Name: ______________________________________

Montgomery Academy

Science Department

Year 8 Knowledge Organiser 2023-2024

Contents

Introduction to Science Knowledge Organiser

A science laboratory is used for carrying out practical investigations. They involve using dangerous chemicals and practical equipment such as Bunsen burners.

Some practical equipment, such as test tubes, are easily breakable so care must be taken.

The pupils' and teacher's health and safety are very important so that no one gets hurt.

Hazard symbols show people how dangerous a chemical is, and what care should be taken when handling them.

Symbols can be used all over the world and are immediately recognisable, so it doesn't matter which language is used.

flammable –

corrosive –

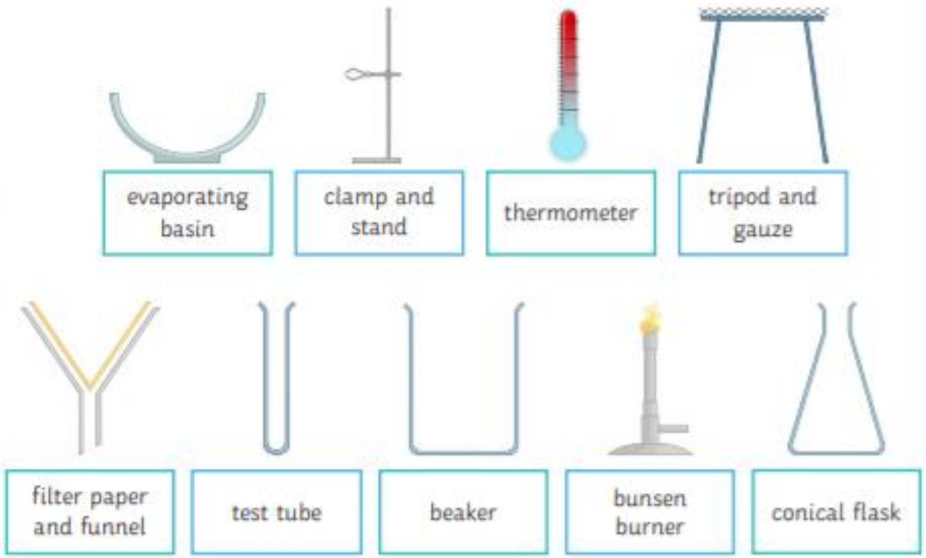
harmful –

irritant –

can damage the environment –

Scientific Equipment

Diagrams are used when drawing practical equipment to make it easier and quicker to draw.



The Safety Flame

The safety flame is used when the Bunsen burner is not in use. The flame is easier to see when it is the yellow flame. To produce this flame, the air hole is fully shut. Less oxygen will get into the Bunsen burner, hence the yellow flame.

The Roaring Flame

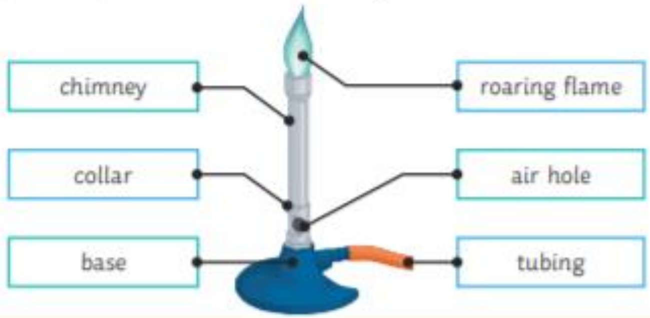
The roaring flame is used to heat things quickly. To produce this flame, the air hole must be fully open. More oxygen will get into the Bunsen burner, hence the blue flame.

Below are some safety rules that should always be followed in a lab.

- Always wear googles during a practical.
- Stand up during a practical.
- No running in the lab.
- Tie long hair back with a bobble.
- When something gets broken, tell a teacher.
- Inform a teacher of any spills and mop up immediately.
- Make sure equipment gets put away at the end of a practical.

Bunsen Burner

The Bunsen burner is an important piece of scientific equipment. It is used in many science experiments and uses methane gas.



