you wrap them around the nail.
5. Attach the wires to the battery terminals by following these steps:
 - a. Peel the plastic coverings off the copper wire.
 - b. Attach the one end to the positive terminal of the battery.

- c. Attach the other end to the negative terminal of the battery.
 - d. Use electric tape to stick both ends of the wire to the battery terminals to keep them in place.
6. Use the iron filings, paper clips and other magnetic items to test the electromagnet.

Some interesting facts about electromagnets

Electromagnets work as long as there is electricity running through a wire, as this will automatically allow a magnetic field to be generated. The magnetic field that the electromagnet creates is only temporary. As long as there is a continuous flow of electrons, the electromagnet will work. Ordinary magnets, on the other hand, do not need electric current to work.



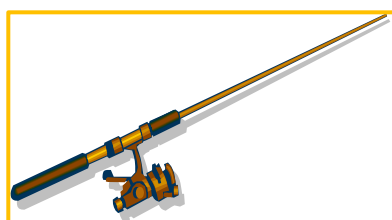
TOPIC 4: MECHANICAL SYSTEMS AND CONTROL

A lever is a simple machine consisting of a rigid bar resting on a pivot or a fulcrum. Levers are used to make work easier for us. Machines can be simple or complex machines. Simple machines are basic machines known as mechanisms. Complex machines are made up of many parts that work together. When parts work together to carry out the same function, we call it a system. Therefore, a complex machine is a mechanical system. The parts that make up this system are either simple machines or mechanisms.

Crank

A crank is a mechanism. It is a bar or rod that has one or more right-angle bends in it. The bar or rod is normally attached to a pivot at one end and rotates in a complete circle. The most common crank is the crank handle. A rod that has a number of cranks is called a crank shaft.

A fishing rod



A manual egg beater

A crank is a useful mechanism. It is actually a type of a second-class lever. A car jack has a hand crank attached to it. A rotary egg beater, a fishing rod and reel, a sewing machine and a coffee grinder all have a crank handle.

Coffee grinder



A sewing machine



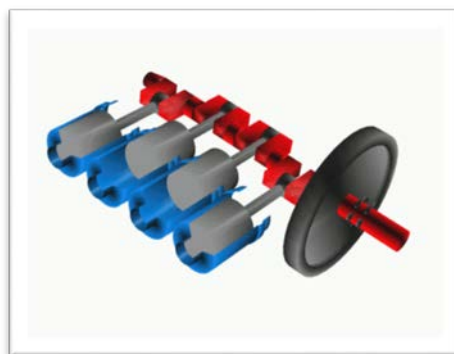
Some of you may have had tricycles when you were younger. You had to pedal a tricycle forward with your feet. Sometimes you had someone pushing you from behind. As it rolled forward, the rotating crankshaft to which the pedals were connected transmitted movement to the wheels. A tricycle is an example of a simple crank machine.

Pedal



Crankshaft

A crank mechanism inside a car engine consists of moving parts - the pistons and a crankshaft.



The crankshaft rotates or circulates and the pistons move back and forth or **reciprocate**, transferring movement to the wheels of a car. Cranks give the user mechanical advantage.

The distance between the pedal and the central shaft is increased, making it easy to turn. Cranks can be used in two ways. They can be used to turn circular movement into reciprocating movement or to turn reciprocating movement into circular movement. The pistons move up and down and push the crankshaft around a central rod. This rotation is transferred to the wheels causing them to turn.

Visit the following website to see the way a crankshaft moves:

www.dailymotion.com/video/x6s8ck_crankshaft_auto

Machines use four basic types of movements:

- 1) **Linear movement:** It is a movement in one, linear, direction. A moving train, a sliding door and a lift use this type of movement.

