KS3 Science Revision Worksheets

Special Edition

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Introduction.

The aim of this resource is to provide a complete revision guide for the Key Stage 3 Science programme of study in a format which is suited to pupils of lower abilities. There are ninety worksheets covering every National Curriculum Statement of Attainment at KS3.

Each sheet provides pupils with the key facts of a topic and also contains one or more short exercises which have been designed to check pupils' knowledge and understanding. The sheets can be used in a variety of ways:

- to provide high quality classwork and homework materials
- for end of topic revision
- to provide pupils with the key facts of a topic that they have missed

P. Hill. BSc.

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W.S.1. Life processes.

Name ……

All plants and animals carry out seven processes in order to stay alive. The table below shows these seven LIFE PROCESSES.

Movement	This is easier to see in animals than in plants. Plants move very slowly as they grow.
Respiration	Getting energy by reacting food with oxygen.
Sensitivity	Sensing changes around them and then responding.
Growth	Food is used to build up the parts of the body.
Reproduction	Producing offspring (young).
Excretion	Getting rid of poisonous waste chemicals from the body.
Nutrition	Plants make their own food by PHOTOSYNTHESIS. Animals must feed on plants or other animals.

Use the name MRS GREN as an easy way to remember all 7 life processes.

Exercise 1 – Complete the sentences below.

1) It is usually easier to see movement in A _ _ _ _ _ _

2) We respire in order to produce E _ _ _ _ _ for the body.

3) Our ears, eyes and nose give us S _ _ _ _ _ _ _ _ _ _ _

4) If living organisms did not R _ _ _ _ _ _ _ _ they would soon become extinct (die out).

5) The kidneys E _ _ _ _ _ _ a waste chemical called urea.

Exercise 2 - A motor car moves but it is not living. Complete the two lists below to show which processes it does and does not show.

Processes a car does show	Processes a car does not show
movement	growth
nutrition (takes in petrol)	……
……	……
……	

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W.S.2. Plant and animal organs.

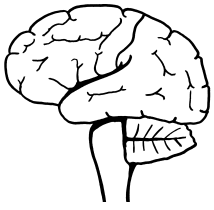
Name ……

Exercise 1 - Fill in the missing words in the passage below.

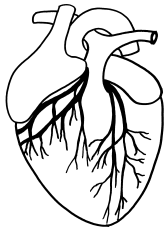
In the human body many cells of the same ..... join together to form TISSUES. These tissues then join together to form ..... An organ is a part of the ..... that has one or more important ..... to carry out. All of the organs work together to keep the body ..... The bodies of most animals and ..... are made up of many organs. Several organs working together on one large task is called a ..... For example, in the human body the mouth, gullet, stomach and ..... make up the digestive system.

intestines type organs plants jobs body healthy system

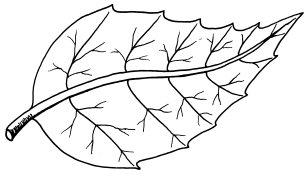
Exercise 2 – Join up the organs below to their correct description.



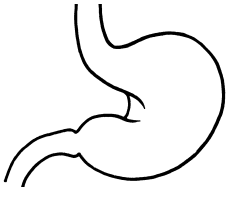
Brain



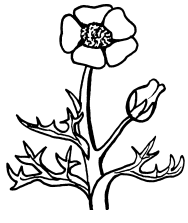
Heart



Leaf



Stomach



Flower

Descriptions
This pumps blood around the body.
This organ makes food in a plant.
This controls the rest of the body.
This organ makes seeds in a plant.
This helps to digest food.

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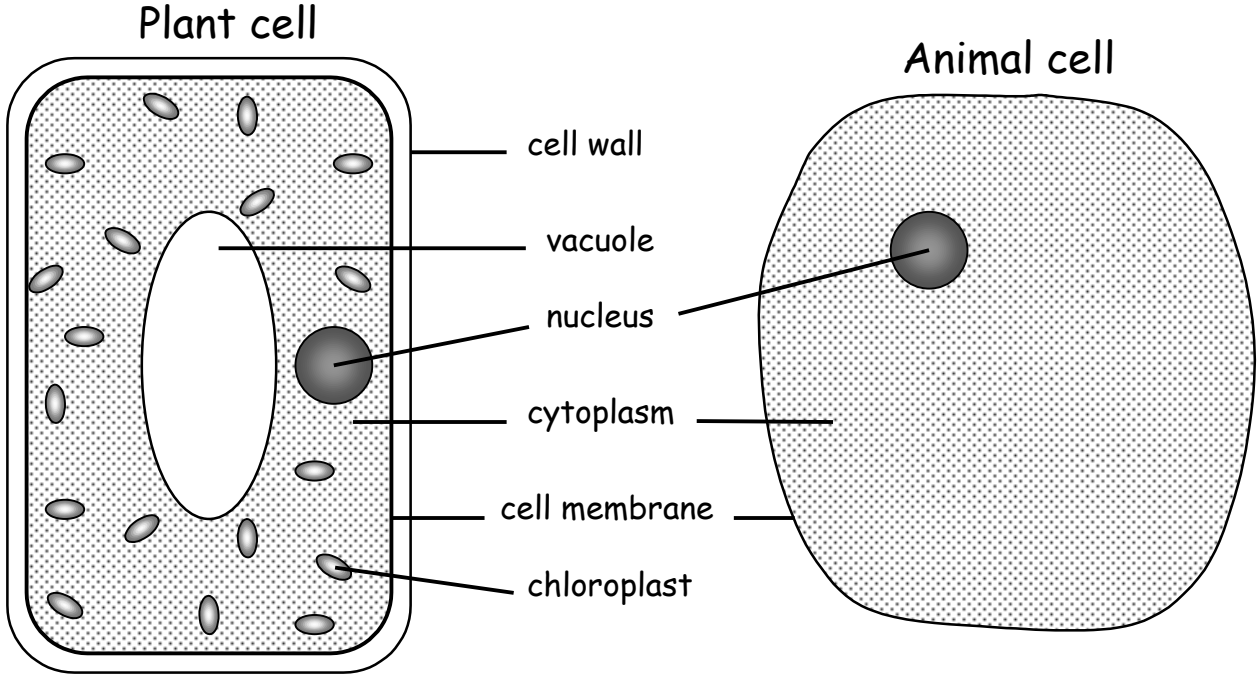
W.S.3. **Animal and plant cells.** Name ……

Exercise 1 – Fill in the missing words in the passage below.

The bodies of all plants and …… are made up of tiny living units called …… Some microscopic organisms consist of only a …… cell but the bodies of most plants and animals are made up of …… of cells. There are many different …… of plant and animal cells. The diagrams below show the …… that they usually contain.

parts **animals** **cells** **types** **millions** **single**



Exercise 2 – Join up the cell parts below to their correct jobs.

Cell part	Job
Nucleus	covers the membrane and gives strength to a plant cell.
Cytoplasm	controls what the cell does.
Cell wall	jelly that fills the cell, chemical reactions happen here.
Chloroplast	stores water in a plant cell.
Vacuole	absorbs light energy to make food for the plant.

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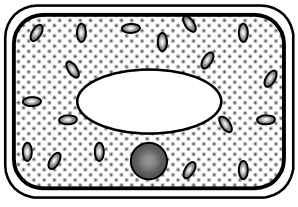
W.S.4. Different cells for different jobs. Name ……

Exercise 1 – Fill in the missing words in the passage below.

Nearly all cells contain a membrane, …… and cytoplasm. There are many …… types of cells. They vary in their shape and …… depending on their functions (jobs). Each type of cell is well …… (suited) to its function. In the human …… there are about twenty different types of cell, each has a certain …… to do. This makes the body work much …… than if each cell was trying to do everything.

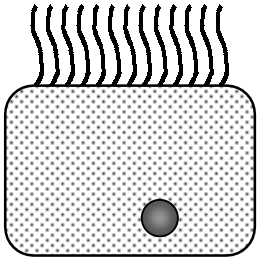
better different nucleus size body adapted job

Exercise 2 – Join up the cells below to their correct descriptions.



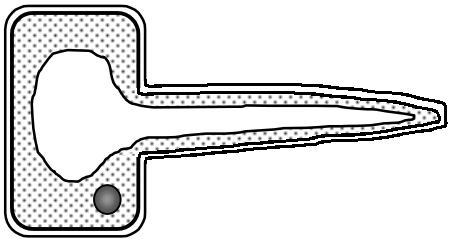
Ciliated cell

This cell is found lining the windpipe. Its surface is covered with tiny hairs called cilia. These waft dirt and germs up to the throat.



Palisade cell

This cell is found on the top side of a leaf. It contains tiny green discs called chloroplasts. These absorb sunlight in order to make food.



Sperm cell

It uses its tail to swim to the ovum. The head contains the nucleus which enters the ovum during fertilisation.

Root Hair cell

This is found on the surface of a root. Its job is to absorb water from the soil. It is long and thin with a big surface area to absorb water.

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W.S.5. **A balanced diet.** Name ……

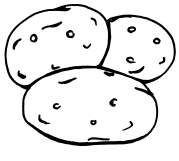
Exercise 1 - Fill in the missing words in the passage below.

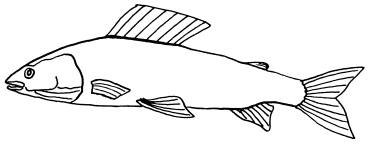
In order to stay ..... the body needs seven main chemicals which are called food ..... These are carbohydrates, proteins, ..., minerals, vitamins, fibre and water. A balanced diet contains the ..... amounts of all seven food types. Carbohydrates are sugars and ..... Carbohydrates give us energy quickly. Fats also give us ..... but they release it much more slowly. Stored fat under the skin also helps us to keep ..... We need ..... to help us grow and to repair damaged parts. Minerals and ..... are needed in smaller amounts to keep the body healthy. Fibre helps to keep the food moving along the .....

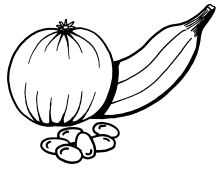
intestines types fats warm correct protein starch healthy energy vitamins

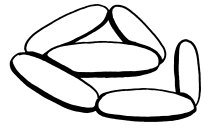
Food type	Foods rich in this
Carbohydrate	Starchy and sugary foods, e.g. potato, bread, cereals and cakes.
Protein	Meat, fish, eggs, cheese, milk and nuts.
Fat	Vegetable oils, butter, lard, cream, cheese and some meats.
Vitamins	Fresh fruit and vegetables.
Minerals	A wide range of foods, e.g. iron from meat and calcium from milk.
Fibre	Cereals, fruit and vegetables.

Exercise 2 – Write down the main FOOD TYPES that each of the foods below contain.

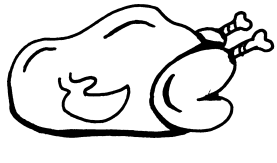








_____ _____ _____ _____



_____ _____ _____ _____

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W.S.6. Food and digestion.

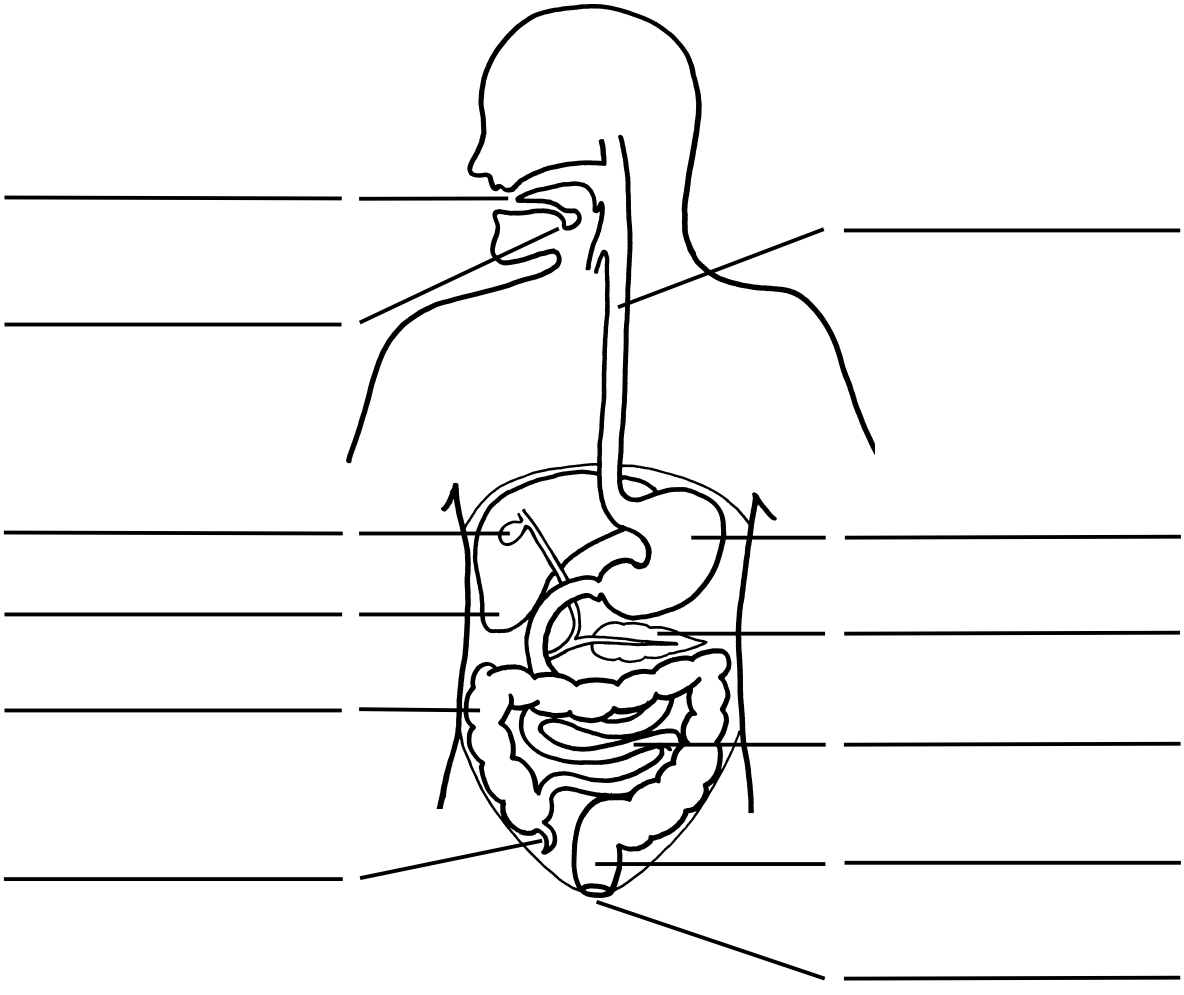
Name ……

Exercise 1 - Fill in the missing words in the passage below.

The body needs food for a number of reasons. We need food for growth and to …… worn out or damaged parts. We also get …… from food. Energy is used for movement, producing …… and to keep all of the parts working properly. Before the body …… can use the food we eat it must pass into the blood. The food is broken down into very small soluble molecules by the …… system. These molecules then pass through the walls of the …… and into the blood.

intestines heat repair cells digestive energy

Exercise 2 - Study the diagram below of the human digestive system and then carefully add the labels by choosing from the list at the bottom of this page



tongue salivary gland liver gall bladder small intestine gullet pancreas stomach large intestine appendix rectum anus

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W.S.7. Stages of digestion.

Name ……

Food is slowly broken down by our digestive system. It is broken up by chewing in the mouth and by churning of the stomach muscles. Special chemicals called ENZYMES break up large food molecules into smaller ones. These molecules then slowly seep out into the blood through tiny pores in the walls of the small intestines. Any undigested food enters the large intestine where water is absorbed back into the blood. The solid waste is then passed out of the body.

What to do

This table gives descriptions of organs in the human digestive system. Read each description and then write down the name of each organ in the left hand column. Use the words at the bottom of this page.

Organ	Description
	Here the food is chewed and moistened with saliva. The food is shaped into a round ball before it is swallowed.
	This is a tube that squeezes the food down to the stomach.
	This is a bag that churns up the food. It contains gastric juice and hydrochloric acid. Gastric juice contains an enzyme that digests protein. The acid kills germs.
	This is a very long tube that the food passes into after it leaves the stomach. Here the food is completely digested and then it is absorbed through the walls and into the blood stream.
	This is a small leaf-shaped organ. It makes pancreatic juice which passes into the small intestine. This juice contains an alkali that helps to neutralise the acid from the stomach. It also contains several enzymes.
	This organ makes a chemical called BILE which is stored in a small bag called the GALL BLADDER. The bile is squeezed into the small intestine where it helps to break up large pieces of fat.
	This is a wide tube that the undigested food passes through. Water is absorbed from this back into the body.
	This organ has no function in humans but it helps with digestion of plant material in herbivores such as sheep. It sometimes becomes infected in humans and then it must be removed.
	The dried out waste food material is stored here until it is ready to be passed out of the body through the anus.

Organs.

liver small intestine gullet pancreas stomach large intestine appendix mouth rectum.

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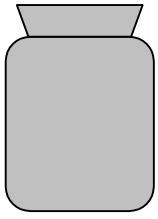
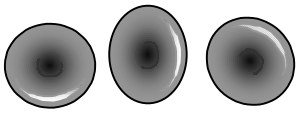
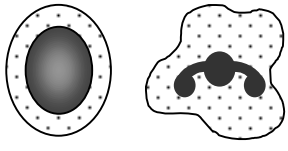
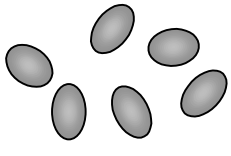
W.S.8. **Blood.** Name ……

The blood transports (carries) substances around the body. The table below shows what the blood is made of and what each part does.

Part of blood	*What it does*
PLASMA 	This is a pale yellow liquid in which the blood cells float. It carries: • waste carbon dioxide from the cells to the lungs; • dissolved food to the cells; • waste urea from the liver to the kidneys; • hormones from one part of the body to another.
RED CELLS 	They do not have a nucleus and there are lots of them. They carry oxygen from the lungs to the cells.
WHITE CELLS 	They do have a nucleus. They fight against germs that enter the blood.
PLATELETS 	These are small pieces of cells. They do not have a nucleus. They help blood to clot if the skin is cut.

Exercise - Fill in the missing words in the passage below.