Introduction to Science Knowledge Organiser

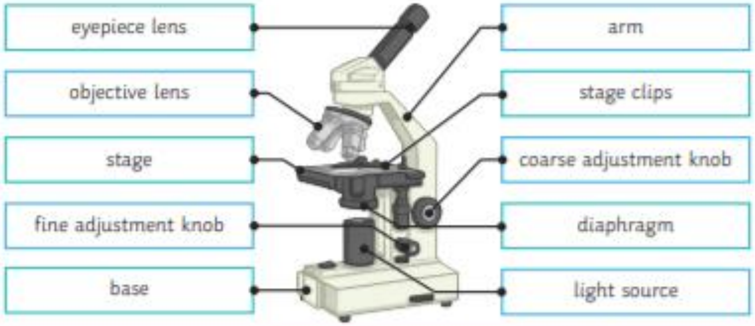
How to Use a Microscope

1. Plug in the microscope and turn on the light.
2. Place the specimen (the object to be observed) on the stage.
3. Turn the magnification to the smallest.
4. Make sure that the specimen is in the centre; fasten it with the clips.
5. Look down the microscope.
6. Use the fine focussing wheel to observe the specimen.
7. Increase the magnification.
8. Draw/write down any observations.

Using a Microscope

Microscopes have been used for years to observe objects that are too small to see with the naked eye.

Over time, the magnification of microscopes has significantly improved due to developments in technology. We now have microscopes that can examine specimens at an atomic level. We have made many important scientific discoveries thanks to microscopes.



The Flame Test

This test is used to find out what metal ion is in a compound. Each metal will burn with a different colour when placed into a Bunsen burner.

1. Dip the splint in some water.
2. Dip the wet end in a test tube sample of metal chloride e.g. copper chloride.
3. Turn the Bunsen burner to the blue flame and carefully place the end of the splint with the metal into the flame.
4. Write down any observations/colours in the results table.

Chemical	Flame Test Colour
potassium (K)	purple
calcium (Ca)	yellow-red
lithium (Li)	red
sodium (Na)	orange
copper (Cu)	green-blue

Investigation Skills

Independent variable – the variable you change.

Dependent variable – the variable you measure.

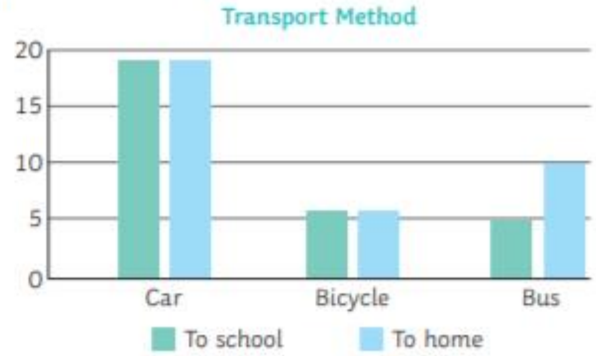
Control variables – the variables you keep the same.

Prediction – what you think will happen and why?

Method – how to carry out the practical investigation.

Results table - as the practical is carried out, write the results in a table.

Bar graph – used with categorical data.



Scatter graph – used with continuous data.

Conclusion and analysis – look at the results and discuss what you found out from the practical.

Evaluation - how can you improve the practical?

Forces (Part 1)

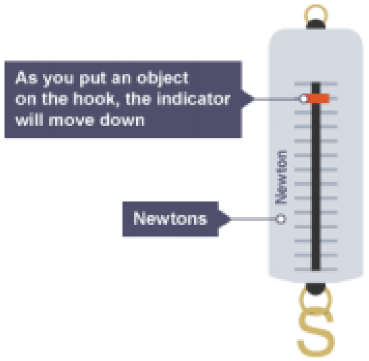
A force can be a **push or a pull,** for example when you open a door you can either push it or pull it. You can not see forces, you can only see what they do.

When a force is applied to an object it can lead to a change in the objects
- **Speed**
- **Direction of movement**
- **Shape (think about a rubber band)**

Forces can also be divided into 2 types, contact forces and non contact forces.

1. Contact forces for example friction, are caused when two objects are in contact.
2. Other forces for example gravity, are non contact forces. The two objects do not need to be in contact for the force to occur.

The unit of force is the **Newton (N),** this is named after Sir Isaac Newton, who came up with many theories including those to do with gravity and the three laws of motion. We measure force using a piece of equipment called a Newton metre. See the picture below.



Types of force

In the table below different forces are summarised:

Name of Force	**What causes it?**	**Example**
Friction	When two objects rub together	Car tyres moving on a road.
Air resistance	When an object rubs against air particles	A sky diver falling through the air
Reaction	A force that acts in the opposite direction	A book on a desk, the force acting up is a reaction force
Weight	The force an object exerts on the ground due to gravity	You will exert a force on the ground, that is your weight
Thrust	The force that drives on objects with an engine	Thrust moves a plane forwards

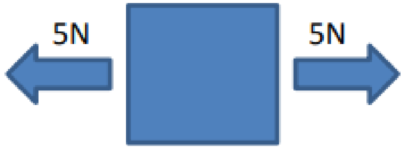
Forces (Part 2)

Balanced Forces

When we talk about the total force acting on object we call this the **resultant force.** When the forces acting in opposite directions are the same size we say the forces are **balanced**. This means one of two things:

1. The object is stationary (not moving)
2. The object is moving at a constant speed

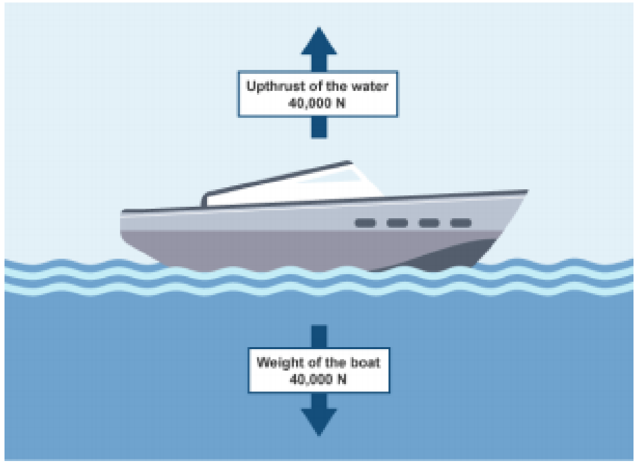
This is known as Newton's first law.



For example, the resultant force acting on this object is 5N-5N=0N

Force Diagrams

To show the forces acting on a body we use a free body force diagram. A **free body force diagram** shows all of the forces that are acting on the body. It has arrows that show the direction the force acts, the larger the arrow, the larger the force. A free body fore diagram should always have labelled arrows.



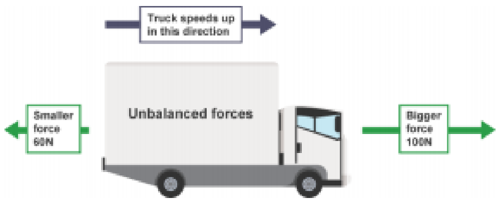
Unbalanced Forces

If the forces are unbalanced on an object there are two things that could happen:

1. If the object is stationary then it will move in the direction of the resultant force
2. If the object is moving, then the object will speed up or slow down in the direction of the resultant force.

For example, what is the resultant force on the lorry below?

100N-60N= 40N (to the right)



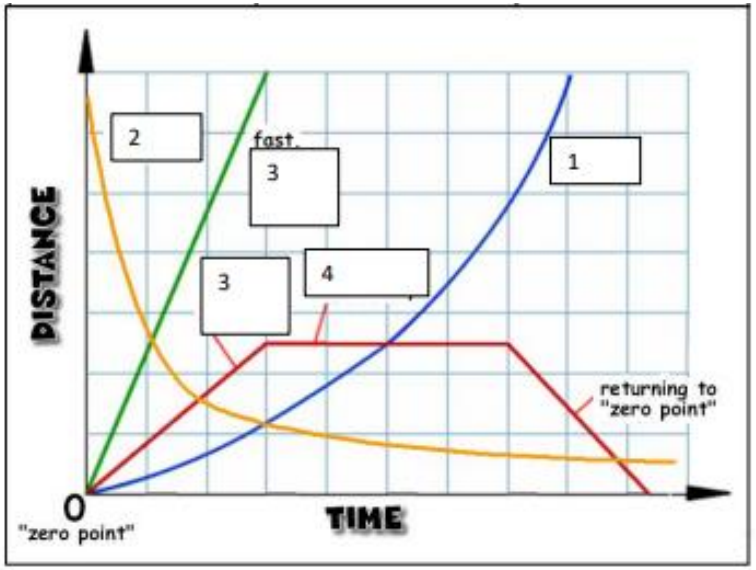
Remember the resultant force does not tell you what direction the lorry is moving in.

- If the resultant force is in the same direction as the movement of the lorry then the lorry will speed up
- If it is in the opposite direction the lorry will slow down

The larger the resultant force the larger the change in movement.

Forces (Part 3)

4. D/T graph keywords		
Keyword	**Meaning**	**Position on distance time graph**
Accelerate	Speeding up	1
Decelerate	Slowing down	2
Constant speed	Staying the same speed	3
Stationary	Not moving	4
Speed	Distance covered in a certain time	The steepness of the line



7. Moments:

1.To calculate a moment you need to know:

- How much force is being applied (Newtons, N)
- The distance from the pivot that the force is being applied (Meters, m)

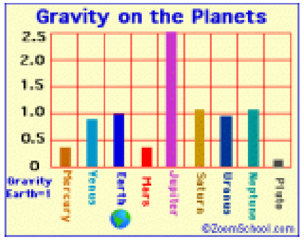
Moment = force x distance

2.The unit for moment is newton metre (Nm)

3.A small force over a large distance can generate the same moment as a large force over a small distance.