Figure 1

A moving train



Figure 2

A sliding door

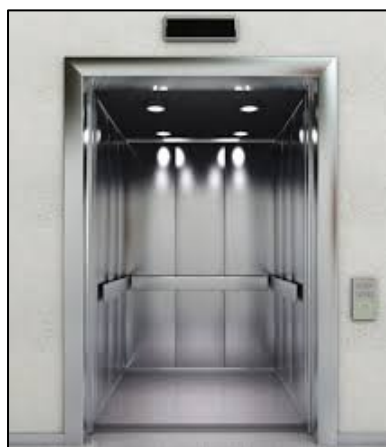


Figure 3 and 4

A closed and an open lift

- 2) **Reciprocating movement:** It is a constant forward and backward or upward and downward movement. This movement is used when you slice bread with a knife.



- 3) **Circular movement:** It is a movement that forms a complete circle like the rotating wheels of a moving car.



- 4) **Oscillating movement:** A forward and backward movement on a fixed axis in a curve or arc, for example a see-saw, a swing, a rocking chair, or the pendulum of a clock.



See-saw



Rocking chair



Swing



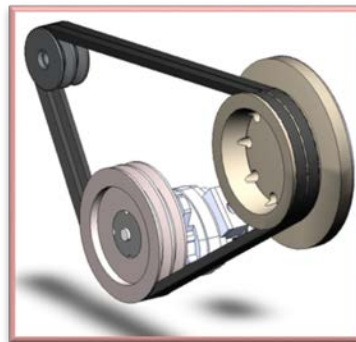
Pendulum Clock

Pulleys

A pulley is a wheel with two raised edges and a groove in the centre. A rope, chain, string or cable can run along the wheel without coming off. Pulleys are used for moving loads up and down.

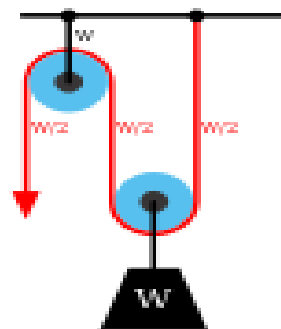
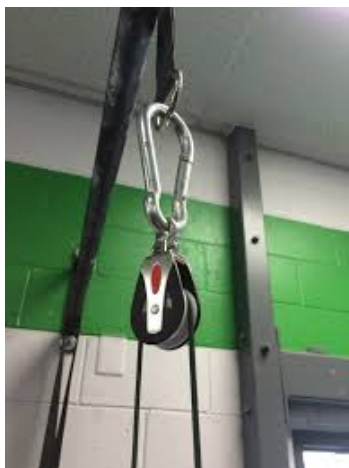
In a pulley system the driver pulley wheel (which is usually the bigger wheel) is driven by a motor. A belt joins this wheel to another wheel called the driven pulley wheel (which turns when the belt turns).

A belt and pulley system

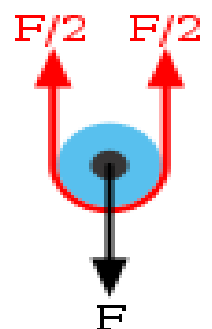
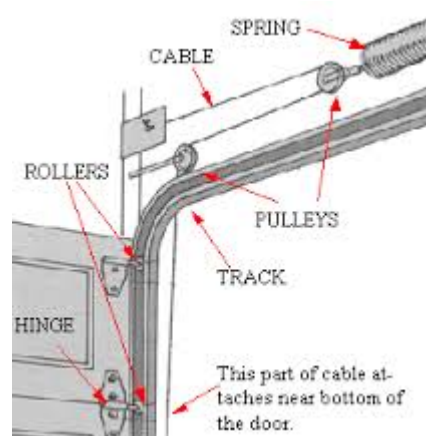
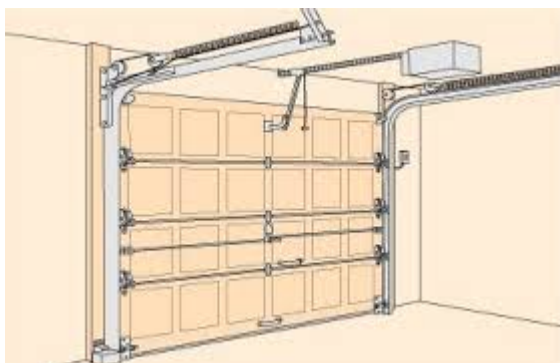


Look at the following figures A and B to see how a pulley system works.