Blood is made of a pale yellow liquid called ..... and two different types of blood cell, white blood cells and ..... blood cells. Most of the chemicals in the blood are ..... in the plasma. ..... is carried by the red blood cells. The white blood cells help to destroy any ..... (bacteria and viruses) which may enter the body. There are also tiny pieces of cells in the blood called ..... These help to clot the blood if the skin is ..... If we could not make ..... we would be in danger of bleeding to death from even the smallest of cuts.

plasma cut scabs red dissolved germs oxygen platelets

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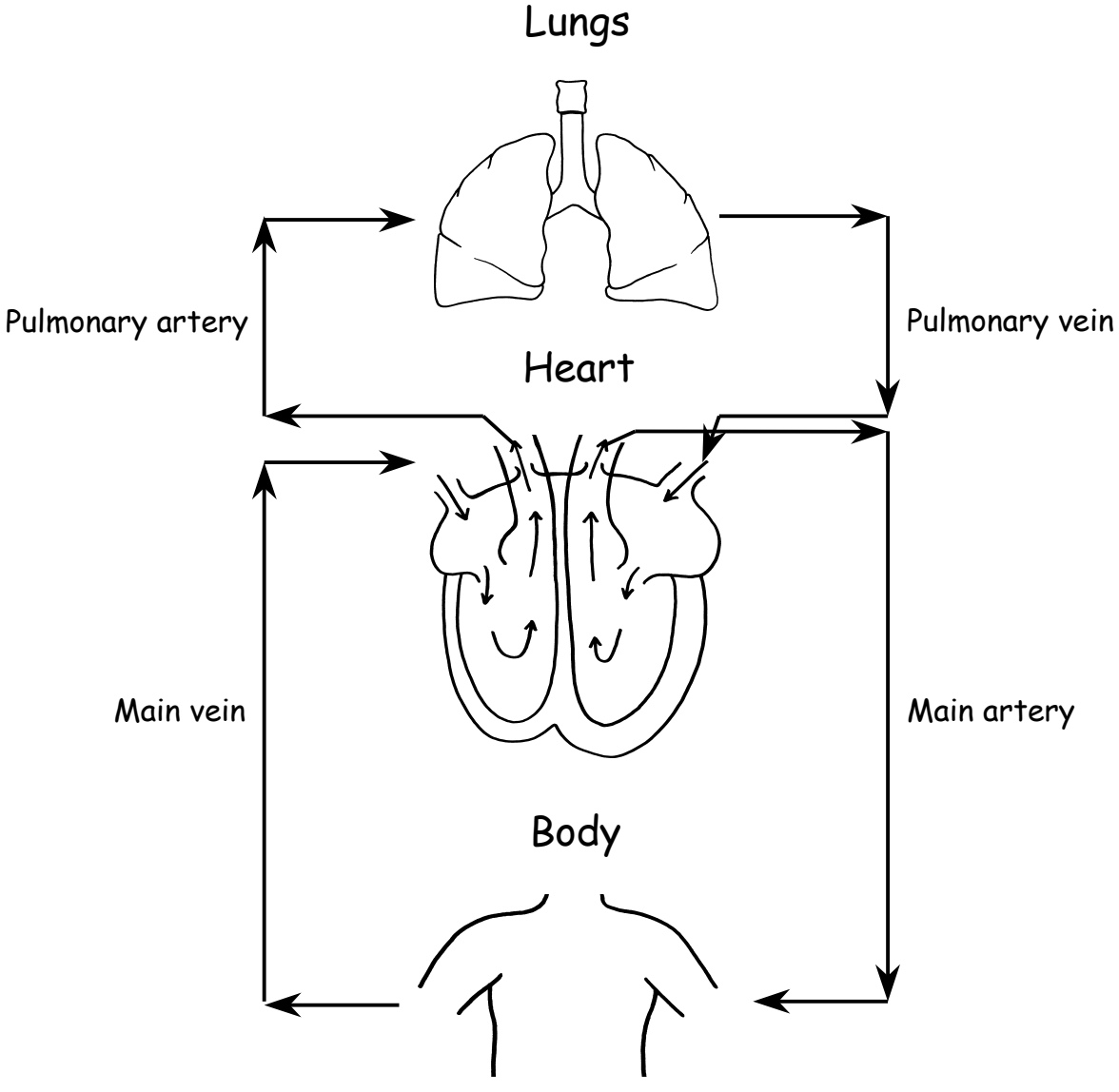
W.S.9. **The blood system.** Name ……

The heart pumps the blood around the body. It travels inside tubes called blood vessels. Look at the diagram below and then try to complete the sentences at the bottom of this page.



Exercise - Complete the sentences below.

1) The blood travels around the body inside tubes called blood ……..
2) The three types of blood vessel are arteries, …….. and capillaries.
3) The heart is a …….. that squeezes blood into the arteries.
4) The veins carry the blood back to the ……..
5) The capillaries have very thin ……..
6) The capillaries give useful chemicals to the body ……..
7) The capillaries take …….. chemicals away from the body cells.

vessels pump heart waste veins walls cells

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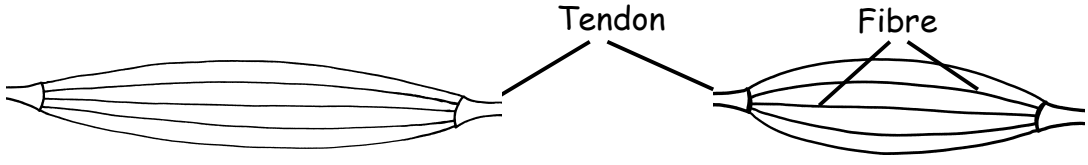
W.S.10. **Moving the body.** Name ……

In order to move the skeleton has JOINTS in between many of its parts. The movements are made by muscles which pull on the bones. Muscles CONTRACT (shorten) in order to pull. A muscle is made up of many thin fibres. Each fibre shortens when the muscle contracts.

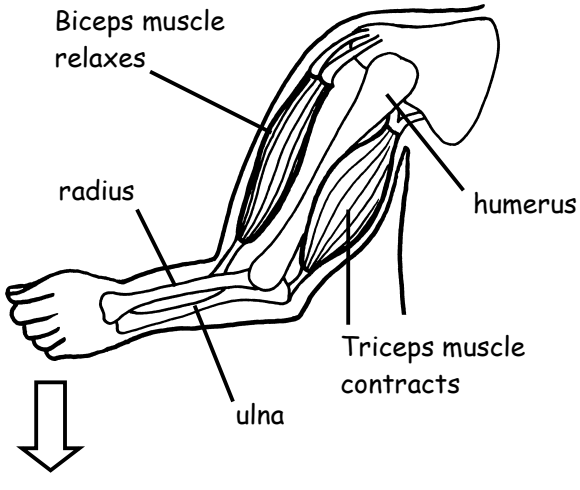


Relaxed muscle
Muscle fibres are resting and appear long and thin.

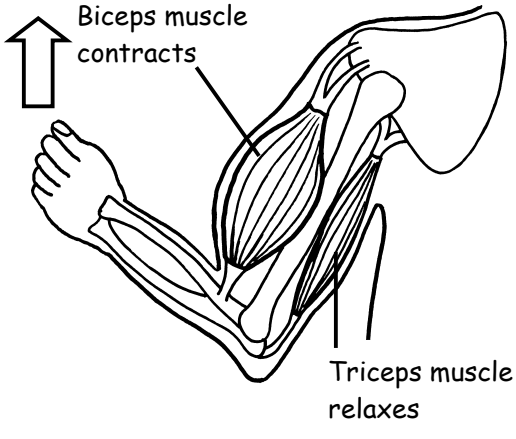
Contracted muscle
Each muscle fibre has shortened and thickened.

A muscle cannot push, it can only pull. This is why a pair of muscles are needed at a joint. One muscle pulls the joint in one direction and the other pulls the joint back.

Lowering arm



Raising arm



Exercise - Complete the sentences below.

1) A muscle is made up of many thin strands called ……..
2) When a muscle contracts each fibre ……..
3) Muscles are attached to bones by tough cords called ……..
4) Muscles can only pull they cannot ……..
5) Muscles work in …….. to move a joint in both directions.
6) If we wish to lift a weight our …….. contracts.
7) To lower the arm the biceps relaxes and the …….. contracts.

triceps shortens biceps fibres tendons push pairs

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W.S.11. Growing up.

Name ……

Puberty is the time when a child begins to change into an adult. In boys it begins between the ages of about 12-14 years. In girls it begins between the ages of about 11-13 years. Special chemicals called SEX HORMONES are released into the blood. These chemicals cause many of the changes that happen in the body. Emotional changes also happen at this time.

Changes in boys at puberty	Changes in girls at puberty
1) The testes begin to make sperms. 2) A hormone called TESTOSTERONE is produced by the testes. 3) The voice becomes deeper. 4) Hair grows on the face and body. 5) The body becomes more muscular. 6) Changes in attitude and behaviour.	1) The ovaries begin to produce ova. 2) A hormone called OESTROGEN is produced by the ovaries. 3) The monthly menstrual cycle starts. 4) Hair grows on parts of the body. 5) The hips widen. 6) The breasts begin to develop.

Exercise 1 - Fill in the missing words in the passage below.

All …… eventually grow up to be men and women. The time when the body is changing is called …… Changes happen all over the …… Emotional changes also happen at puberty and we feel …… to the opposite sex. A …… called testosterone is made by the testes in a boy and this causes some of the …… in his body. In a girl the ovaries make a hormone called …… which causes many of the changes in her body.

body changes oestrogen hormone puberty children attracted

Exercise 2 - In the table below there is a list of changes which happen at puberty. Tick the right hand columns to show which changes happen to boys, girls or both.

Changes at puberty	Boys	Girls
The breasts grow larger.		
The body becomes more muscular.		
The monthly periods start.		
The voice becomes deeper.		
Hair grows around the sex organs.		
The hair and skin become more greasy.		
Sperms are produced.		
Ova are produced.		
Feel attracted to the opposite sex.		

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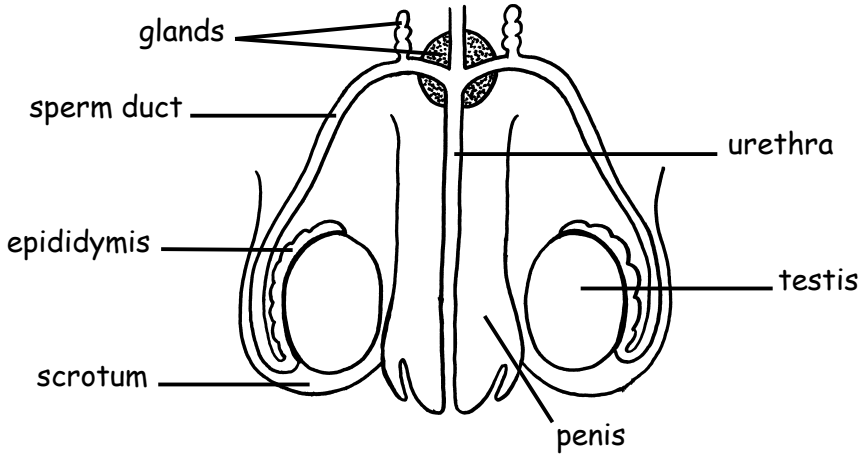
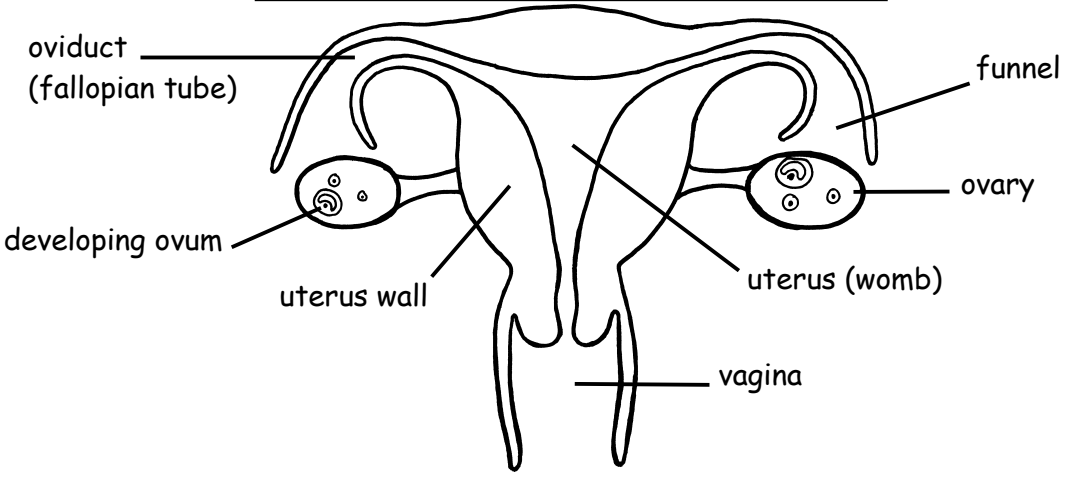
W.S.12. **The human reproductive system.** Name ……

The diagrams below show the male and female reproductive systems.

The male reproductive system



The female reproductive system



Exercise - fill in the missing words in the passage below.

In the man the testes make the …… cells. The sperms are stored in a coiled …… called the epididymis. The …… becomes erect during sexual intercourse. The sperms are carried through a long tube called the sperm …… to the top of the penis. Here glands make fluids that help the sperms to …… The urethra is a tube that carries sperms and …… out of the body.

In the woman the ovaries make the …… (egg cells). One ovum is produced every …… The ovum is carried along the …… (fallopian tubes) down to the uterus (womb). The placenta grows in the uterus wall during pregnancy. This gives the developing baby …… and oxygen.

duct urine ova food sperm tube month swim oviducts penis

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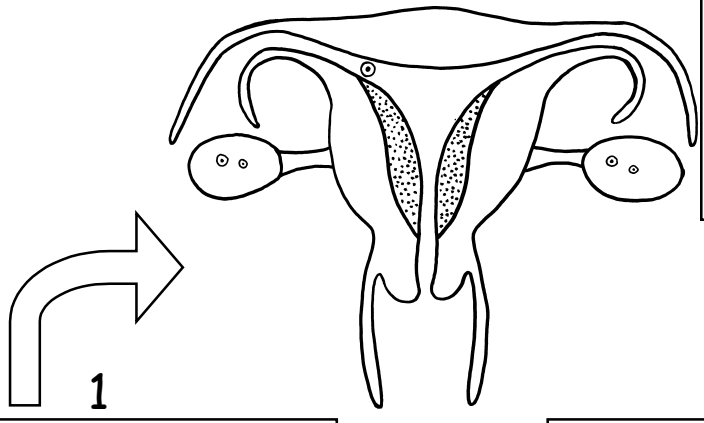
W.S.13. The menstrual cycle.

Name ……

Once every month a woman's body releases an ovum (egg cell) into the oviduct (fallopian tubes). Usually the ovum is not fertilised and it dies. The woman has her period when the lining of the uterus breaks down and blood and dead cells pass out through the vagina. The diagram below shows what happens during a woman's monthly cycle.

2

During the week after ovulation the lining of the uterus becomes thicker as many blood capillaries grow in it. This prepares the uterus to feed the fertilised ovum.

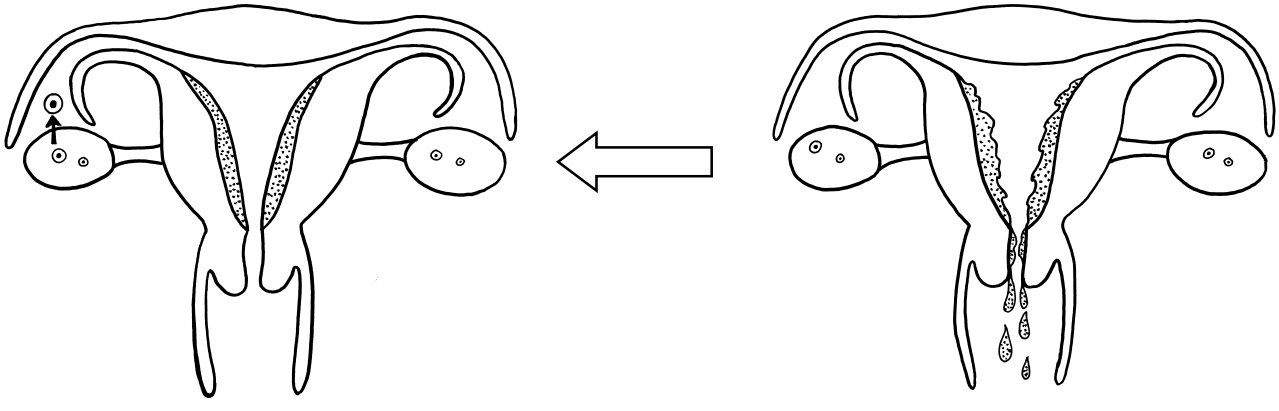


1

During the first 2 weeks the ovum develops inside the ovary and the uterus lining repairs itself. On about day 14 OVULATION happens.

3

If the ovum is not fertilised the thick uterus lining breaks down about 14 days after ovulation. Blood and dead cells pass out through the vagina.



Exercise - Complete the sentences below.

1) Only one ovum is released every _ _ _ _ _

2) The release of an ovum from the ovary is called _ _ _ _ _ _ _ _ _

3) Ovulation happens after about ____ days.

4) The uterus lining _ _ _ _ _ the fertilised ovum.

5) If the ovum is not fertilised it will _ _ _

6) A woman has her period when the _ _ _ _ _ _ lining breaks down.

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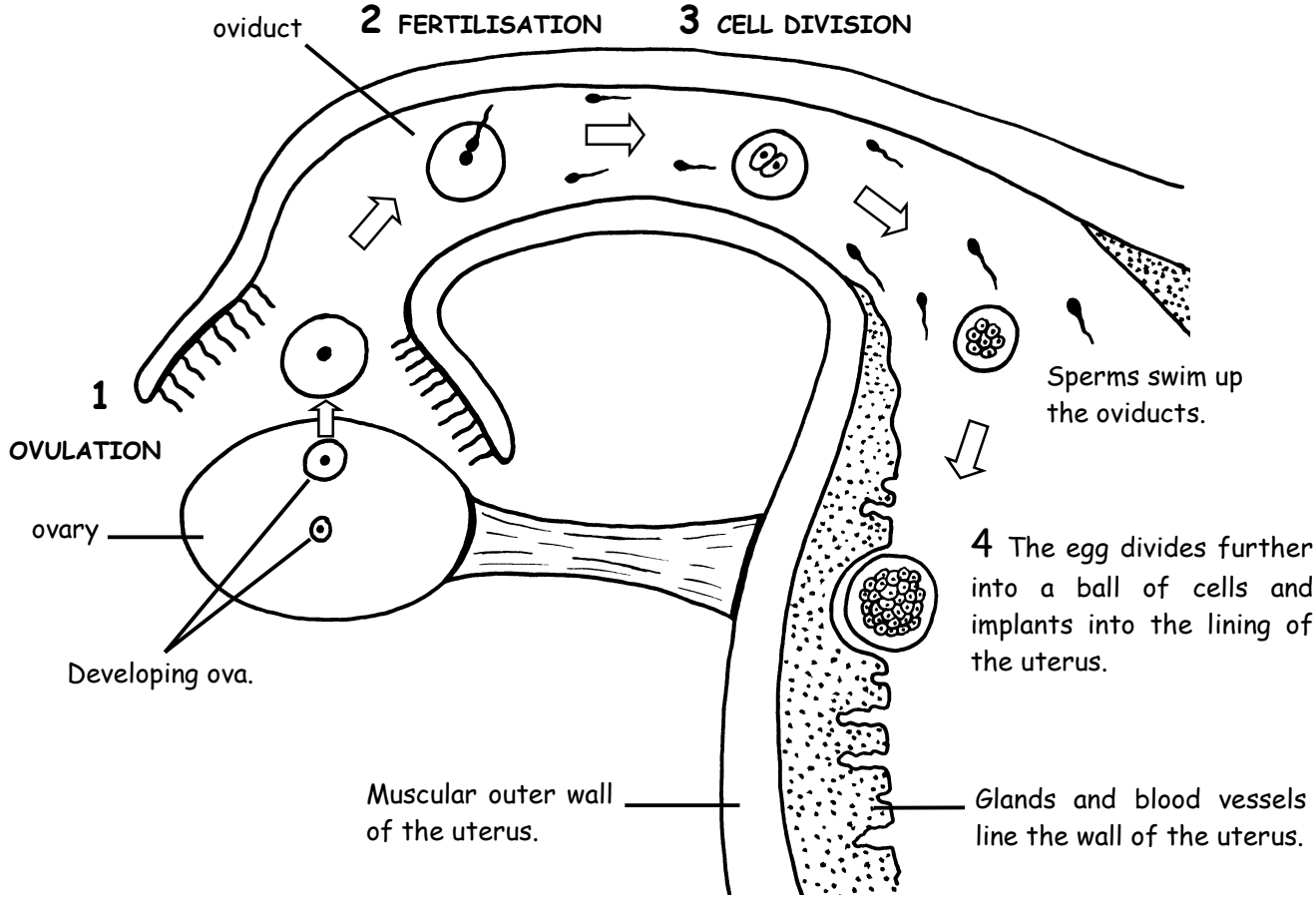
W.S.14. Ovulation and fertilisation. Name ……

Every month an ovum (egg cell) is released from an ovary into the oviduct. This is called OVULATION. If there are sperm cells in the oviduct the ovum may join with one of them. This is called FERTILISATION. The fertilised ovum then travels down to the uterus where it grows into a baby. The diagram below shows what happens to the ovum after it is released from the ovary if it is fertilised.



Exercise – Complete the sentences below.

1) O _ _ _ _ _ _ _ _ means when the ovum is released from the ovary.