Weight on different Planets

As planets have different masses a person's weight would be different depending which planet they were on. For example, a person's weight on Earth is 1000N. If that same person was on Jupiter their weight would be 2500N.



Useful Websites

Forces - https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/zs3896f

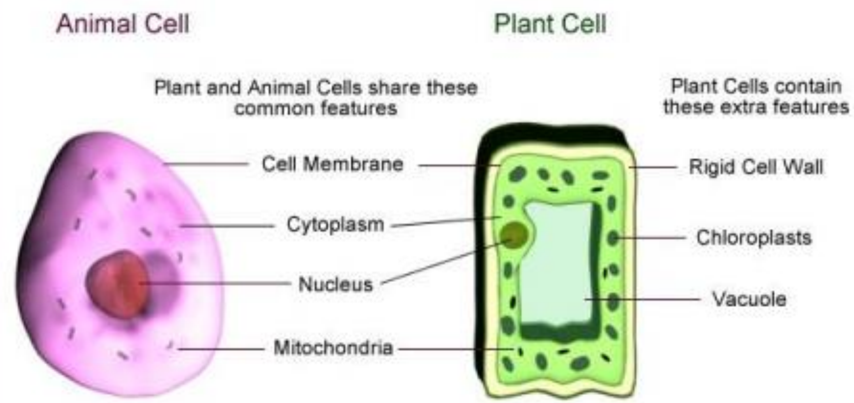
Force diagrams - https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/zhnfp4j

Motion and speed - https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/zw9qwnb

Keeping Healthy (Part 1)

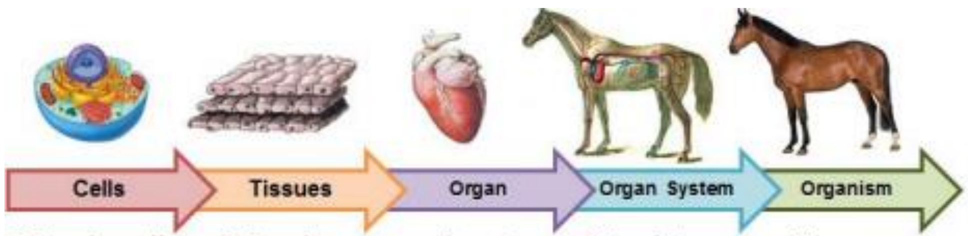
Cells

Cells are the building blocks of all living organisms



Key Terms	Definition
Cell wall	Made of cellulose, which supports the cell
Cell membrane	Controls movement of substances into and out of the cell
Cytoplasm	Jelly-like substance, where chemical reactions happen
Nucleus	Contains genetic information and controls what happens inside the cell
Vacuole	Contains a liquid called cell sap, which keeps the cell firm
Mitochondria	Where most respiration reactions happen
Chloroplast	Where photosynthesis happens

Key Terms	Definitions
Cell	The building block of life and the smallest structural unit of an organism
Tissue	A group of cells working together to perform a particular function
Organ	A group of tissues working together to perform a particular function
Organ system	A group of organs working together to perform a particular function
Organism	An individual life form, can be multicellular or unicellular
Multicellular	Consisting of many cells
Unicellular	Consisting of just one cell



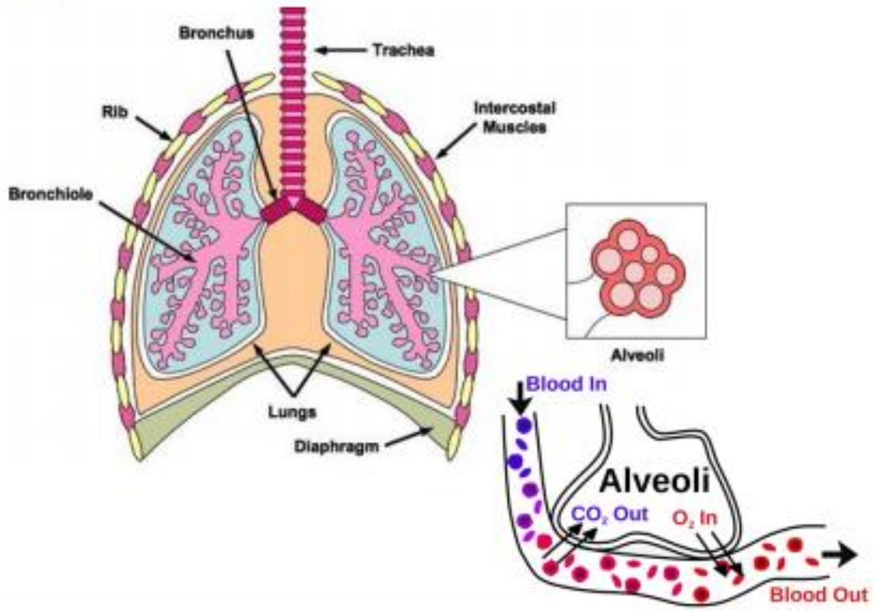
Keeping Healthy (Part 2)