A)



B)



A pulley is used to lift heavy loads. It is a simple machine that is sometimes also called a block and tackle. A pulley allows you to change the direction of the pulling force. A pulley, by changing the direction of a force, helps to make work easier.

Everyday use of pulleys includes:

- Machines for constructing tall buildings use pulleys to lift heavy materials.
- Birdfeeders have to be hung high in a tree and pulleys are used to lower and lift the feeding platform.



- The motor in a washing machine drives the small pulleys faster during spinning and bigger pulleys slowly during washing.
- Flag poles consist of pulleys and ropes. The ropes are to hoist the flag high.
- Escalators and lifts use pulleys to carry people and objects up and down.
- Venetian blinds use a set of pulleys to open and close.



Strengthening Frame Structures

Structures that are not strong, rigid and stable cannot withstand forces acting on them. Frame structures and structural materials may be strengthened by using these three basic strengthening techniques: tubing, folding and triangulation.

There are FIVE FORCES that can act on a structure:

- 1) **Torsion**: a twisting force acting on a structure, it is the same as when you play sport and accidentally twist your ankle.
- 2) **Tension**: a stretching force acting on a structure, for example when a car is being towed the rope gets stretched by the pulling of the force of the other car.
- 3) **Bending**: a bending force acting on a structure (like when trees bend in windy weather).
- 4) **Shearing**: a tearing force acting on a structure like a trunk of a tree that has broken or sheared in half because the tree had bent too far.
- 5) **Compression**: a squashing force or pushing force acting on a structure, for example when you step on a sponge and it gets compressed or squashed.

PAT: Examine pictures of cranes MODEL CRANES



Cranes are machines consisting of an extendable arm and pulleys. They are used to move heavy loads vertically and/or horizontally. They use a combination of simple systems like pulleys and levers to do work. Modern cranes are technologically advanced. They are operated at the touch of a button to do work faster, more efficiently and safer. You need

specialised training to operate a crane. In the construction of multi-storey buildings and highways, cranes are used for lifting and hoisting tons of steel and concrete slabs. In the transport industry cranes are used for loading goods onto trucks, aeroplanes and trains. In the manufacturing industry cranes are used in the assembly of heavy machinery.



Click on the following link to access websites and see how cranes and tower cranes work:

- 1) <http://science.howstuffworks.com/transport/engines-equipment/tower-crane.htm>
- 2) www.youtube.com/watch?v

**Step 1: Draw one possible
freehand design of a
moveable crane**

**Step 2: Draw a
second possible
freehand design for
your model crane**

Sketch two possible freehand designs for a suitable crane. Sketch your ideas on the given worksheets.

**Step 3: Draw a final
design showing the
materials, tools, labels
and adding colour**

**Step 4: Write the
Design brief based on
information of the
final sketch**

Plan and write a design brief for your model. Below is an example of sentences with which to begin your design brief.

Design and make a model of a crane; I am making a model crane and I will be using...
Look closely at the specifications and constraints.

Making skills

Group / pairs works together. You can also work individually (alone). Choose the best design and group / pair members will make one chosen model crane.

Now you should have the following:

- First freehand drawing of your model crane
- Second freehand drawing of your model crane
- Final drawing of your model crane
- A design brief
- Your chosen design for the group/ pair /individual
- A plan on how to make it
- Materials (It should be a frame structure made from simple materials, such as wooden skewers, matchsticks, paper tubes.)

It is now time to start building your model, in groups / pairs or alone. Build a model crane with an electromagnet at the end of the pick-up scoop, if you can, or just a crane. The crane should show some strengthening techniques.

Enjoy making your crane project. The rubrics for the PAT will be pasted into your workbooks.