2) The joining of the ovum and sperm is called F _ _ _ _ _ _ _ _ _ _ _ _ _

3) Fertilisation usually happens in the O _ _ _ _ _ _

4) After fertilisation the egg begins to D _ _ _ _ _

5) The egg develops into a ball of C _ _ _ _

6) The baby develops in the U _ _ _ _ _

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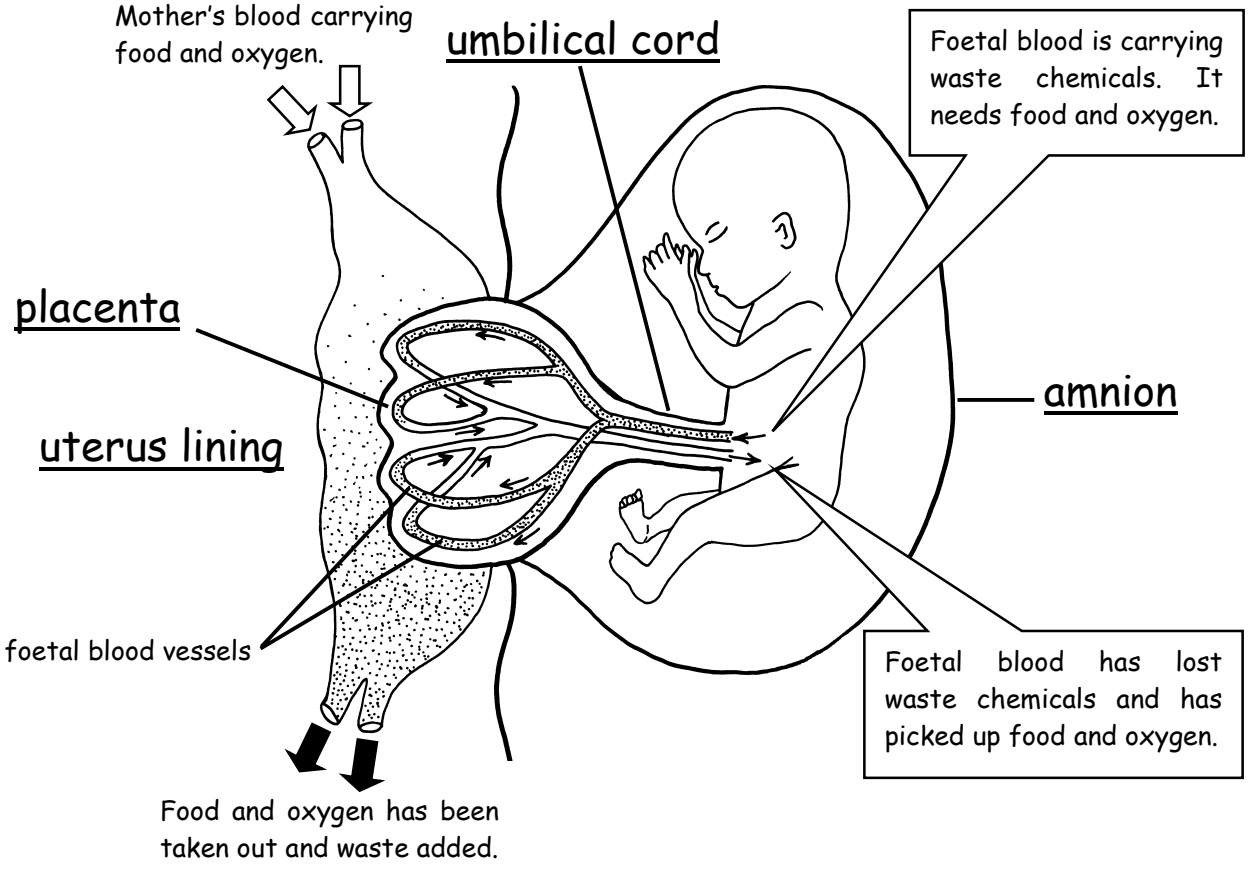
W.S.15. The developing baby.

Name ……

When the baby starts to grow inside the uterus it is called an EMBRYO. By the time it reaches 9 weeks old it looks like a tiny human being and it is then called a FOETUS. The PLACENTA is a special organ that develops in the wall of the uterus. It gives the baby food and oxygen. The placenta also removes waste chemicals such as carbon dioxide and urea from the baby. The baby is attached to the placenta by the UMBILICAL CORD. This contains blood vessels that carry chemicals to and from the baby. The diagram below shows how this happens.



Exercise – Complete the sentences below.

1) When the baby reaches 9 weeks old it is called a _ _ _ _ _ _

2) The baby is surrounded by a bag of fluid called the _ _ _ _ _ _

3) The amnion _ _ _ _ _ _ _ _ the baby if the mother is knocked.

4) The placenta gives the baby food and _ _ _ _ _ _

5) The palcenta takes _ _ _ _ _ chemicals away from the baby.

6) The U _ _ _ _ _ _ _ _ C _ _ _ attaches the baby to the placenta.

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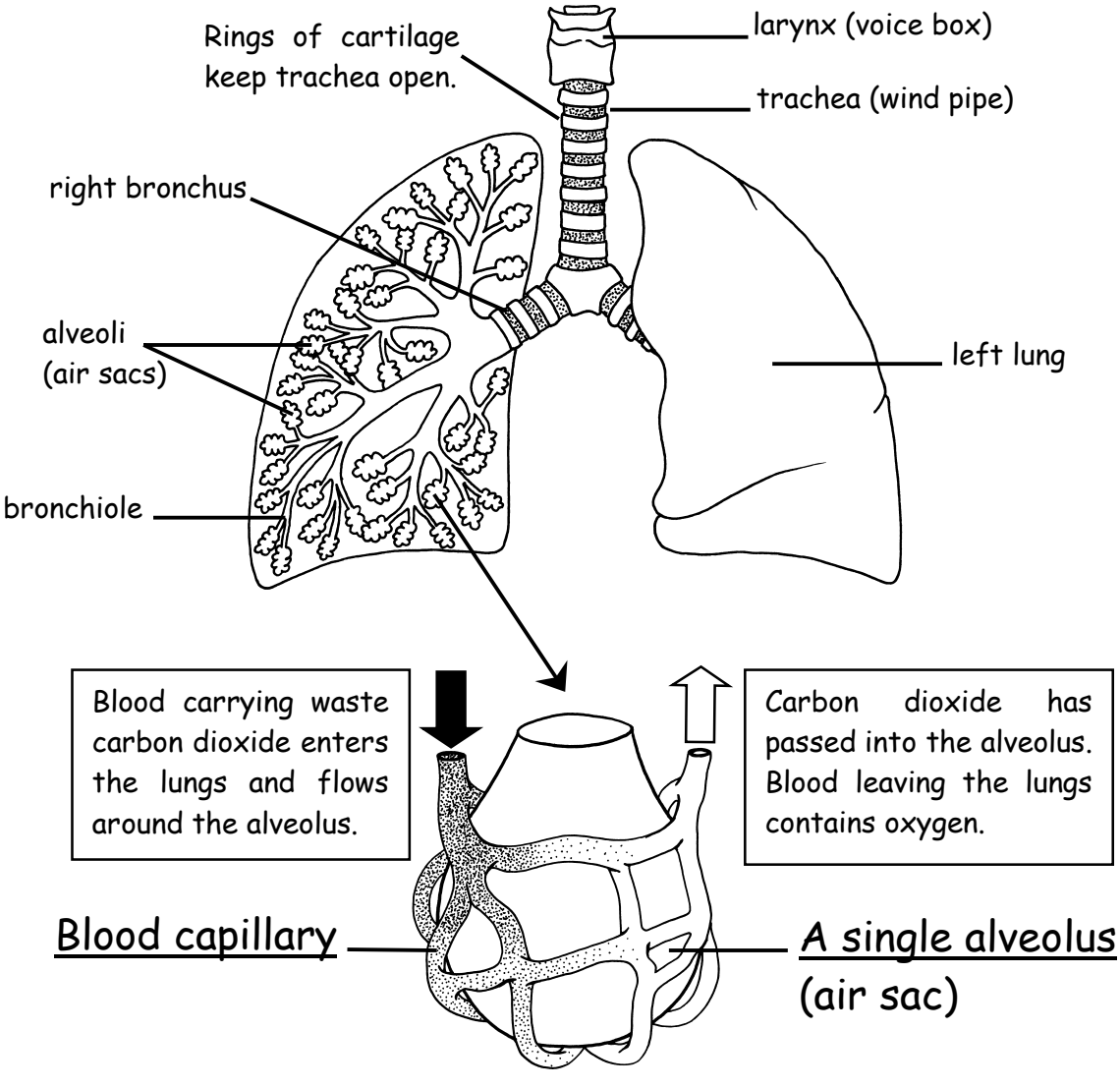
W.S.16. **Breathing (1).** Name ……

Our lungs absorb oxygen from the air. They also excrete waste carbon dioxide gas when we breathe out. The diagram below shows the structure of the lungs.



Exercise - Fill in the missing words in the passage below.

The lungs absorb …… gas and excrete waste carbon dioxide. The air is drawn in through the …… (windpipe) which is kept open at all times by rings of a bony material called …… The trachea divides into the right and left …… which branch out into narrower tubes called bronchioles. The bronchioles end in tiny air sacs called …… The alveoli have very thin walls and are surrounded by …… Here oxygen is absorbed into the …… and carbon dioxide passes into the alveoli.

trachea oxygen capillaries cartilage bronchus alveoli blood

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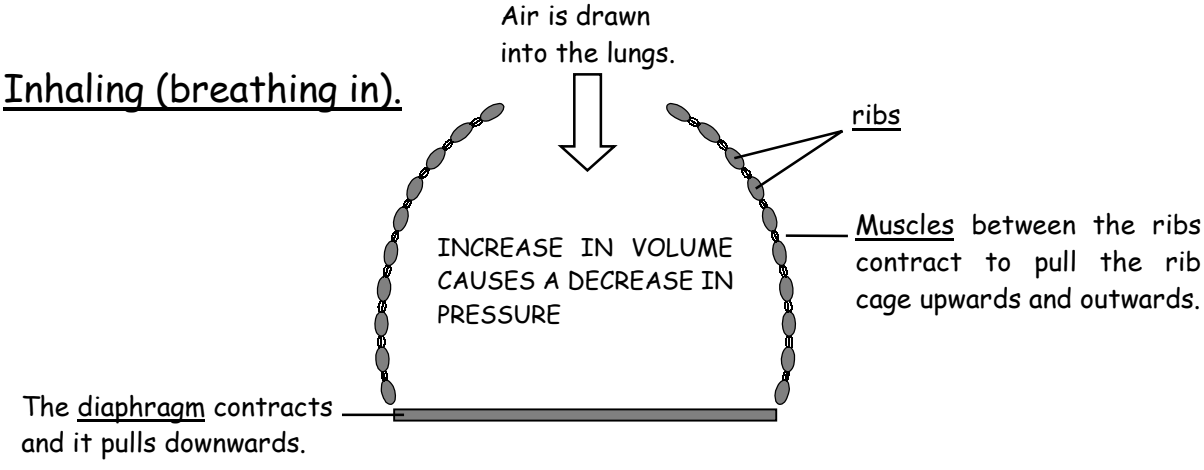
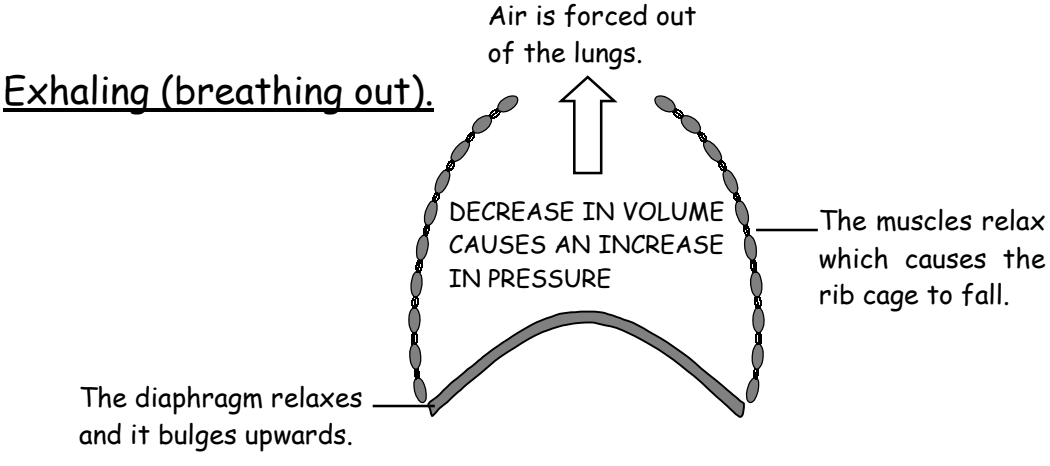
W.S.17. **Breathing (2).** Name ……

The lungs are in the chest. They are separated from the lower part of the body by a sheet of muscle called the diaphragm. The diagrams below show how we **inhale** (breathe in) and **exhale** (breathe out).

Inhaling (breathing in).



Exhaling (breathing out).



Exercise - Complete the sentences below.

1) The diaphragm is a sheet of M _ _ _ _ _

2) The word I _ _ _ _ _ means to breathe in.

3) The word E _ _ _ _ _ means to breathe out.

4) The diaphragm and rib muscles both C _ _ _ _ _ _ _ during inhaling.

5) The V _ _ _ _ _ of the chest increases when we inhale.

6) Air is drawn into the lungs due to a D _ _ _ _ _ _ _ in pressure.

7) The diaphragm and rib muscles both R _ _ _ _ during exhaling.

8) Air is forced out of the lungs due to an I _ _ _ _ _ _ _ in pressure.

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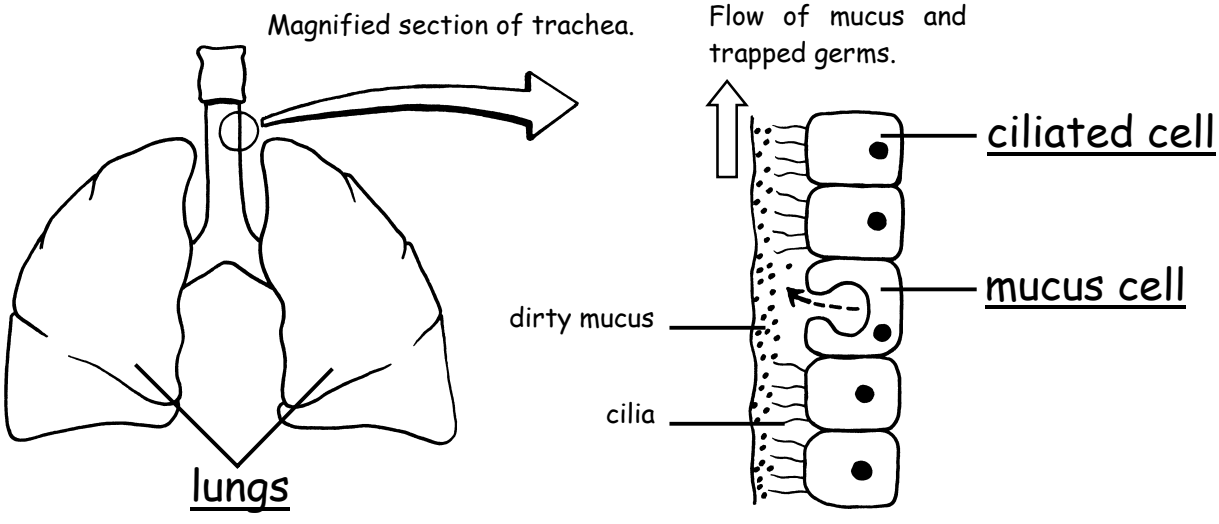
W.S.18. Keeping the lungs clean. Name ……

Your nose, trachea (wind pipe) and the air tubes inside the lungs are lined with special cleaning cells and a thick, sticky liquid called MUCUS. This traps dirt and germs in the air you breathe. The cleaning cells have tiny hairs called CILIA on their surface. These hairs waft the dirty mucus up to your throat where it is swallowed. Any germs are killed by the acid in the stomach. The diagram below shows how this cleaning system works.



The effects of smoking on the lungs.

Cigarette smoke stops the cilia beating and then dirty mucus builds up in the air tubes. This can lead to chest infections and people who smoke often develop a nasty cough. The air tubes can become swollen and sore. This is called BRONCHITIS. Cigarette smoke also contains a poisonous gas called carbon monoxide which stops the blood carrying as much oxygen around the body. Cigarette smoke also contains tar which collects in the lungs. Tar contains many chemicals that cause cancer.

Exercise - Complete the sentences below.

1) Dirt and germs in the air you breathe are trapped by M _ _ _ _

2) Ciliated cells have tiny H _ _ _ _ to waft up the dirty mucus.

3) Any germs that are swallowed are killed by the A _ _ _ in the stomach.

4) Cigarette smoke stops the cilia B _ _ _ _ _ _

5) A smoker may have less O _ _ _ _ _ in their blood.

6) Tar from cigarette smoke causes C _ _ _ _ _

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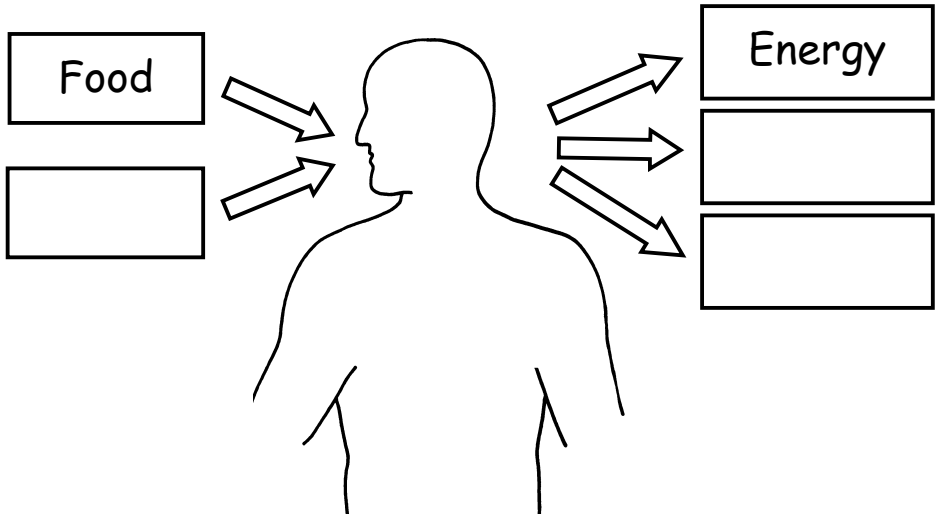
W.S.19. **Respiration.** Name ……

We need energy for movement, warmth and to keep all of the body parts working. We get our energy by reacting glucose and oxygen together in our cells. This chemical reaction is called RESPIRATION and it can be shown with a word equation.

FOOD + OXYGEN ⟹ ENERGY + WATER + CARBON DIOXIDE

Respiration is similar to burning food but it releases the energy much more slowly inside our cells.

Exercise 1 - Complete the missing labels on the diagram below.



Exercise 2 - Complete the sentences below.

1) Respiration produces useful _ _ _ _ _ _ in the cells.

2) We need energy to _ _ _ _ and to keep warm.

3) The main food substance that is used in respiration is _ _ _ _ _ _ _

4) _ _ _ _ _ _ _ is a similar process to respiration but it happens much more quickly.

5) The waste gas produced by respiration is C _ _ _ _ _ D _ _ _ _ _ _

6) We get rid of carbon dioxide by _ _ _ _ _ _ _ _ _ it out.

7) If plants did not make _ _ _ _ _ _ gas we would soon use it all up.

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W.S.20. Drugs and health.

Name ……

Drugs affect the way the body works. Some drugs are used by doctors to treat sick people. These can be very useful but they must be taken in the correct amounts. It is illegal (against the law) to take certain drugs because they are so dangerous to health. Even legal drugs such as alcohol can be very harmful if too much is taken. Some drugs are ADDICTIVE. This means that a person can become dependent on them and if they do not have the drug they may develop WITHDRAWAL SYMPTOMS such as shaking and sickness. The table below gives information about the effects of various drugs on health.