3. Aerobic respiration	
Respiration	An exothermic reaction which continuously happens in living cells
Purpose	Transfer energy for: • Chemical reactions • Movement • Warmth
Aerobic	With oxygen
$C_6H_{12}O_6 + 6O_2 \Rightarrow 6CO_2 + 6H_20 + ATP$ Glucose Oxygen Carbon Dioxide Water Energy	
Anaerobic	Without oxygen
Anaerobic respiration in muscle cells	glucose → lactic acid
Anaerobic respiration in yeast cells (fermentation)	glucose → ethanol + carbon dioxide
Lactic acid	A chemical that when built up in muscles causes fatigue

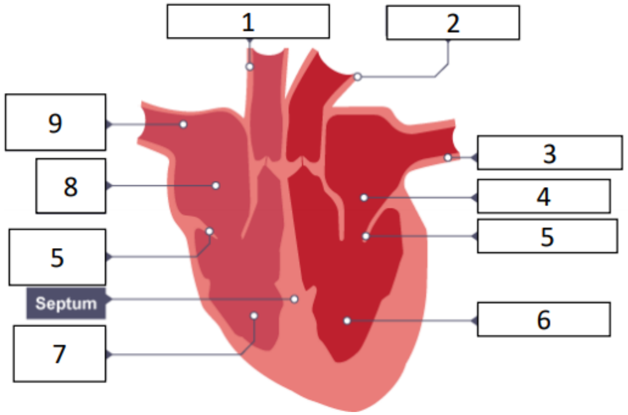
The Respiratory System

The respiratory system is responsible for taking in oxygen and expelling carbon dioxide. The lungs are the organ where this gas exchange occurs. They are made up of many fine air tubes called bronchioles, which terminate in alveoli. Here Oxygen diffuses into the bloodstream and carbon dioxide diffuses out.

Lungs are designed for absorbing oxygen as they have a huge surface area (alveoli), a rich blood supply, are moist (gases move in solution), and alveoli walls are thin so the gases do not have far to diffuse.



Keeping Healthy (Part 3)



7. The heart		
1	Pulmonary artery	Carries deoxygenated blood to the lungs
2	Aorta	Carries oxygenated blood to the body
3	Pulmonary vein	Brings oxygenated blood from the lungs
4	Left atrium	Pushes blood to left ventricle
5	Heart valve	Prevents backflow of blood
6	Left ventricle	Pumps blood to body
7	Right ventricle	Pumps blood to lungs
8	Right atrium	Pushes blood into right ventricle
9	Vena cava	Brings deoxygenated blood from body

Pathogen	Micro-organisms that cause infectious disease (eg bacteria, protists, fungi and viruses).
Bacteria	Prokaryotic cells. Some can cause disease by making toxins.
Protists	Eukaryotic cells. Some can cause disease.
Fungi	Class of organisms that includes mushrooms. Some can cause disease.
Virus	The smallest organisms. Much smaller than bacteria. They reproduce inside host cells damaging them and causing disease.

4. Specific defence by white blood cells	
Phagocytosis	Ingesting (take in) pathogens digesting and destroying them
Antibody production	Target a specific pathogen. Stick them together and target them for destruction. Gives you a 'memory' of that pathogen so you can fight it more quickly next time
Antitoxin production	Cancel out toxins released by pathogens

3. Non-specific defence systems	
Skin	Physical barrier
Nose	Hairs trap pathogens
Trachea and bronchi	Mucus traps pathogens
Stomach	Acid destroys pathogens

Vaccine	Small amount of dead or inactive pathogen to stimulate white blood cells to produce antibodies
How vaccines work:	
1	Weak or dead pathogen injected
2	White blood cells generate antibodies to destroy pathogen
3	White blood cells that make those antibodies remain and make you immune to future infections

Useful Websites

Cells to systems - https://www.bbc.co.uk/bitesize/topics/znyycdm/articles/zrp3ydm

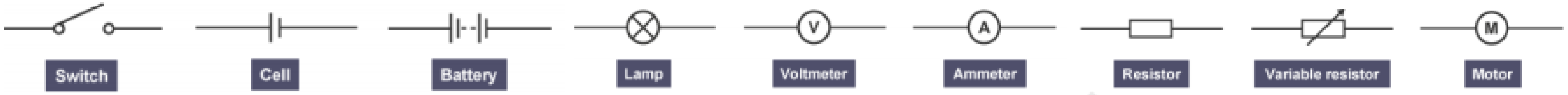
Respiration - https://www.bbc.co.uk/bitesize/topics/zvrrd2p/articles/zdqx2v4

Circulatory System - https://www.bbc.co.uk/bitesize/topics/zvrrd2p/articles/zkq7wnb

Electricity and Magnetism (Part 1)

Circuit Symbols

When drawing an electric circuit, we use different symbols to represent different components, the symbols you need to memorise are:



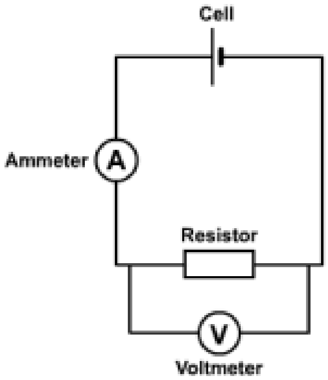
Insulators	Conductors
Can become charged (+ or -), but DO NOT let the charges flow	DO let charges flow (e.g. electrons)
Examples: almost any non-metal materials, like rubber, fabrics, paper, plastics, wood	Examples: all metals, and graphite (in your pencil!)
CANNOT be used in a circuit	To make a circuit, you MUST use conductors, joined in a complete loop
Insulators have extremely HIGH resistance, which is why current can't flow through them	Conductors have LOW resistance, which is why they let charges flow through them

Key Terms	Definitions
Circuit	A complete loop of conductors
Current	The rate of flow of charge
Potential difference	p.d. for short, and also known as voltage. This is the measure of the difference in electrical potential energy between two points
Resistance	The property of materials that determines how much current they will carry and how much work they do
Work	Transfer of energy from one store to another
Component	Part of a circuit. See symbols below
Series	Linking components one after another, making one loop
Parallel	Linking components so they are in separate loops

Electricity and Magnetism (Part 2)

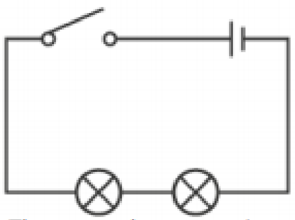
Measuring current and potential difference

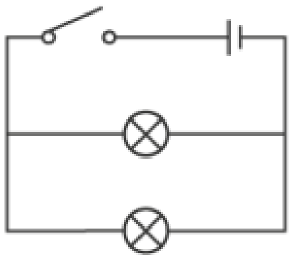
- Current is measured with an ammeter. An ammeter is included in the circuit (in series with the other components).
- Potential difference (voltage) is measured with a voltmeter. Since voltmeters measure the difference in potential energy between two points, they must be added across the component whose potential difference you want to measure.

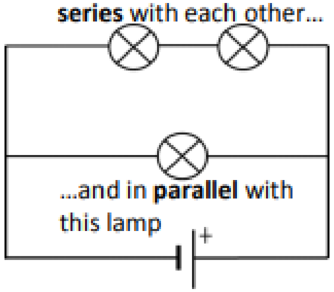


Arranging Components in Circuits

Components (like bulbs/lamps) can be arranged in series with each other OR in parallel with each other.







Resistance

Resistance, potential difference and current are linked in the equation *V = IR*. This is also known as Ohm's Law. This equation shows that:

- If potential difference is kept constant... increasing resistance *decreases* current
- You could increase current EITHER by increasing potential difference OR decreasing resistance
- You can calculate the resistance of a component using *R = V/I* (worked example below)

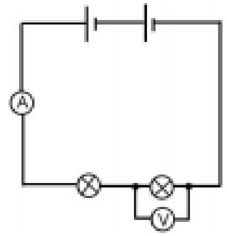
Equation	Meanings of terms in equation
$V = I\,R$	*V = potential difference (volts, V)* *I = current (amperes, A)* *R = resistance (ohms, Ω)*

If the reading on the ammeter is 0.2 A and the reading on the voltmeter is 5.5 V, what is the resistance of the lamp?