Type of drug	How it affects the body
Alcohol	Alcohol slows down the speed at which the brain and nervous system works. A little alcohol makes people feel happy and relaxed. More alcohol makes a person feel dizzy and affects their judgement. Large amounts may make a person unconscious and they may even die. An alcoholic is a person who is addicted to alcohol. Heavy drinking over several years causes damage to the brain, liver, and heart.
Tobacco	Tobacco smoke is very poisonous. A person can become addicted to smoking because of a chemical called nicotine in the smoke. Smoking causes cancers, heart disease, bronchitis, and damaged lungs. Smoking also makes a person short of breath and more tense.
Cannabis	Cannabis or 'pot' causes hallucinations. This is when a person thinks that they are seeing or hearing something that does not exist. They can then become confused and do dangerous things and may have a fatal accident.
Solvents	Some people like to breathe in the fumes from substances such as glue and paint (glue sniffing). This makes them feel dizzy and they may have hallucinations. The fumes get into the blood and damage the heart. Many people have died as a result of breathing in solvents.

Exercise – Fill in the missing words in the passage below.

An ..... is a person who has become dependent on a certain drug. It is very dangerous to drink alcohol and then drive because the ..... are slowed down. An ..... is a person who is addicted to alcohol. They may damage their brain, ... and heart. People who smoke are usually more tense and ..... as a result of the nicotine in their blood. The risk of developing ..... cancer is much greater in smokers. Drugs such as cannabis make a person ..... This can make them behave ..... The fumes from ..... may damage the heart and even cause death.

hallucinate addict reactions liver lung nervous dangerously solvents alcoholic

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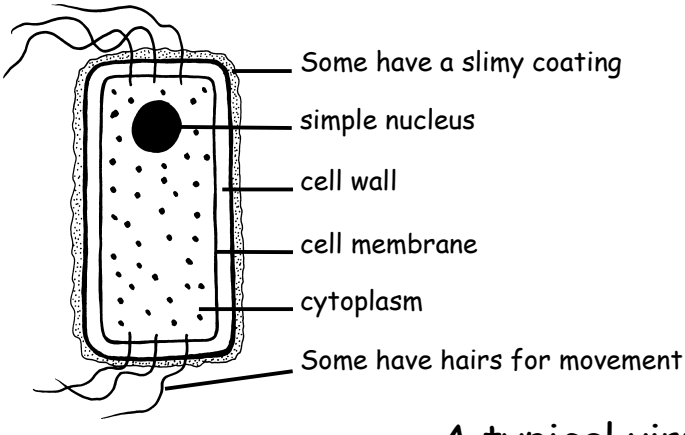
W.S.21. Germs and health.

Name ……

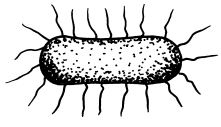
Germs are MICROBES that can live inside our bodies. The two main types of germ are BACTERIA and VIRUSES. Only some types of bacteria are germs. They cause us harm by attacking our cells or by producing waste poisonous chemicals. Viruses are much smaller than bacteria and they can only exist inside living cells. A virus injects its DNA (instructions) into a cell. The virus DNA tells the cell to make more viruses. The cell then bursts open to release the new viruses.

A typical bacterium



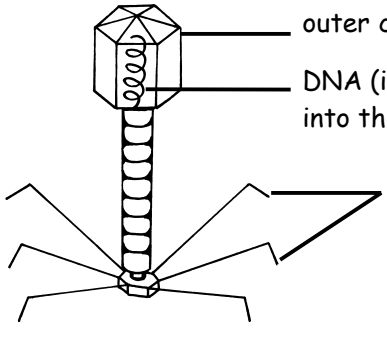
Types of bacteria

COCCI (round)
e.g. cause sore throat.



BACILLI (rod)
e.g. cause typhoid.

A typical virus



Exercise – Complete the sentences below.

1) Germs are microbes that live _ _ _ _ _ _ our bodies.

2) Bacteria and viruses are too _ _ _ _ _ to see.

3) Bacteria may cause disease by attacking body _ _ _ _ _

4) Bacteria may produce _ _ _ _ _ _ _ _ _ waste chemicals.

5) _ _ _ _ _ _ _ are much smaller than bacteria.

6) Viruses can only live and multiply inside _ _ _ _ _ _ cells.

7) A virus injects its _ _ _ into the cell it is attacking.

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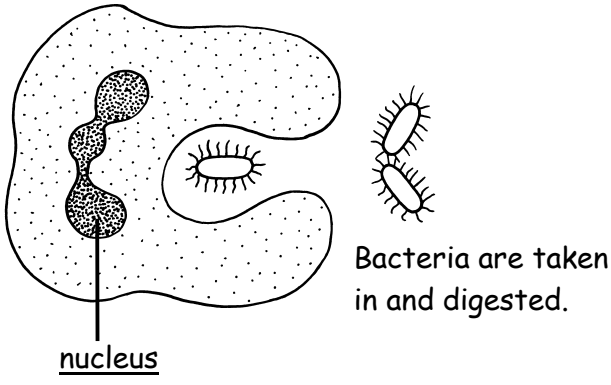
W.S.22. **Fighting germs.** Name ……

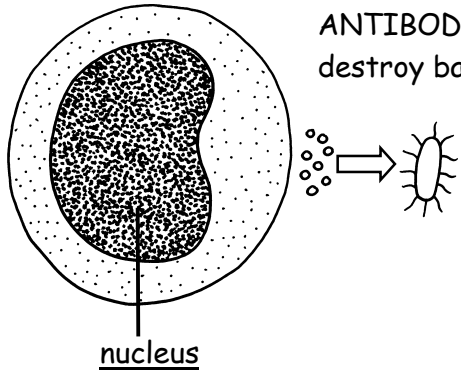
There are huge numbers of microbes in the air, soil and water. Some of these are germs. Therefore our bodies need a defence system. The skin helps to stop germs entering the body. The breathing system is lined with a sticky liquid called mucus which traps the dirt and germs that we breathe in. Tiny hairs called CILIA gradually waft the dirty mucus up to the throat where it is swallowed. The germs are then killed by hydrochloric acid in the stomach. Germs sometimes get into the bloodstream through wounds. If this happens white blood cells attack them. The diagrams below show how they do this.

Phagocyte



Lymphocyte

The lymphocte sends out chemicals called ANTIBODIES to destroy bacteria.



Exercise - Complete the missing words in the passage below.

Most microbes are ..... but some are germs that can live inside our bodies. The body needs to ..... itself from invading germs. The ..... forms a barrier that stops germs getting into the body. Any germs that are ..... in are trapped by sticky mucus in the nose, ... and lungs. Eventually dirty mucus is ..... and the hydrochloric acid inside the ..... destroys the germs. The two types of white blood cell that kill germs are ..... and lymphocytes. Phagocytes ..... germs and lymphocytes make .....

A ..... contains dead or harmless germs. It allows antibodies to build up in the body. ..... are chemicals that can also be used to help us fight germs.

defend phagocytes medicines harmless skin antibodies eat breathed trachea vaccine stomach swallowed

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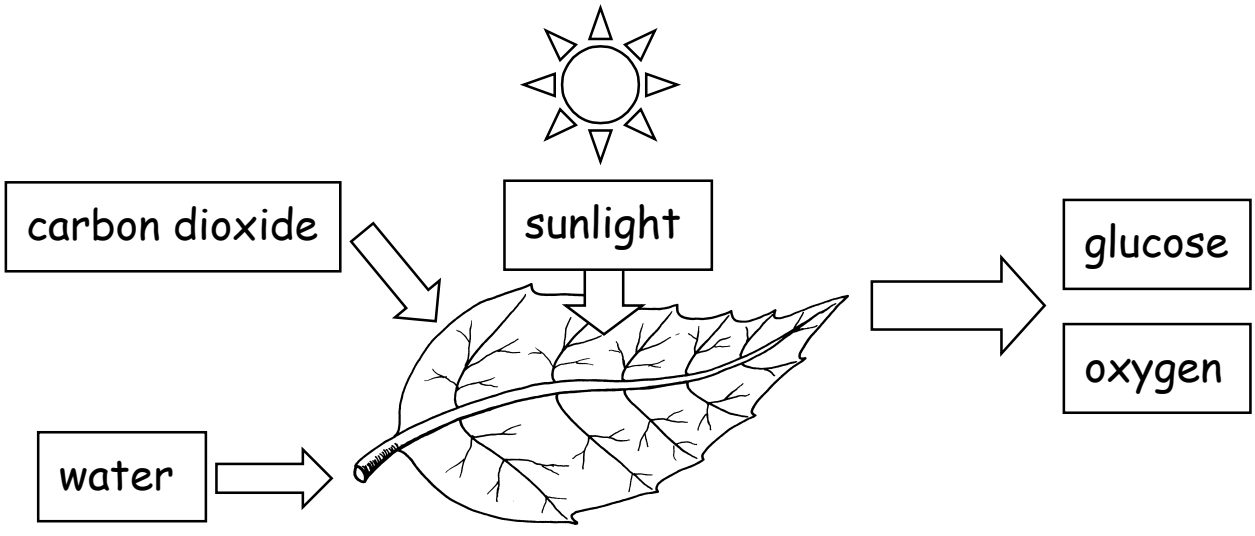
W.S.23. **Photosynthesis.** Name ……

Animals feed on plants or other animals but most plants make their own food by using light energy and simple chemicals. This process is called PHOTOSYNTHESIS. Water and carbon dioxide molecules are joined together to make GLUCOSE sugar and waste oxygen gas. This happens in the leaf cells inside tiny discs called CHLOROPLASTS. The chloroplasts contain a green chemical called CHLOROPHYLL which absorbs light energy. The diagram below shows this process.



The glucose sugar that is made may be changed into other useful chemicals for growth or storage. The plant also uses glucose as a fuel in RESPIRATION to release energy when it is needed in the cells. Respiration is the opposite process of photosynthesis :

FOOD + OXYGEN ⟹ CARBON DIOXIDE + WATER + ENERGY

Exercise - Complete the sentences below.

1) Animals can not make their own F _ _ _

2) Plants use L _ _ _ _ energy to help them make their food.

3) Photosynthesis happens in the L _ _ _ cells.

4) The gas needed for photosynthesis is C _ _ _ _ _ D _ _ _ _ _ _

5) C _ _ _ _ _ _ _ _ _ _ is the green chemical that absorbs light energy.

6) The opposite reaction to photosynthesis is R _ _ _ _ _ _ _ _ _ _

7) Plants give animals food and O _ _ _ _ _

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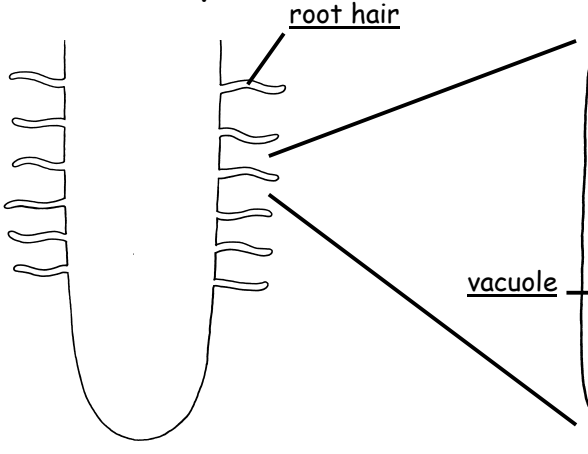
W.S.24. Plant nutrition.

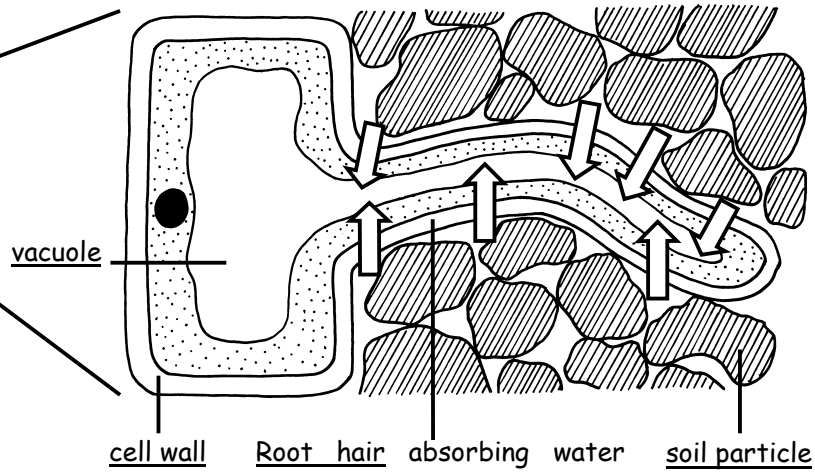
Name ……

Plants make glucose sugar by the process of photosynthesis. For healthy growth they also need to absorb mineral salts that are dissolved in the soil water. Mineral salts contain elements such as nitrogen, phosphorus and magnesium. Water and mineral salts are absorbed from the soil by the ROOT HAIR CELLS which cover the surface of the root. These cells greatly increase the surface area for absorption.

Root tip



A single root hair cell



Element	Why it is needed
Nitrogen	To make proteins for good growth.
Magnesium	To make the green chemical CHLOROPHYLL needed in photosynthesis.
Phosphorus	For good root growth.

Exercise - Complete the missing words in the passage below.

Certain chemical ..... are needed for healthy growth in plants. They are obtained from mineral salts ..... in the soil water. Root ..... cells absorb water and mineral salts which are then carried up the ..... to the leaves. The root hair cells greatly ..... the surface area of the root. If a plant does not have enough ..... it cannot make chlorophyll and its leaves turn yellow. If a plant does not have enough ..... it cannot make proteins and its growth is stunted. Phosphorus is needed for good ..... growth.

root elements hair magnesium nitrogen dissolved stem increase

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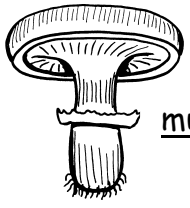
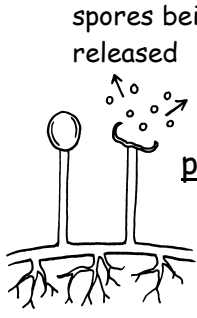
W.S.25. **Classification.** Name ……

All of the millions of species (types) of living things can be sorted into groups. This is called CLASSIFICATION. They are sorted into groups that have features in common.

Plants without flowers.

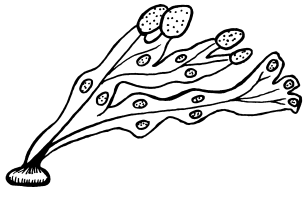
FUNGI
They do not contain the green chemical chlorophyll and so do not make their own food. Most feed on dead material and reproduce with tiny spores.


mushroom



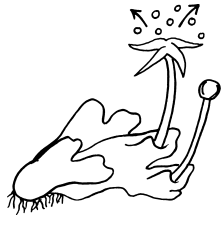
pin mould

ALGAE
They live in water and have no roots or leaves. They make their own food and can be green, brown or red.


seaweed

MOSSES AND LIVERWORTS
They have small, simple roots and leaves. They can only grow in damp places. They reproduce with spores.

moss

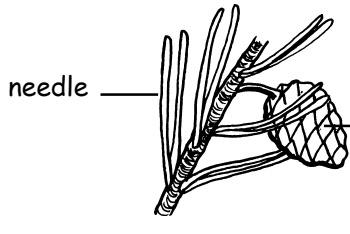

liverwort

FERNS AND HORSETAILS
They have well developed roots and stems. They usually grow in damp, shady places. They reproduce with spores.

fern

horsetail

CONIFERS
They are trees with tough, needle-shaped leaves. They do not have flowers and reproduce with cones.



Exercise - Fill in the missing words in the passage below.

Classification means sorting living things into …… Living things can be sorted into groups that have …… in common. Fungi are unusual plants because they do not contain green …… Algae have no …… or leaves. Fungi, mosses and ferns produce tiny …… for reproduction and conifers produce ……

spores groups features chlorophyll roots cones

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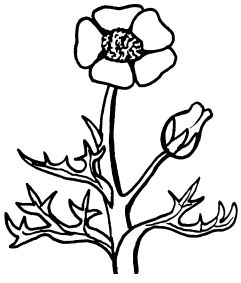
W.S.26. Flowering plants.

Name ……

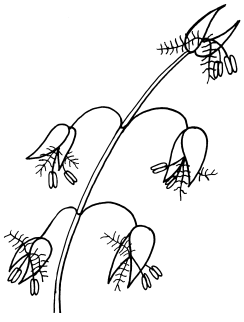
Flowers contain sex organs which produce seeds for reproduction. The male sex cells are inside the pollen grains. The female sex cells are called OVULES. Pollen grains are carried from one flower to another by insects or wind. This is called POLLINATION. The sex cells then join together. This is called FERTILISATION. The fertilised ovules develop into seeds.

buttercup – insect pollinated.



The flowers are colourful and scented to attract insects.

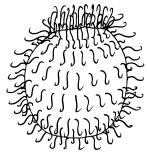
grass flowers – wind pollinated.



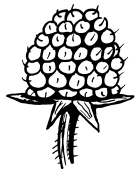
The flowers are light and feathery to catch the breeze.

When the flower dies the seeds are left inside a FRUIT. Fruits help to DISPERSE (spread out) the seeds. Three types of fruit are shown below.

Sycamore seeds have wings. They are dispersed by wind.



Burdock seeds have hooks that catch onto animals fur.



Blackberries are juicy but the seeds do not digest.

Exercise - Fill in the missing words in the passage below.

Flowers make ..... so that plants can reproduce. Pollination is when ..... is carried from one flower to another. Pollen can be carried by wind or ..... The insects visit the flower to drink the ..... Flowers are colourful and ..... to attract insects. Plants that use wind to pollinate their flowers are not brightly ..... They are light and feathery to catch the breeze.

Fertilisation is when the male and female sex cells ..... The fertilised ..... then develop into seeds. When the flower dies a ..... is left behind. Fruits help to ..... the seeds.

insects join pollen seeds ovules scented coloured nectar fruit disperse

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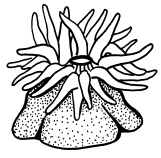
W.S.27. Animals without backbones (1). Name .....

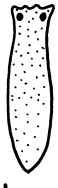
All animals can be sorted into two main groups. VERTEBRATES have a backbone and INVERTEBRATES do not. Read the information below about the groups of invertebrates with soft bodies.

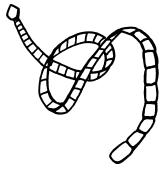
JELLYFISH AND ANEMONES
They live in the sea. They have a very simple body with tentacles. Some have sting cells.

jellyfish

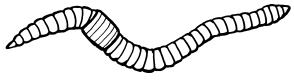

sea anemone

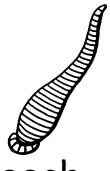
FLATWORMS
They have a long, flat body. Some live in freshwater. Some are parasites that live inside other animals.


flatworm

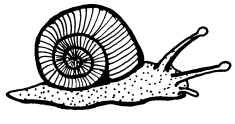

tapeworm

SEGMENTED WORMS
They have a long body divided by rings into segments. Most of them live in water or soil.


earthworm


leech

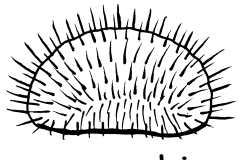
MOLLUSCS
They often have a shell for protection. Most of them live in water. Some have tentacles.


snail

squid

STARFISH AND SEA URCHINS
They all live in the sea. They have a thick skin which is sometimes covered in spines.

starfish


sea urchin

Exercise – Complete the sentences below.

1) Animals with a backbone are called _ _ _ _ _ _ _ _ _ _ _ _

2) Animals without a backbone are called _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

3) Jellyfish and sea anemones both have _ _ _ _ _ _ _ _ _ _

4) A _ _ _ _ _ _ _ _ is a flatworm that lives inside other animals.

5) An earthworm's body is divided into _ _ _ _ _ _ _ _

6) A _ _ _ _ _ is a mollusc that has a shell for protection.

7) Sea urchins are covered in _ _ _ _ _ _

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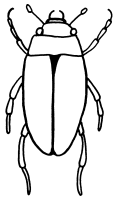
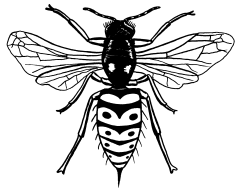
W.S.28. Animals without backbones (2). Name ……

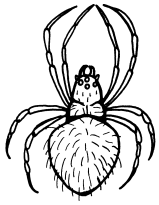
ARTHROPODS are invertebrates with a hard outer coating. They all have a segmented body with jointed legs. This is a very large group and it can be divided into the smaller groups shown below.

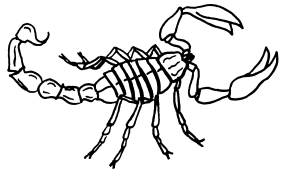
INSECTS
They have three parts to the body and six legs. The adults usually have four wings and a pair of antennae.


beetle

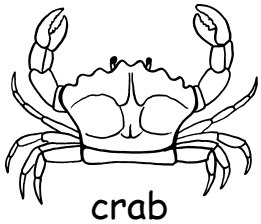

wasp

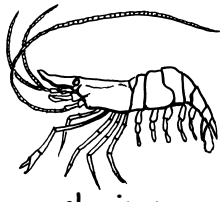
SPIDERS AND SCORPIONS
They have two parts to the body and eight legs. Spiders usually spin a web of silk and have poisonous fangs. Scorpions have a sting at the end of their tails.


spider

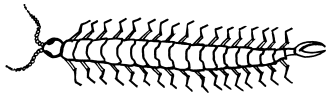

scorpion

CRUSTACEANS
Most of them live in water. They usually have a thick, hard coating. They have many legs and two pairs of antennae.


crab


shrimp

CENTIPEDES AND MILLIPEDES
They have long bodies made up of many segments. Centipedes have one pair of legs on each segment and millipedes have two.


centipede

millipede

Exercise – Complete the sentences below.

1) _ _ _ _ _ _ _ _ _ _ _ all have a hard outer coating.

2) A fly is an _ _ _ _ _ _

3) Insects usually have _ _ _ legs and _ _ _ _ wings.

4) Spiders have _ _ _ _ _ legs.

5) Scorpions have a _ _ _ _ _ at the end of their tails.

6) Crabs and _ _ _ _ _ _ _ are closely related.

7) The bodies of centipedes are made up of many _ _ _ _ _ _ _ _

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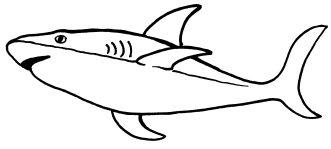
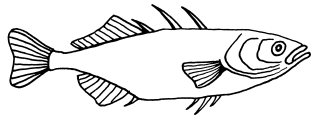
W.S.29. Animals with backbones.

Name ……

VERTEBRATES have a backbone and an inside skeleton. Read the information below about the groups of vertebrates.

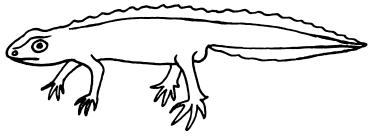
FISH
They live in water and have gills for breathing. They are covered with scales and have fins for swimming.


shark

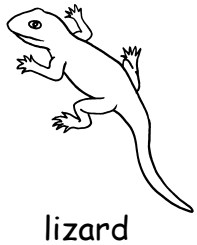

stickleback

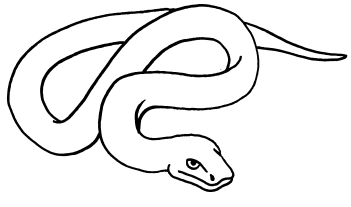
AMPHIBIANS
The tadpole (young) lives in water and has gills for breathing. The adult lives on land and has lungs. They have a damp skin without scales.

frog

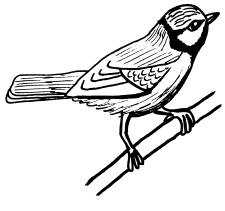

newt

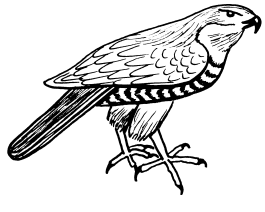
REPTILES
They have a dry, scaly, waterproof skin. Their eggs have a tough leathery shell and are laid on land.


lizard


snake

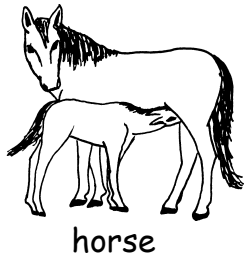
BIRDS
They are covered with feathers and have wings for flying. Their eggs have a hard shell. They have a beak for feeding. Their bodies are warm because they make heat inside.


blue tit


sparrowhawk

MAMMALS
They have hair and a warm body. The young develop inside the mother's body. After they are born the young feed on milk from the mother's body. Humans belong to this group.

wolf


horse

Exercise – Fill in the missing words in the passage below.

Fish live in water and have …… for breathing. Both fish and …… have a scaly skin. The young of …… live in water but the adults live on land. Amphibians have a …… skin. Both reptiles and …… lay eggs on land. Birds are covered with …… and have …… for flying. Birds and …… have a warm body. Mammals have …… and feed their young on ……

amphibians gills reptiles birds hair milk wings damp feathers mammals

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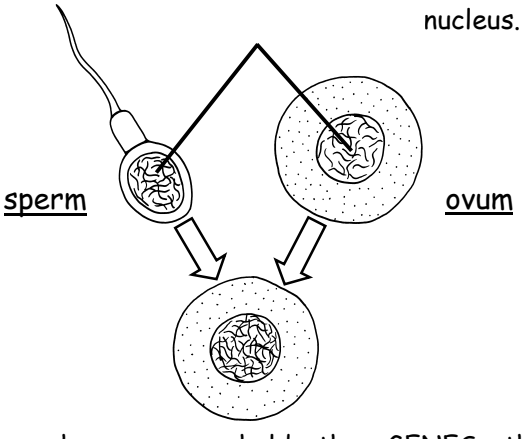
W.S.30. Variation.

Name ……

All animals and plants are different from each other. Even members of the same species (type) show small differences and no two humans are exactly alike. This is called VARIATION. Some features that vary which are easy to study in humans are height, mass, hair colour, eye colour and shoe size. CONTINUOUS VARIATION is when a feature shows many different types eg. height. DISCONTINUOUS VARIATION is when a feature only shows a few different types eg. human blood groups and whether a person can roll their tongue or not.
Variation is caused partly by different GENES (instructions) that individuals inherit from their parents and partly by different ENVIRONMENTS (surroundings) that individuals live in :

Genetic (inherited)



The chromosomes hold the GENES that control a person's features and how they develop. All sperms and ova contain a different set of genes therefore every person receives a different combination from their parents.

Environment (surroundings)

FOOD SUPPLY affects the growth rate of young animals. Two identical twins have the same genes but one may be heavier than the other due to eating more food. Plants also grow better in soil that has a good water and mineral supply.

CLIMATE affects how animals and plants develop. Some animals grow a thicker coat if their environment becomes colder. Plants usually grow faster in the sun than they do in the shade. A person's skin may become darker (tanned) if they are exposed to more sunlight.

Exercise - Complete the sentences below.

1) We are all different from each other. This is called V _ _ _ _ _ _ _ _

2) The two types of variation are C _ _ _ _ _ _ _ _ _ and discontinuous.

3) An example of continuous variation in humans is H _ _ _ _ _

4) We are all different, partly because of the G _ _ _ _ we inherited from our parents and partly because of our E _ _ _ _ _ _ _ _ _ _

5) Every sperm and O _ _ _ contains a different set of genes.

6) Food supply affects the G _ _ _ _ _ rate of young animals.

7) Plants will grow larger in soil that is rich in M _ _ _ _ _ _ _

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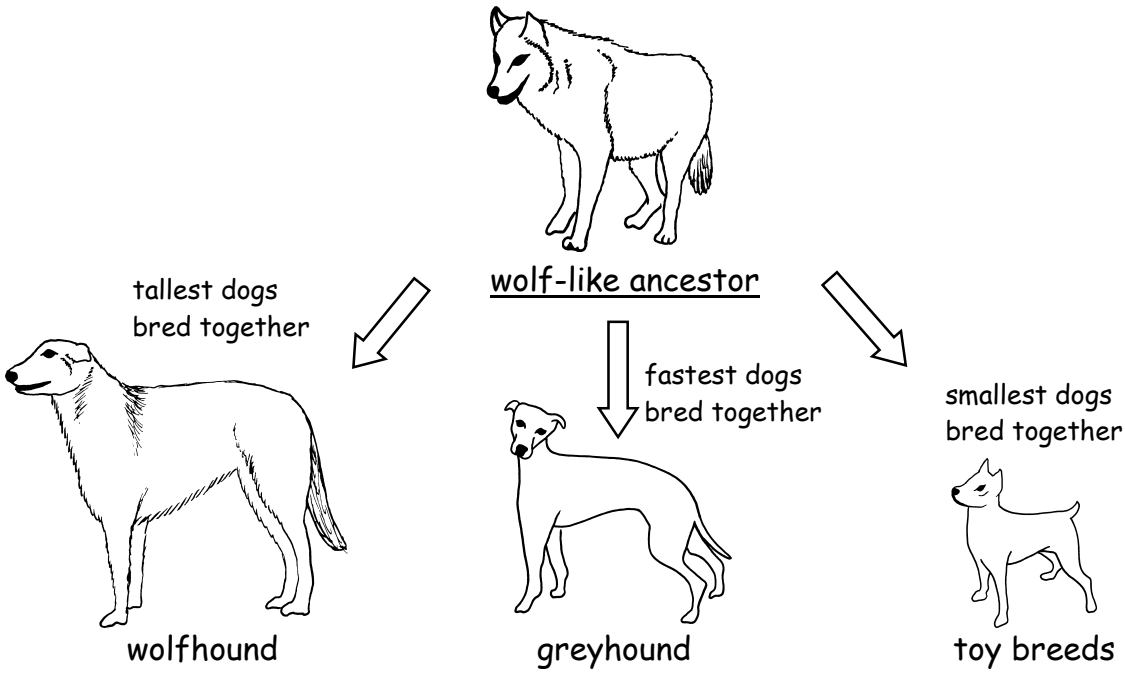
W.S.31. **Selective breeding.** Name ……

Humans have changed wild plants and animals by SELECTIVE BREEDING. This means picking out plants or animals that show the features that humans like. These are then bred together so that they pass on their features to the next generation. After many generations the plant or animal may look quite different to its wild ancestor. Dogs, cats, pigeons, rabbits, goldfish, farm animals and crops have all been produced in this way. Dog breeds have been developed from a wild wolf-like ancestor.



Scientists think that in nature all plants and animals have slowly changed over millions of years. This is called EVOLUTION. Those that are the best adapted to their environments (surroundings) have a better chance of surviving and passing on their features. Therefore nature is selecting which ones survive and breed. This idea is called NATURAL SELECTION.

Exercise – Complete the sentences below.

1) Humans have C _ _ _ _ _ _ animals and plants by selective breeding.

2) Only those that show the best F _ _ _ _ _ _ _ are allowed to breed.

3) Racing pigeons have been developed by selecting the F _ _ _ _ _ _ birds.

4) Wolfhounds have been developed by selecting the T _ _ _ _ _ _ dogs.

5) E _ _ _ _ _ _ _ _ means how plants and animals have slowly changed.

6) Natural S _ _ _ _ _ _ _ _ causes evolution.

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W.S.32. A place to live.

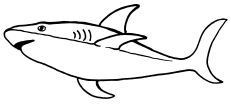
Name ……

The place where a plant or animal lives is called its HABITAT. All species have special features called ADAPTATIONS which help them to survive in their habitats. For example a polar bear has a thick coat of fur to protect it from the cold and a camel can store large amounts of water in its stomach. The table below shows some of the ENVIRONMENTAL CONDITIONS that are important for survival.

Environmental condition	Why it is important for survival
Temperature	This affects the chemical reactions inside the cells of living organisms. When it is cold organisms slow down.
Light	Plants need light to make food by photosynthesis. Animals need the food that plants make.
Water	Water is needed to dissolve chemicals for transport and so that chemical reactions can take place.
Oxygen	This is needed so that energy can be released inside the cells by respiration. There is plenty of oxygen in the air but it may be in short supply in water, soil or mud.

Exercise 1 – Join up the organisms below to their correct habitats.

shark

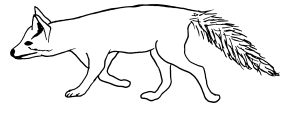


buttercup

newt

monkey

fox



meadow ocean woodland pond jungle

Exercise 2 – Complete the sentences below.

1) A _____ is the place where an organism lives.

2) An _____ is a special feature that helps an organism to survive.

3) An adaptation of a cactus is a thick _____ outer covering.

4) An organism's surroundings are called its _____

5) _____ is needed for chemical reactions to take place inside cells.

environment adaptation water habitat waterproof

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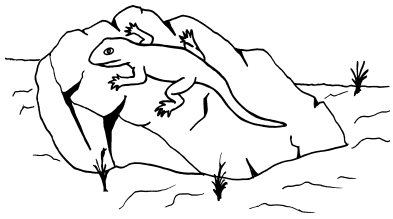
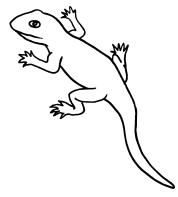
W.S.33. Changing habitats.

Name ……

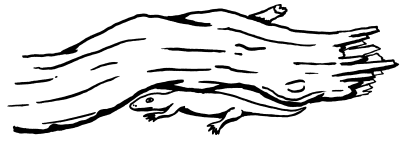
The conditions in a habitat are always changing from day to night and from one season to the next. Light and temperature increase after sunrise and usually reach a peak at midday. In dry deserts the days are very hot but the nights are cold. Lizards and snakes need to absorb heat from their surroundings to keep their bodies working quickly.



Early morning the lizard basks in the sun to warm its body so that it can move more quickly.



Later in the morning the lizard is very active and hunts for food.



At midday the temperature in the desert is too high and the lizard hides in the shade.

The lizard's behaviour is an adaptation to help it to survive. Many desert animals are NOCTURNAL (only active at night) when it is cooler.

The British winter is very cold and there is little food. Many animals grow a thicker fur coat to reduce heat loss. Some animals HIBERNATE. This is like a deep sleep. The body temperature falls and the heart and breathing almost stop. The body needs less energy and the animal can use its stored fat reserves over the winter.

Many birds MIGRATE during the winter months. This means that they fly to warmer countries where they can find enough food.

Exercise 1 – Write down the correct words beside their meanings.

Word	Meaning
_____	Only active at night.
_____	A deep sleep to save energy.
_____	Fly to a warmer country.

Exercise 2 – Complete the missing words in the passage below.

The conditions in a habitat are always C _ _ _ _ _ _ _ from day to night. In a desert it may be very hot during the day and C _ _ _ at night. Many desert animals are N _ _ _ _ _ _ _ _ _ The British winter is very cold and there is not much F _ _ _ for animals. Some animals adapt to cold winters by growing a T _ _ _ _ _ _ fur coat. Most animals store F _ _ under the skin during autumn. Animals hibernate to save E _ _ _ _ _

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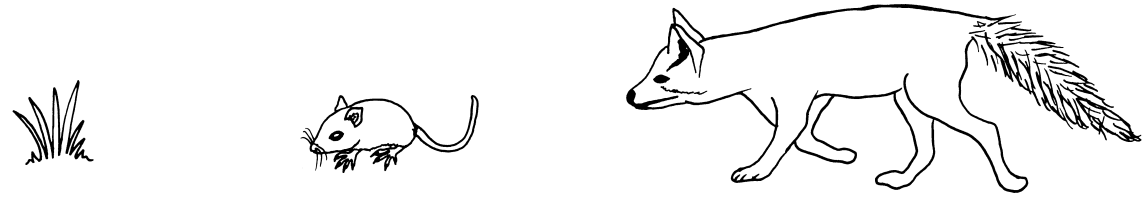
W.S.34. Food chains.

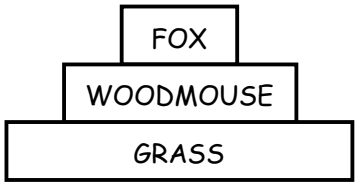
Name ……

Green plants make food by PHOTOSYNTHESIS. Animals must feed on plants or other animals. The food is passed along a FOOD CHAIN.

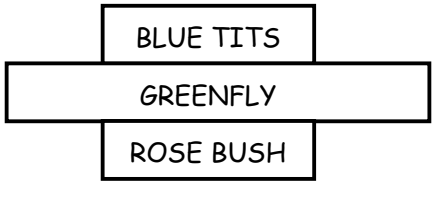


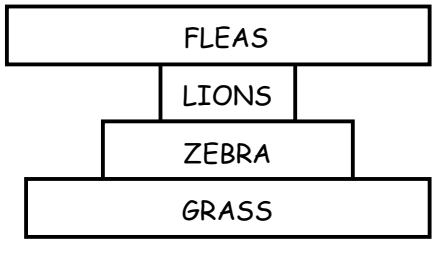
grass ⟶ woodmouse ⟶ fox

Food chains always begin with plants. Animals that eat plants are called HERBIVORES. Animals that eat other animals are called CARNIVORES. Carnivores are also called PREDATORS and the animals that they hunt are called the PREY. In most habitats there are more plants than herbivores and more herbivores than carnivores. This can be shown with a PYRAMID OF NUMBERS.



Pyramids of numbers are usually large at the bottom and small at the top. Sometimes they have a different shape because of the different sizes of the organisms in them. Two examples of this are shown below.





Exercise - Fill in the missing words in the passage below.

In habitats there is a mixture of ..... herbivores and carnivores. Carnivores are animals that eat other ..... Herbivores eat plants and are ..... by carnivores. Another name for carnivores is ..... and the animals that they hunt are called the ..... The amount of plants in a habitat must be ..... than the amount of herbivores or else the herbivores would run out of ..... In the same way there must be ..... carnivores than herbivores.

predators animals food fewer eaten plants prey greater

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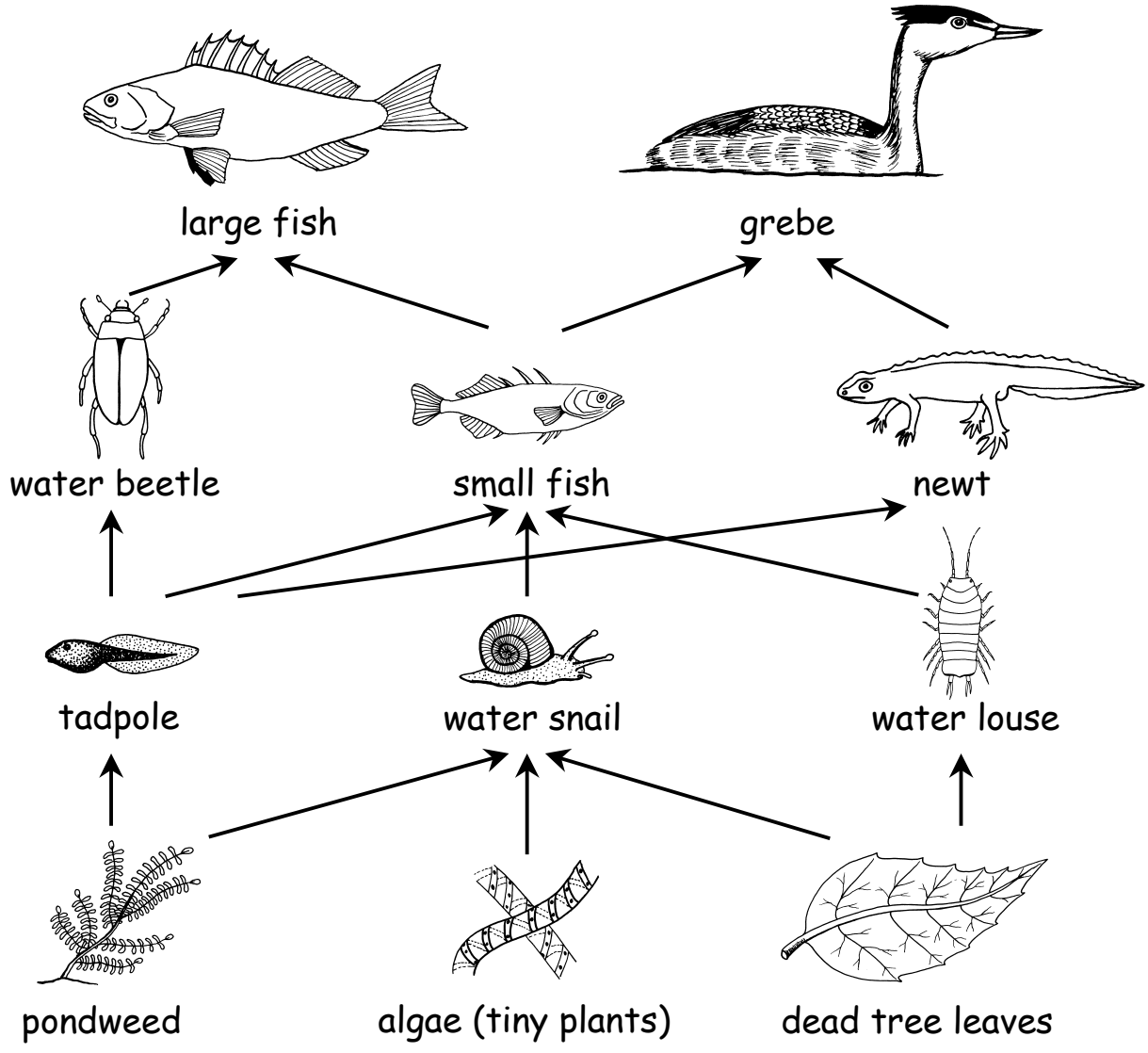
W.S.35. **Food webs.**

Name ……

Food chains can be connected together to make FOOD WEBS. The diagram below shows a food web in a lake.