R = V/I

R = 5.5/0.2

R =27.5 Ω



Electricity and Magnetism (Part 3)

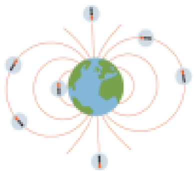
Key Terms	**Definitions**
Permanent magnet	A magnet that always has its own magnetic field. Attracts magnetic materials, and can attract or repel other magnets.
Electromagnet	A magnet created by the flow of electric current
Magnetic Field	The area around a magnet where a force acts on other magnets or on magnetic materials. (3D, unlike diagrams usually show)

Magnets and magnetic fields

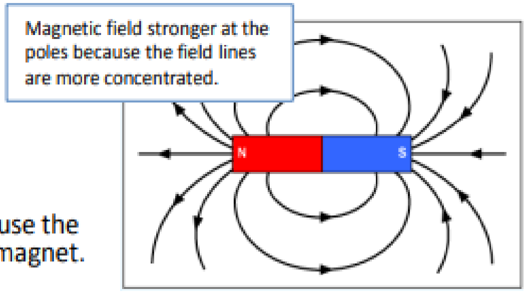
Magnets have two poles, a North pole (N) and a South pole (S).
- **opposite poles attract** (N and S)
- **like poles repel** (N and N, OR S and S)

Magnets have magnetic fields (which are invisible). If a magnet or magnetic material enters the magnetic field of a magnet, it feels a force: either a force of attraction or a force of repulsion.

Although we cannot see magnetic fields, we can detect them and plot magnetic field lines on a diagram, as shown. In the diagram, note that:
- **field lines point from north to south pole**
- **field lines are more concentrated at the poles.**
- The **magnetic field is strongest at the poles**, where the field lines are most concentrated.

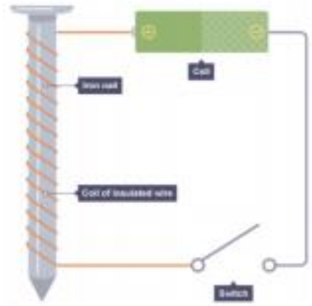


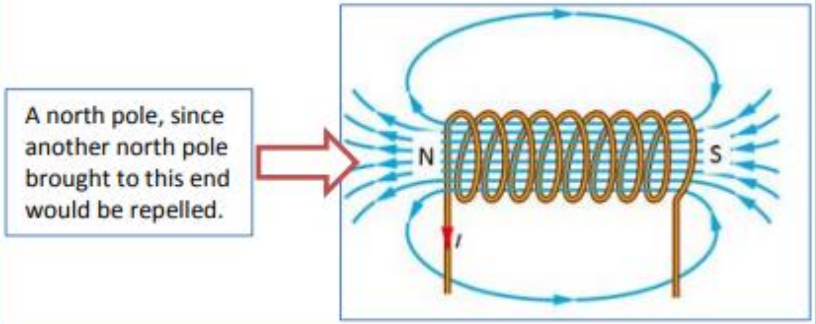
The Earth has a magnetic field because the core rotates. It acts like a giant bar magnet.



Electromagnets

When an electric current flows through a wire, it creates a magnetic field around the wire. The wire can be used to make **an electromagnet,** by making the wire into a coil. It has a magnetic field just like a bar magnet (see diagram).
You can increase the strength of an electromagnet by doing three things:
1. Increase the number of coils
2. Increase the current
3. Add an iron core





Useful Websites

Electricity https://www.bbc.co.uk/bitesize/topics/zgy39j6/articles/zjm8kty#z76wdp30

Magnetism - https://www.bbc.co.uk/bitesize/topics/zrvbkqt/articles/z8g996f

Chemical Reactions (Part 1)

Elements

- Elements are substances made up of one type of atom.
- All the elements are found listed in the Periodic Table – there are currently 118 of them.

Compounds

- Compounds contain two or more elements that are chemically joined to each other.
- Compounds are formed by chemical reactions.
- In order to separate the elements in a compound you would need to carry out another chemical reaction.
- Examples of compounds are:
  - Carbon dioxide (CO_2)
  - Water (H_20)

Chemical Change vs Physical Change

Physical Change

In a physical change, the matter's physical appearance is changed, but no chemical bonds are broken or formed. For example, when water is heated from liquid water to gaseous steam, only the appearance of water is changed – both steam and liquid water have the chemical formula H_2O.

Chemical Change

A chemical change involves a change in the chemical composition. Different elements or compounds are present at the end of the chemical change. Bonds of the reactants are broken down; new bonds are formed after the chemical change to produce new compounds.

A chemical change usually is indicated by:

1. A colour change
2. Emission of a gas
3. An increase or decrease in mass
4. Formation of a new solid

Chemical Reactions and Conservation of Mass

In a chemical reaction, there is the breaking of chemical bonds and the formation of new chemical bonds.

In a chemical reaction we start with ***reactants*** and we make ***products***. We represent this using a word or symbol equation.