Exercise - Complete the food chains and sentences below.

PONDWEED ⟶ …… ⟶ WATER BEETLE ⟶ LARGE FISH

LEAF ⟶ WATER LOUSE ⟶ …… ⟶ GREBE

1) The predators of small fish are _____ and _____

2) The prey of water beetles are _____

3) The prey of grebes are _____ and _____

4) The animal that **only** eats dead tree leaves is the _____

5) The 3 **herbivores** are _____ _____ and _____

6) The 2 top **predators** are the _____ and _____

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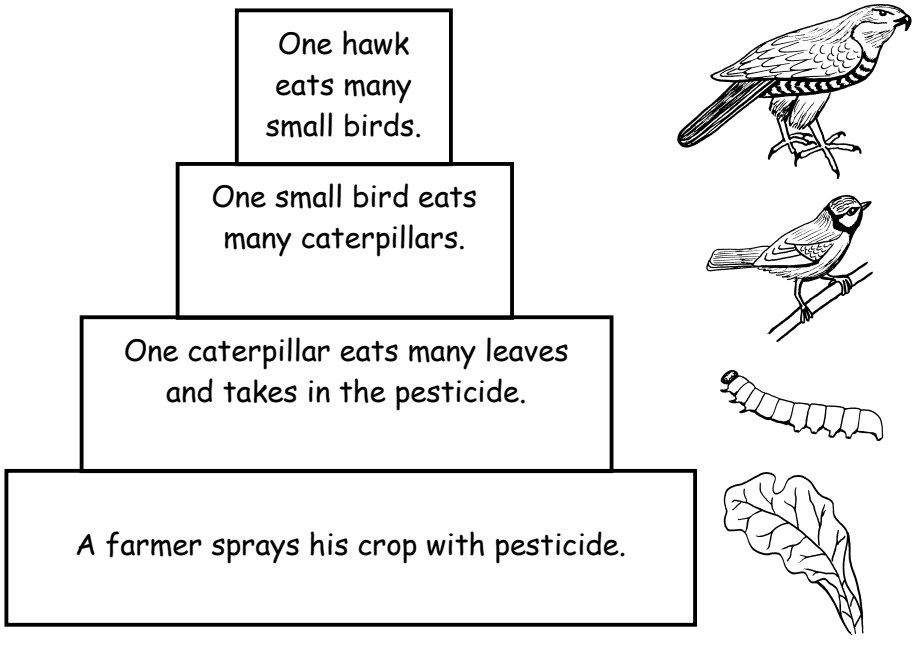
W.S.36. **Poisoned food chains.** Name ……

Farmers often spray their crops with PESTICIDES to kill pests such as insects and weeds. Pesticides may stay in the environment (surroundings) a long time and poison animals higher up the food chains. Pesticides can also be washed into streams and ponds. The diagram below shows how pesticides can build up along food chains.



If the pesticide is passed on from the caterpillars into small birds and then into the hawk we can see how it would quickly build up in the hawk's body. Scientists are now trying to make pesticides that only affect the pest and break down a short time after they have been used. They are also trying to find other ways of controlling pests by using their natural enemies. This is called BIOLOGICAL CONTROL.

Exercise - Complete the sentences below.

1) P _ _ _ _ _ _ _ _ _ are poisons that kill pests.

2) Pesticides can get into food C _ _ _ _ _ and poison other animals.

3) Small B _ _ _ _ eat many insects which may have pesticides in them.

4) Hawks may be P _ _ _ _ _ _ _ by eating birds that contain pesticides.

5) Pesticides can also be washed into S _ _ _ _ _ _ and P _ _ _ _

6) B _ _ _ _ _ _ _ _ _ control means using a pest's natural enemy to destroy it.

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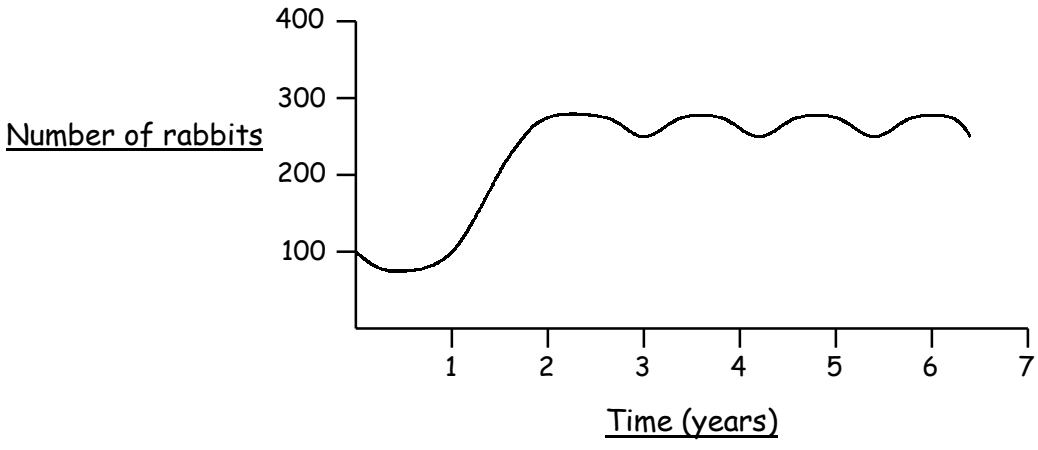
W.S.37. **Populations.** Name ……

A population is a number of organisms of the same species (type) living in one place. For example there may be a population of one thousand tadpoles living in a pond, or a population of five hundred oak trees in a wood. The graph below shows how a population of rabbits grew when scientists placed one hundred of them onto an island where rabbits had never lived before.



The population grew slowly at first as the rabbits were getting used to their new habitat. The population then grew very quickly as the rabbits had plenty of food and space and they were reproducing. The growth rate of the population then slowed down until it reached a fairly steady level of about 260 rabbits. At this point competition between the rabbits for food and space had increased and predators were finding and killing the rabbits more easily. When the balance between the number of births and deaths becomes equal the population stops growing.

Exercise – Complete the missing words in the passage below.

A …… is a number of organisms of the same species living in one place. There are a number of factors that control how big a population of animals can …… Competition for …… and space is important. As the population grows there will be …… competition and so more animals will …… Predators are also important in controlling the numbers of …… animals. If the number of predators increases more prey will be …… If the number of predators decreases more prey will …… In the same way, the …… of a predator's population is controlled by the numbers of its prey. If there are more prey there will be more predators. A population stays steady when the number of births equals the number of ……

size greater prey population deaths killed grow survive food die

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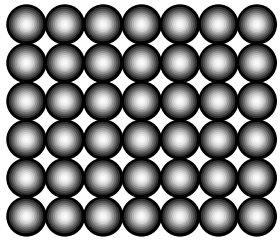
W.S.38. Solids, liquids and gases.

Name ……

Everything is made up of particles that are too small to see. The three states of matter are SOLID, LIQUID and GAS. They all have different properties due to the arrangement and movement of their particles.

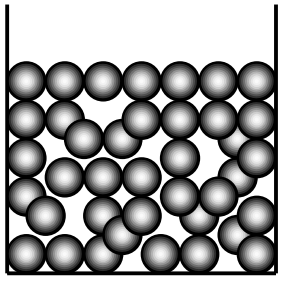
Solids.

The particles are held tightly together by strong forces. They make small vibrations but they stay in place. This gives solids a definite shape and volume. Solids are DENSE (heavy) and they can not be compressed (squashed) easily because the particles are already packed closely together.



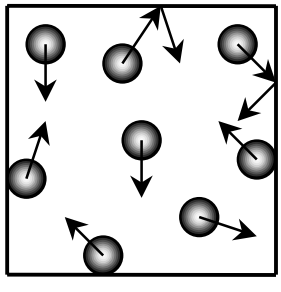
Liquids.

A liquid can flow because the particles can move past each other. The particles are still held closely together by strong forces. Liquids are DENSE and they can not be compressed easily. A liquid can change its shape but not its volume.



Gases.

There are only very weak forces between the particles which are far apart. The particles move around very quickly and bounce off each other. Gases have a low density (they are very light) and they do not have a definite shape or volume.



Exercise – Complete the spaces in the table below.

Property	Solids	Liquids	Gases
Density (heavy or light)	High density (heavy)		Low density (light)
How easy are they to compress (squash)?	Hard		Easy
Do they flow?		Yes	Yes
Do they keep the same shape?		No	
Do they keep the same volume?	Yes		

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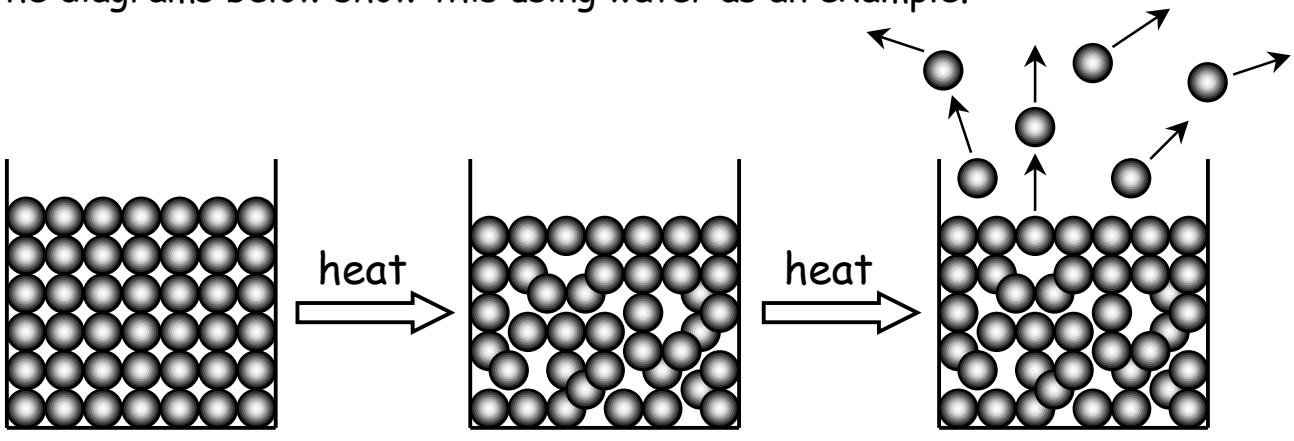
W.S.39. **Changes of state.** Name ……

When a solid is heated it changes into a liquid state and then a gas state. When a gas is cooled it changes back into a liquid and then into a solid. The diagrams below show this using water as an example.



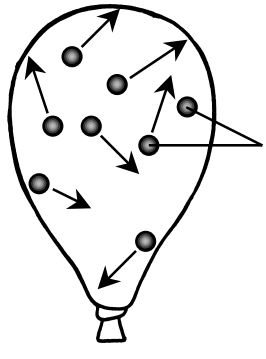
Solid – ice.
The particles are held firmly in place but they vibrate.

Liquid – water.
The particles gain more energy. The vibrations become stronger until they break apart.

Gas – steam.
The particles have gained enough energy to break free. They are moving very quickly.

Gas pressure and diffusion.

If a gas is squeezed into a small space e.g. when air is pumped into a balloon, the particles bump against the walls. This causes a PRESSURE.
A gas will DIFFUSE (spread out) until it fills up any area that it is contained in. The gas particles diffuse until they are EVENLY SPREAD OUT.



Air particles move around quickly and bump against the inside of the balloon.

Exercise – Join up the words in the left-hand column with their meanings in the right-hand column.

DIFFUSION	A solid changing to a liquid.
ICE	The spreading out of particles.
MELTING	The solid state of water.
STATE OF MATTER	A solid, liquid or gas.
EVAPORATION	A gas changing to a liquid.
CONDENSING	A liquid changing to a gas.

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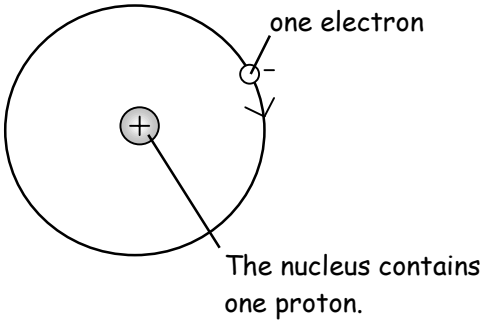
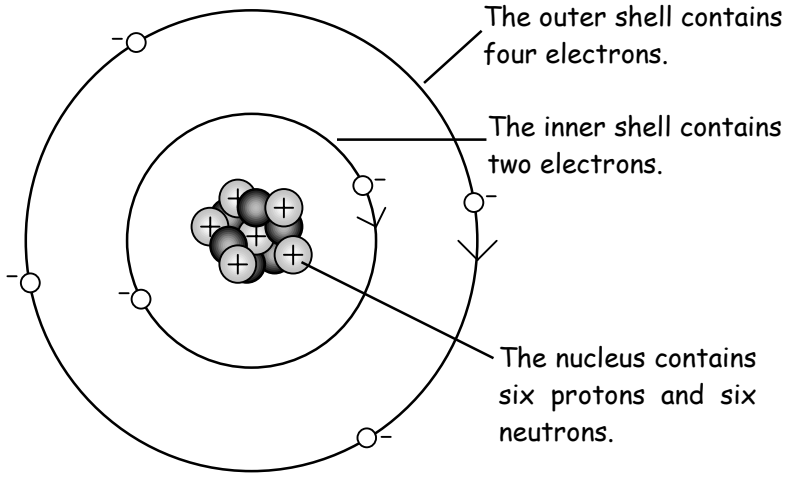
W.S.40. **Elements.** Name ……

An element is a pure substance that cannot be broken down into anything simpler. Everything on Earth is made from about one hundred different elements. An ATOM is the smallest particle of an element. They are much too small to be seen even with the most powerful microscope. Each element contains only one type of atom. Atoms have a NUCLEUS in the centre with ELECTRONS moving around it.

hydrogen atom



carbon atom



= positively charged proton

= neutron (no charge)

= negatively charged electron

Atoms always have the same number of electrons and protons so that their overall charge is neutral (no charge).

Different elements have different numbers of protons in their atoms. The ATOMIC NUMBER is the number of protons that an atom contains. The smallest atom is hydrogen with an atomic number of one. Lead is one of the largest atoms with an atomic number of eighty two.

Exercise – Complete the missing words in the sentences below.

1) An _ _ _ _ _ _ _ cannot be broken down into anything simpler.

2) The smallest particle of an element is called an _ _ _ _

3) The _ _ _ _ _ _ _ is in the centre of an atom.

4) Electrons have a _ _ _ _ _ _ _ _ charge.

5) Protons have a _ _ _ _ _ _ _ _ charge.

6) The atomic number is the number of _ _ _ _ _ _ _ in an atom.

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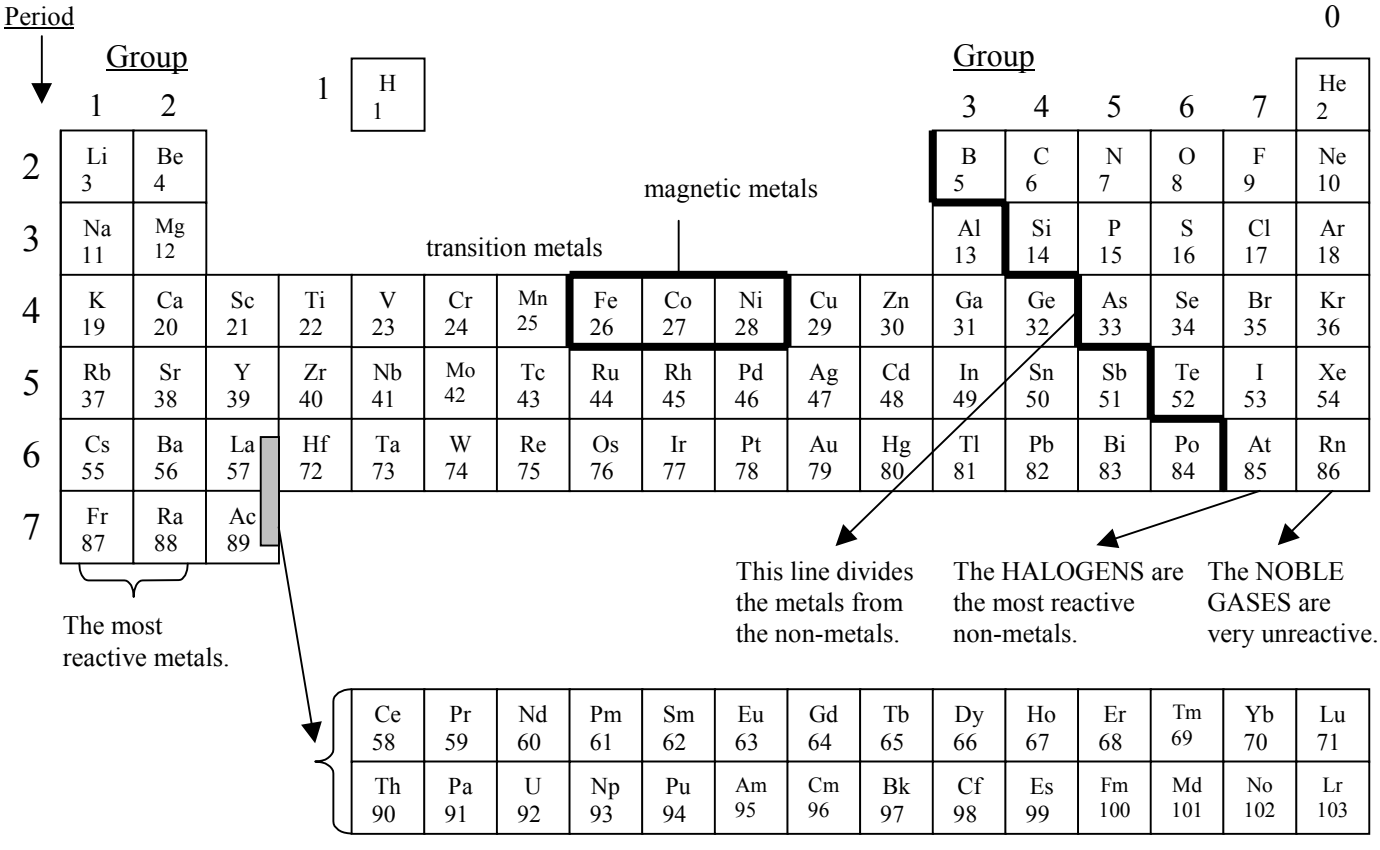
W.S.41. The periodic table.

Name ……

All of the elements have been arranged into the PERIODIC TABLE. This contains seven rows of elements called PERIODS. These are arranged so that each column contains elements with similar properties. The table shows the symbol and ATOMIC NUMBER (number of protons) for every element.



Exercise – Complete the missing words in the passage below.

Each group in the periodic table contains elements that have similar …… The atomic number gives the number of …… that an element contains. The lightest element is …… (H) which has an atomic number of one. The atomic number of …… is eight. Sodium (Na) and potassium (K) are two very …… metals. Iron (Fe) and nickel (Ni) are two of the …… metals. The most reactive non-metals are called the …… The …… gases are very unreactive. Magnesium (Mg) and calcium (Ca) are both in group …… of the periodic table. Nitrogen (N) and phosphorus (P) are both in group …… of the periodic table.

magnetic noble two hydrogen reactive five halogens properties oxygen protons

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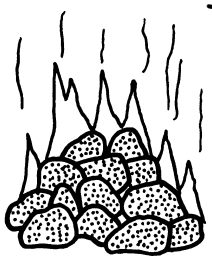
W.S.42. **Compounds.** Name ……

Elements join together by chemical reactions to form compounds. Compounds have different properties to the elements that formed them. In a chemical reaction new substances are formed and energy is taken in or given out. It is also difficult to make a reaction go backwards.

Exercise 1 – Fill in the missing words or symbols for the chemical reactions below.

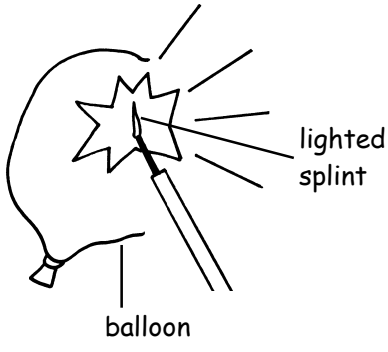
Coal burning



CARBON + OXYGEN ⇨ CARBON DIOXIDE + HEAT

…… + O_2 ⇨ CO_2 + HEAT

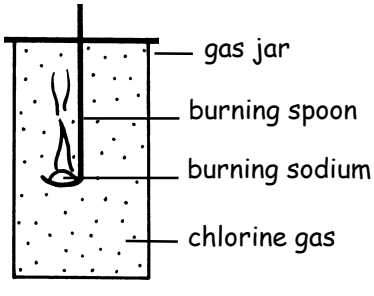
Hydrogen exploding



HYDROGEN + …… ⇨ WATER + HEAT

$2H_2$ + O_2 ⇨ $2H_2O$ + HEAT

Making salt



SODIUM + CHLORINE ⇨ SODIUM CHLORIDE (salt)

Na + Cl ⇨ ……

Exercise 2 – For each of the changes below write down if it is a physical or chemical change.

When a firework explodes it is a _____ change.

When salt dissolves in water it is a _____ change.

When a cake is baked in an oven it is a _____ change.

When ice melts it is a _____ change.

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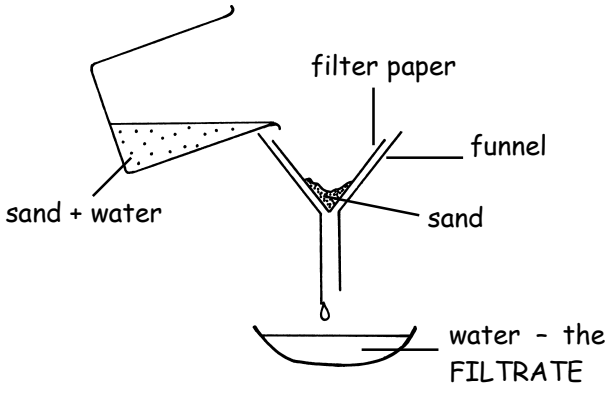
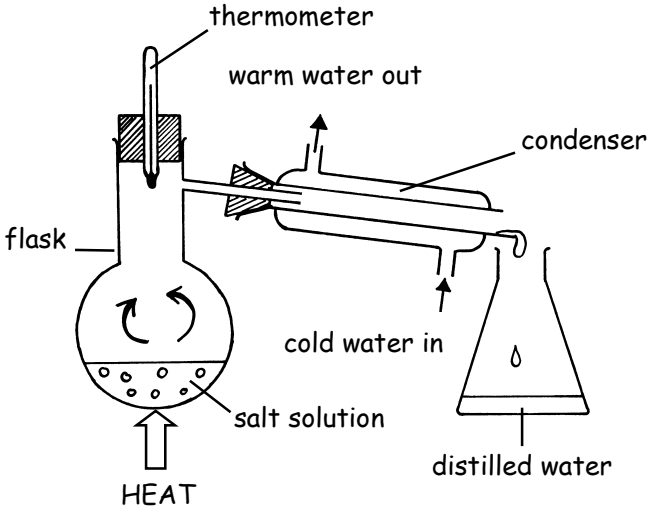
W.S.43. **Separating mixtures.** Name ……

A mixture contains a number of substances that are not chemically joined. The diagrams below show different ways of separating mixtures. Fill in the missing words in the paragraphs beside each method.



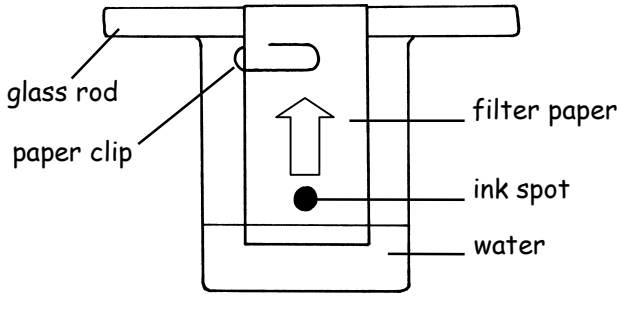
Filtration.

This method separates small, solid particles from liquids. In the diagram a mixture of sand and water is being filtered. The ..... passes through the filter paper and the ..... is held back. The sand particles are too big to pass through the pores in the .....



Distillation.

This method separates dissolved chemicals (SOLUTES) from the liquids that they are dissolved in (SOLVENTS). In the diagram salt solution is being separated into salt and ..... The water evaporates from the boiling solution and then condenses as it is ..... in the condenser. The salt is left behind in the .....



Chromatography.

In the diagram the colours in pen ink are being separated. As water rises up the ..... it takes the colours with it. Different colours travel at different ..... If the ink contains more than one colour they will separate out along the paper.

Exercise 2 – Join up each mixture below with the correct method for separating it.

muddy water	distillation
copper sulphate solution	filtration
peas and sand	magnetic attraction
iron filings and sawdust	sieving

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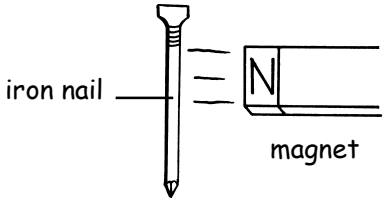
W.S.44. Metals and non-metals.

Name ……

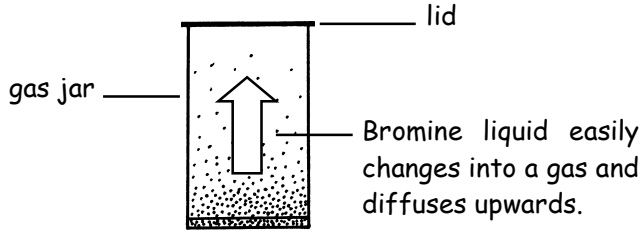
The elements can be divided into two main groups which are METALS and NON-METALS. The table below shows the properties of each group.

Metals	Non-metals
Most are shiny solids at room temperature although mercury is a liquid. They usually have high melting points.	They vary in their properties. They usually have low melting points and many are gases at room temperature.
Good conductors of heat.	Most are poor conductors of heat.
Good conductors of electricity.	Poor conductors of electricity except for graphite which is a form of carbon.
A few are magnetic (iron, cobalt and nickel).	None are magnetic.
They are often flexible (bendy) and can be hammered into shape.	They are often brittle (hard but break easily).

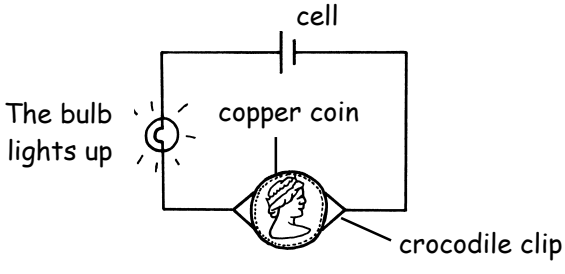
Exercise 1 – For each diagram below write down if the element is a metal or a non-metal.



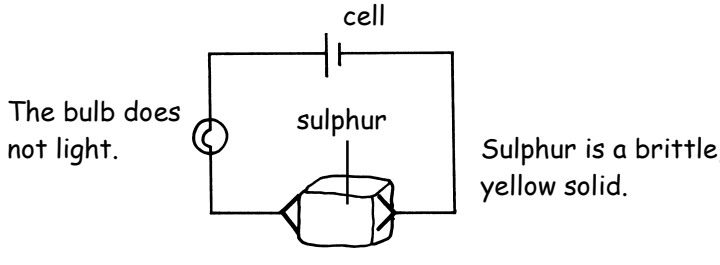
Iron is a _____



Bromine is a _____



Copper is a _____



Sulphur is a _____

Exercise 2 – Complete the sentences below.

1) M _ _ _ _ _ _ is the only metal that is a liquid at room temperature.

2) G _ _ _ _ _ _ _ is the only non-metal that is a good conductor of electricity.

3) The M _ _ _ _ _ _ _ metals are iron, cobalt and nickel.

4) M _ _ _ _ _ can be hammered into shape.

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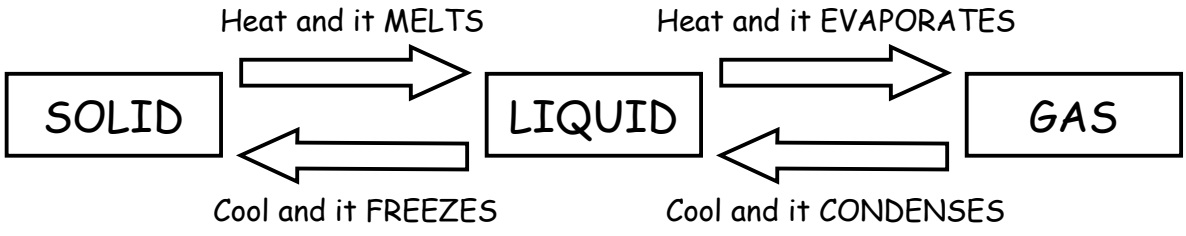
W.S.45. Changes of state.

Name ……

The three states of matter are SOLID, LIQUID and GAS. One state can change into another. The diagram below shows this.



When a solid changes to a liquid, or a liquid changes to a gas, heat is absorbed. This is because the particles that make up the substance need more energy to move faster and overcome the forces that hold them together. When a gas changes to a liquid, or a liquid changes to a solid, heat is given out. This is because the particles lose energy as they slow down. The substance still keeps the SAME MASS because it still contains the SAME NUMBER OF PARTICLES.

Exercise – Use the information in the table below to help you complete the sentences at the bottom of this page.

Substance	Melting point (°C)	Boiling point (°C)
Oxygen	-219	-183
Ethanol	-15	78
Water	0	100
Sulphur	119	445
Iron	1,540	2,900

1) Oxygen is a _ _ _ at room temperature.

2) Water and _ _ _ _ _ _ _ are liquids at room temperature.

3) _ _ _ _ _ _ _ and iron are solids at room temperature.

4) Sulphur melts at a temperature of _____ °C

5) Iron melts at a temperature of _____ °C

6) The substance with the lowest melting point in the table is _ _ _ _ _ _

7) Ethanol has a _ _ _ _ _ boiling point than water.

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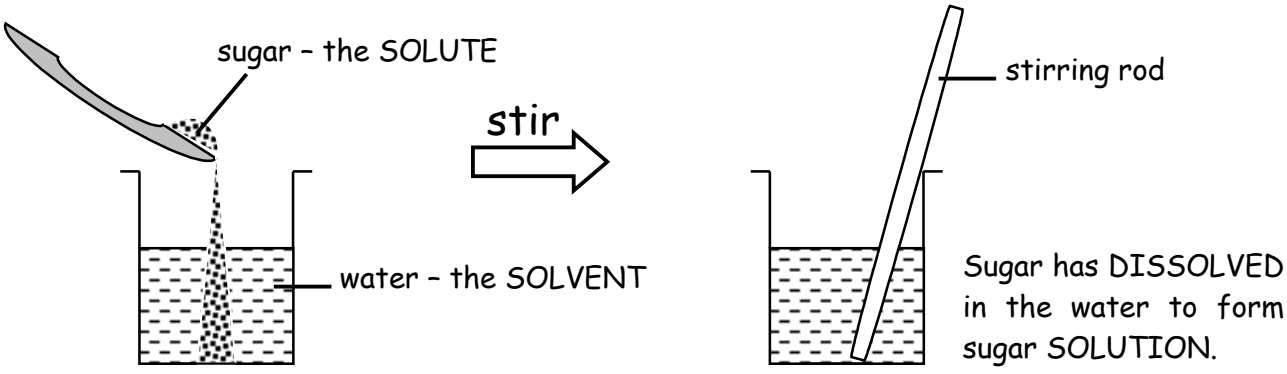
W.S.46. **Solubility.** Name ……

The diagrams below show how sugar can be dissolved in water.

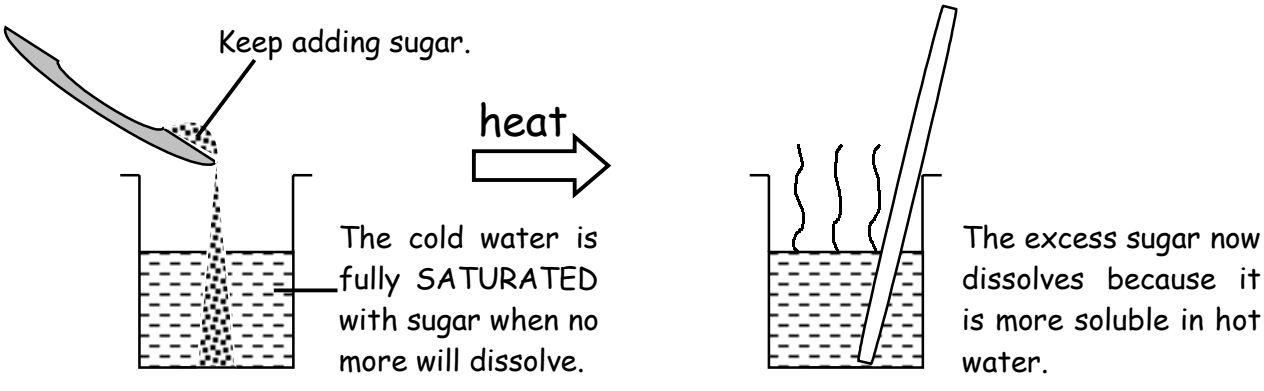


Exercise 1 – Fill in the missing words in the passage below.

If a solid …… in water we say that it is SOLUBLE. The substance that dissolves is called the SOLUTE and the liquid that it dissolves in is called the SOLVENT. Water is a good …… because many substances will dissolve in it. If you have been using …… paint you can not wash your brush in …… because the paint will not dissolve. The correct solvent for gloss paint is white ……

spirit **solvent** **dissolves** **gloss** **water**

The effect of temperature on solubility.



Exercise 2 – Complete the sentences below.

1) If you keep adding sugar to cold water you reach a point where no more sugar will _ _ _ _ _ _ _ _

2) A solution that cannot dissolve any more solute is fully _ _ _ _ _ _ _ _ _

3) Solids are _ _ _ _ soluble in water as the temperature rises.

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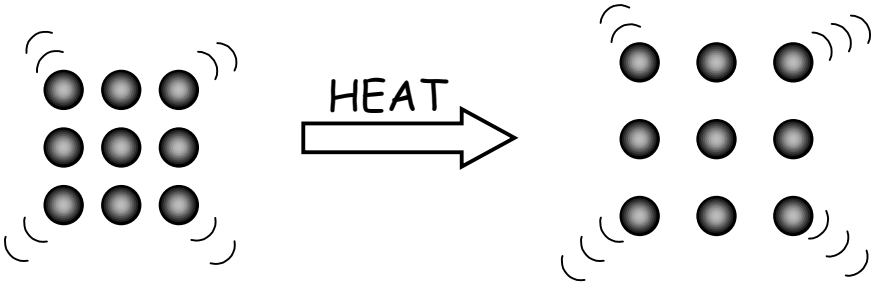
W.S.47. Expansion.

Name ……

If a metal bar is heated up it EXPANDS (gets bigger) slightly. This happens because the metal particles gain more energy and vibrate more.

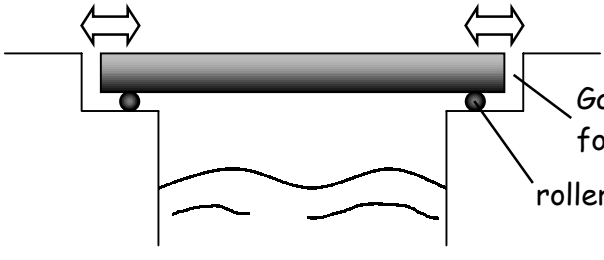


The particles vibrate more and so they move further apart.

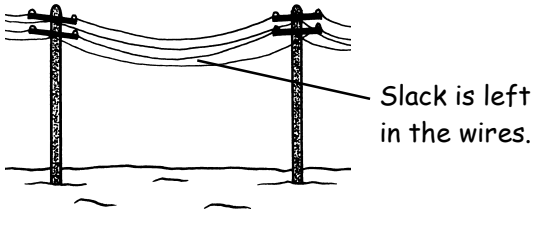
Most materials expand slightly when they are heated.

Problems caused by expansion.

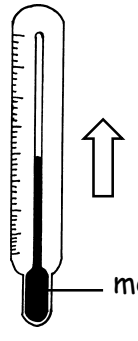
In hot weather a bridge could expand and buckle.



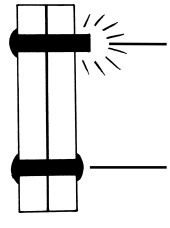
Overhead wires shorten in cold weather and could snap.



Uses of expansion.



Rivets hold metal plates tightly together.



Exercise – Fill in the missing words in the passage below.

Most materials …… when they are heated and …… when they are cooled. This is because their particles …… more when hot and so move further …… In hot weather a metal bridge could expand and …… To stop this from happening it is held on rollers. Overhead wires could contract and …… in cold weather. To stop this from happening they are given slack when they are put up. Mercury is a liquid metal that is used inside a …… When it is put in a warmer place the mercury expands and moves up the ……

vibrate apart snap thermometer contract buckle expand scale

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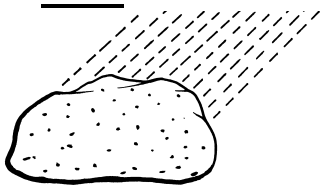
W.S.48. Rocks and weathering.

Name ……

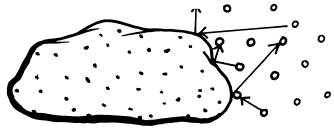
Rocks can be slowly broken up by the weather. This is called WEATHERING. The diagrams below show how this can happen.

Rain



Rainwater is slightly acidic. This makes certain rocks e.g. limestone slowly dissolve away.

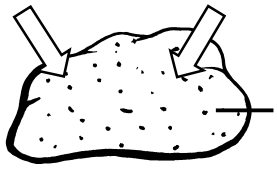
Wind



Wind carries sand particles which blast against the surface of rocks and produce more sand.

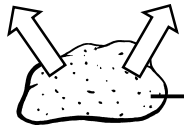
Expansion and contraction.

Heat is absorbed. DAY



Rock expands.

NIGHT Heat is lost.

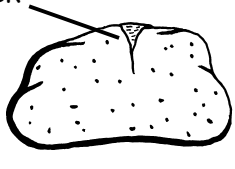


Rock contracts.

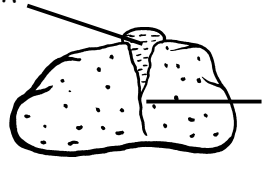
In a desert it is very hot during the day and very cold at night. Constant expansion and contraction of rocks causes them to break up.