For example:

Sodium + Chlorine	→	Sodium Chloride
Reactants		***Products***

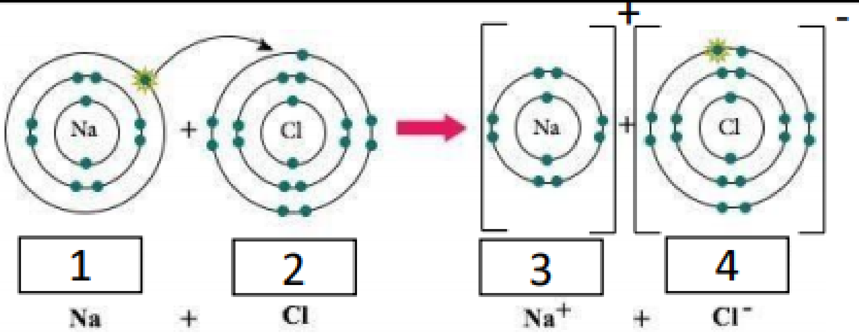
We can also represent the reaction using a symbol equation. The numbers indicate the number of atoms involved. The number of each type of atom must be the same before and after the reaction.

$$2Na + Cl_2 \rightarrow 2NaCl$$

Chemical Reactions (Part 2)

1. Keywords	
Ionic bond	When a metal donates electrons to a non-metal forming opposite charged ions that are attracted to each other
Covalent bond	A shared pair of electrons between two non-metals

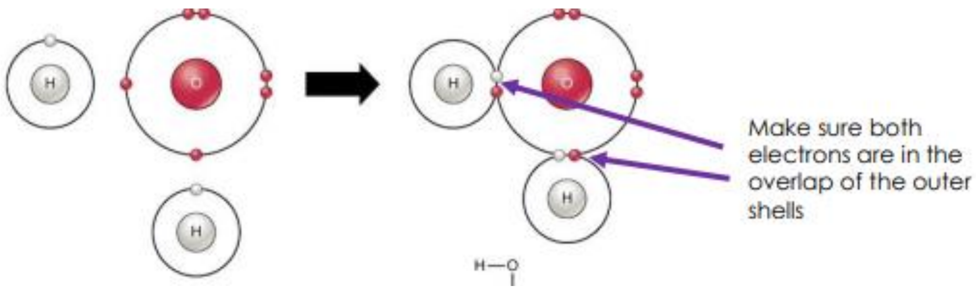
2. The process of ionic bonding



No	Name	Electron movement	Charge	Electron configuration	Does it have a full outer shell?
1	Sodium atom	0	0	2,8,1	No
2	Chlorine atom	0	0	2,8,7	No
3	Sodium ion	Lost 1	+1	2,8	Yes
4	Chloride ion	Gained 1	-1	2,8,8	Yes

Key terms	Definition
Physical change	A physical change usually refers to a change of state. No chemical bonds are broken or formed in a physical change
Chemical change	A chemical change involves the breaking and forming of bonds. Usually a new chemical (product) is formed afterwards
Conservation of mass	Matter involved in a physical or chemical change is the same before and after the change. Mass is the same before and after a physical change; the number of atoms in the reactants of a chemical reaction should stay the same after the chemical change

3. The process of covalent bonding	
1	Non metals share their outer unpaired electrons
2	Now all outer shell spaces appear full
3	There is no change in charge. They remain uncharged

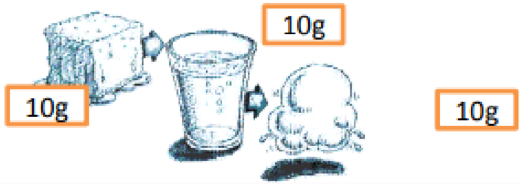


Chemical Reactions (Part 3)

Conservation of Mass

The Law of Conservation of Mass states that **mass cannot be created or destroyed.**

Therefore, mass stays the same before and after a change of state. For example, 10g of ice melts into 10g of water and 10g of water evaporates into 10g of water vapour. The same applies to other substances.



2. Identification of common gases		
Gas	Test	Observation
Hydrogen	Burning splint	Squeaky pop
Oxygen	Glowing splint	Relights
Carbon dioxide	Limewater	Goes cloudy
Chlorine	Damp Litmus paper	Bleached (goes white)

1. Keywords	
Conservation of energy	Energy can not be created or destroyed just transferred from one for to another
Exothermic reaction	Reaction which releases heat to the surroundings. Causing an increase in temperature
Endothermic reaction	Reaction which absorbs heat from the surroundings. Causing a decrease in temperature

Reaction type	**Temperature change**	**Amount of energy absorbed to break bonds**	**Amount of energy released when making new bonds**
Exothermic	Increases	Less	More
Endothermic	Decreases	More	Less

Useful Websites

Elements and compounds - https://www.bbc.co.uk/bitesize/topics/zstp34j/articles/zngddp3

Chemical Reactions - https://www.bbc.co.uk/bitesize/topics/zypsgk7/articles/zwxhk2p