Freezing of water.

Water fills a crack in the rock.



Ice forms which expands.



The rock is forced apart and the crack gets bigger.

Exercise – Complete the sentences below.

1) The slow wearing away of rocks is called _ _ _ _ _ _ _ _ _ _ _

2) _ _ _ _ can make limestone rocks slowly dissolve away.

3) In deserts rocks can be weathered by _ _ _ _ carried in the wind.

4) Expansion and _ _ _ _ _ _ _ _ _ _ _ _ can cause rocks to crumble.

5) When water freezes it _ _ _ _ _ _ _ This can break rocks apart.

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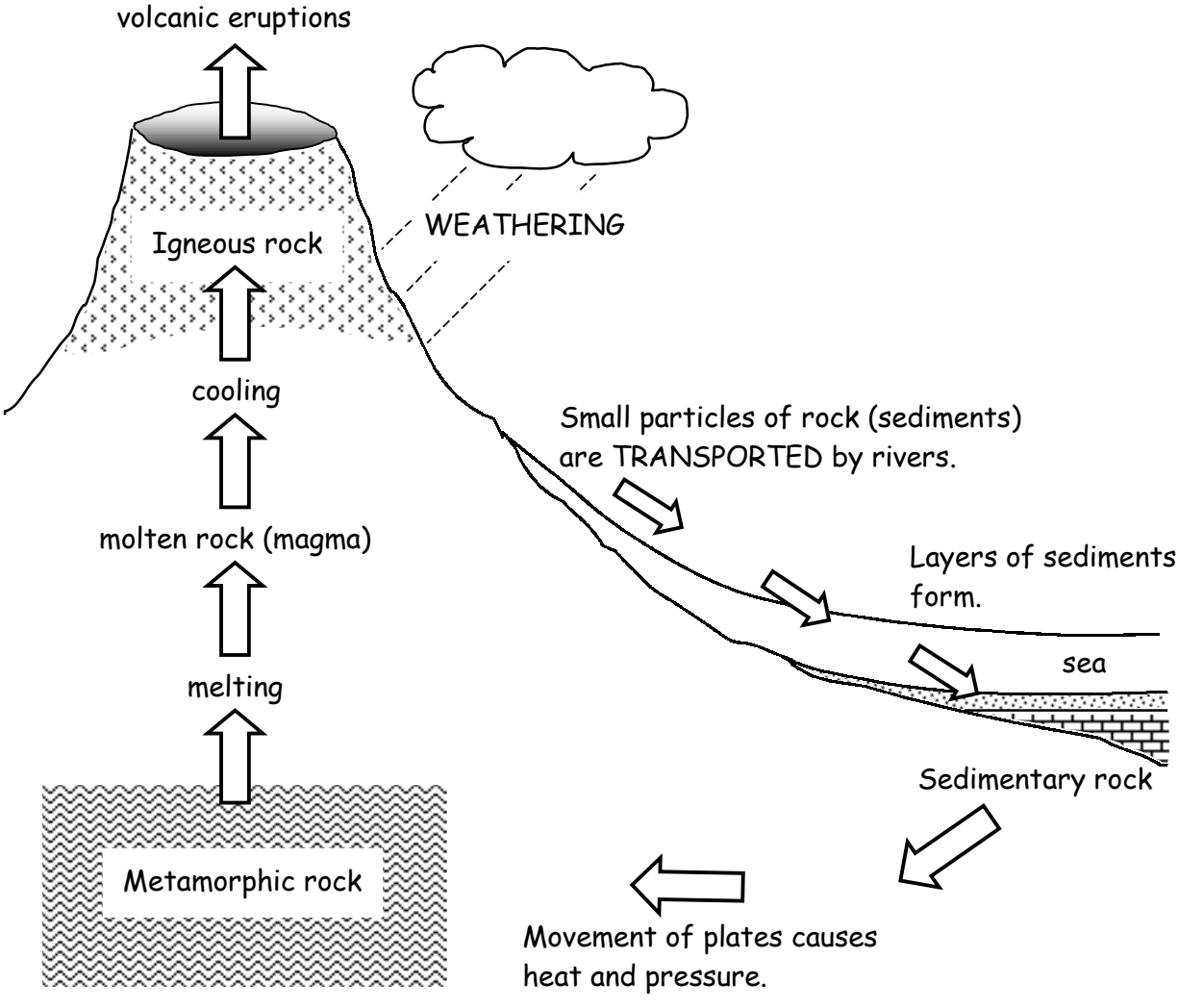
W.S.49. The rock cycle.

Name ……

Over millions of years rocks slowly change from one type into another. This is called the ROCK CYCLE. The diagram below shows how it happens.



Exercise - Fill in the missing words in the passage below.

Weathering of rocks causes small particles called …… to form. The sediments are …… by rivers to seas. Over many years …… of sediments build up on the sea bed. The sediments are squashed together so that they form …… rocks. Sandstone and …… are two examples of sedimentary rocks. Heat and pressure deep inside the Earth may change sedimentary rock into …… rock. Rocks inside the Earth may melt to form …… Sometimes magma returns to the surface during volcanic …… It then cools down to form solid …… rock.

mudstone magma igneous sediments metamorphic transported eruptions layers sedimentary

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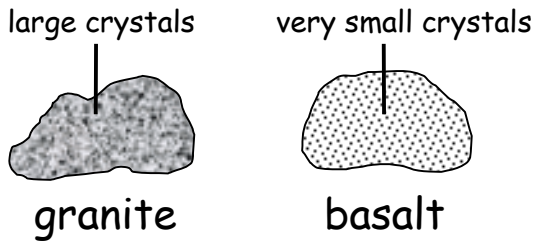
W.S.50. Types of rock.

Name ……

Rocks can be divided into three main types depending on how they were formed. Read the information below about the three types of rock.

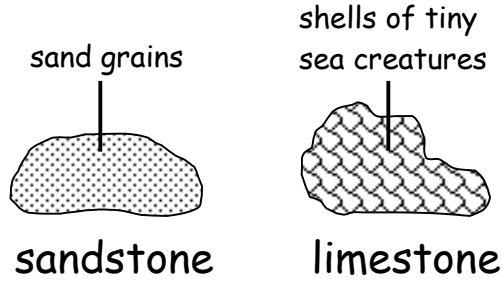
Igneous rocks.

These are formed when molten magma cools down and becomes solid. They are made of tiny crystals. If the magma cools quickly on the surface of the Earth then the crystals are small. If the magma cools slowly, deeper in the Earth's crust, then the crystals are larger. Igneous rocks are very hard.



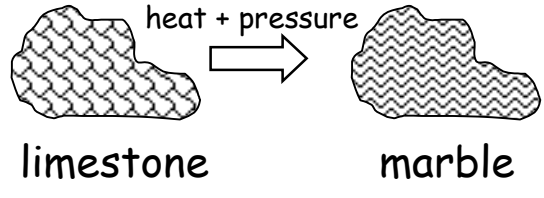
Sedimentary rocks.

These are made from layers of SEDIMENT (small particles) on the bottom of rivers or seas. The sediments are compressed as more layers build up on top of them. The particles then become cemented together to form solid rocks. The layers of rock are called STRATA. Sedimentary rocks have a grainy structure and they easily crumble.



Metamorphic (changed) rocks.

These are formed from igneous or sedimentary rocks which are changed by heat or pressure deep underground. They are usually harder than the rocks that formed them.



Exercise – Complete the sentences below.

1) Igneous rocks form when M _ _ _ _ cools down.

2) Granite contains L _ _ _ _ crystals because the magma cooled slowly.

3) Sedimentary rocks are made from particles called S _ _ _ _ _ _ _ _

4) Layers of rock are called S _ _ _ _ _

5) Sedimentary rocks easily C _ _ _ _ _ _

6) Metamorphic rocks have been changed by H _ _ _ or pressure.

7) Heat and pressure changes limestone into M _ _ _ _ _

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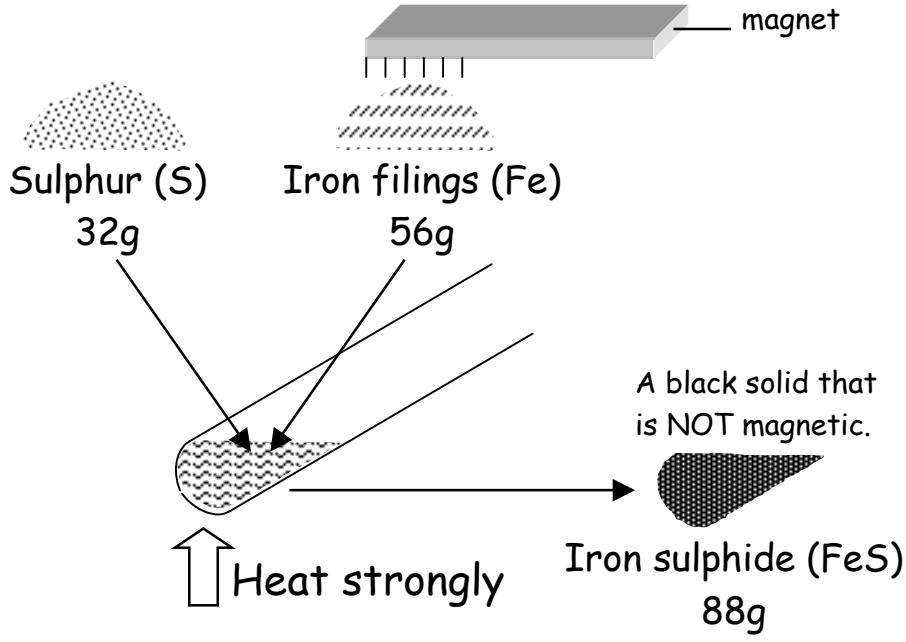
W.S.51. Chemical reactions.

Name ……

All of the different materials around us have been formed by chemical reactions from about one hundred simple elements. The diagram below shows a chemical reaction between the elements iron and sulphur.



This reaction can be shown as a word equation:

IRON + SULPHUR (REACTANTS) ⟹ IRON SULPHIDE (PRODUCT)

The new substance formed is a compound called iron sulphide. It has different properties to the iron and sulphur that it is made from.

Exercise 1 – fill in the missing words in the sentences below.

1. The mass of the reactants (starting chemicals) is E _ _ _ _ to the mass of the products (the chemicals that are made).
2. The products have different P _ _ _ _ _ _ _ _ _ _ to the reactants.
3. During a chemical reaction H _ _ _ is either taken in or given out.
4. A chemical change is difficult to R _ _ _ _ _ _ (go backwards).

Exercise 2 – Join up each word in the left hand column with its meaning on the right.

ELEMENTS	The chemicals that are made.
PRODUCTS	The simplest substances.
COMPOUND	Starting chemicals.
REACTANTS	Elements joined together.

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W.S.52. Types of chemical reaction. Name ……

There are several different types of chemical reaction.

Synthesis

Two or more substances join together to make a single new substance. For example when iron and sulphur are heated together :

$$\text{IRON} + \text{SULPHUR} \xrightarrow{\text{heat}} \text{IRON SULPHIDE}$$

Decomposition

A substance breaks down into simpler substances. For example, if calcium carbonate (limestone) is heated to a very high temperature :

$$\text{CALCIUM CARBONATE} \xrightarrow{\text{heat}} \text{CALCIUM OXIDE} + \text{CARBON DIOXIDE}$$

Oxidation

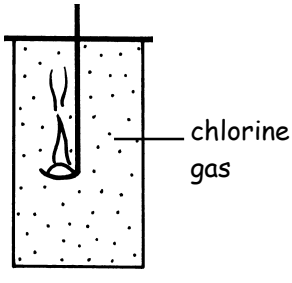
A substance gains oxygen during a chemical reaction. The substance that gains the oxygen is OXIDISED. For example, if copper is heated in air :

$$\text{COPPER} + \text{OXYGEN} \xrightarrow{\text{heat}} \text{COPPER OXIDE}$$

Exercise 1 – Complete the sentences below.

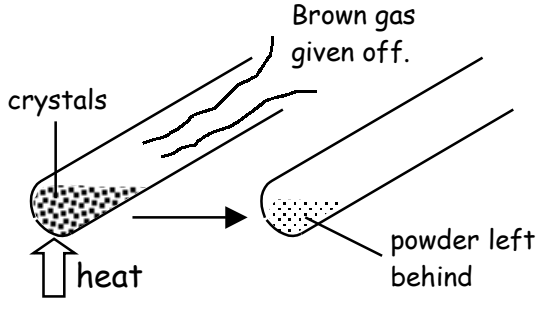
1) Synthesis means when substances _ _ _ _ together.
2) Decomposition means when a substance _ _ _ _ _ _ down.
3) Oxidation is when a substance gains _ _ _ _ _ _ in a chemical reaction.

Exercise 2 – For each diagram below write down the type of chemical reaction it shows.



1) Burning sodium metal in chlorine gas to form sodium chloride (salt). This type of reaction is :

_____



2) Heating white lead nitrate crystals to produce a yellow powder and a brown gas. This type of reaction is :

_____

3) If an iron nail is exposed to air it forms orange iron oxide (rust). This type of reaction is :

_____

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W.S.53. Burning. Name ……

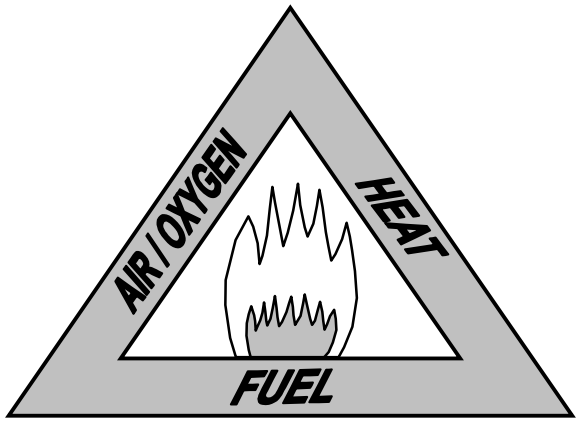
Burning is a type of oxidation reaction. It happens when a substance reacts with oxygen in the air to produce heat and light. The substance that burns is oxidised during the reaction. For example when carbon in the form of coke is burnt :

CARBON + OXYGEN ⇨ CARBON DIOXIDE + heat and light.

FUELS can be burnt to release useful energy. They burn more strongly in pure oxygen. If a smouldering wooden splint is placed into a jar that contains oxygen it will relight. This is a test for oxygen gas.

The fire triangle.

The fire triangle shows the three things that are needed for burning to happen. Removing any of them stops a fire.



Exercise – Complete the sentences below.

1) Burning is a chemical reaction between fuel and O _ _ _ _ _

2) When carbon burns C _ _ _ _ _ D _ _ _ _ _ _ gas is produced.

3) Burning can be useful because it releases E _ _ _ _ _

4) The test for oxygen is a smouldering S _ _ _ _ _

5) The three things needed for a fire are oxygen, F _ _ _ and heat.

6) A fire blanket is used to stop A _ _ getting to a fire.

7) Pouring water onto a fire takes away the H _ _ _

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W.S.54. Products from chemical reactions. Name ……

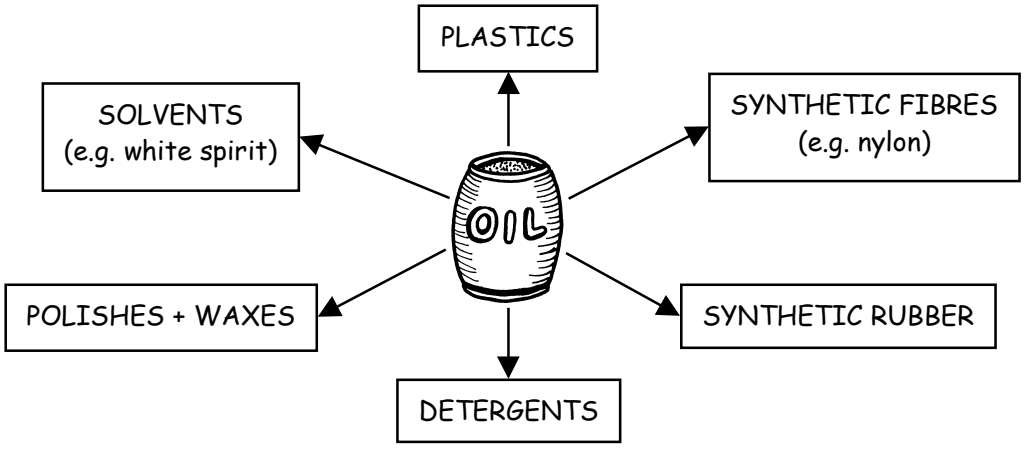
Most of the materials that we use every day have been made by chemical reactions. Some of the most common products are made from two important raw materials, METAL ORES and CRUDE OIL.

Metal ores.

Most metals exist as compounds called ORES inside rocks. Ores must be reacted with other chemicals to extract the metals that they contain. The more reactive the metal is, the more difficult it is to release from its ore. If a metal is less reactive than carbon it can be extracted by heating its ore with coke in a furnace. For example HAEMATITE (iron ore) contains iron oxide :

Crude oil.

Natural oil from the ground is called CRUDE OIL. It contains a mixture of substances that can be changed into many useful products.



Exercise – Complete the sentences below.

1) Many useful materials are made by chemical R _ _ _ _ _ _ _ _

2) An ore contains a M _ _ _ _ joined to other elements.

3) If a metal is less reactive than C _ _ _ _ _ it can be extracted using coke in a furnace.

4) Crude oil is a M _ _ _ _ _ _ of useful substances.

5) N _ _ _ _ is a synthetic fibre.

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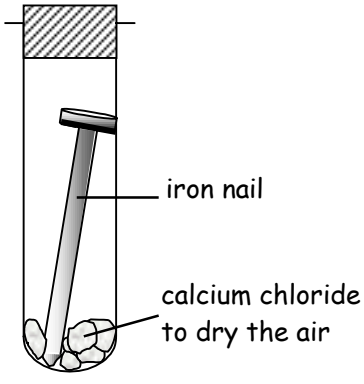
W.S.55. Harmful chemical reactions. Name ……

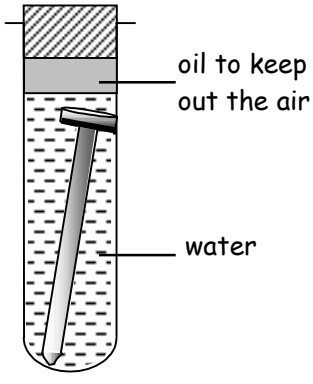
Some chemical reactions are harmful because they destroy our products.

Corrosion of metals.

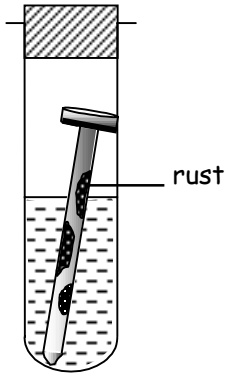
Metals may be attacked by air, water or other substances around them. Usually the more reactive the metal is, the faster it corrodes. The corrosion of iron and steel is called RUSTING. The experiment below shows that both air and water are needed for rusting to happen.



In dry air the iron nail does not rust.



In water without air the iron nail does not rust.



In air and water the iron nail rusts.

To stop rusting metals can be coated with a substance that keeps out air and water. Paint, grease, plastic, or a thin layer of tin or zinc can be used.

Oxidation of foods.

Some foods react with oxygen gas in the air. This makes them taste unpleasant. Fat can be oxidised quickly, therefore fatty foods such as butter should be kept in a fridge to slow down the rate of oxidation. Another way of stopping oxidation is to keep air away from the food by using sealed packets or tins.

Exercise – Fill in the missing words in the passage below.

The corrosion of iron and steel is called …… Iron will only rust if it is exposed to both air and …… We can stop rusting by …… the metal with a substance that keeps out …… and water. This is why motor cars are given several layers of ……
Some foods are …… when exposed to air. This gives them an unpleasant …… Keeping foods …… will slow down the rate of oxidation. Another way of stopping …… is to make sure that the food does not come into contact with air.

air rusting taste cool water oxidation coating oxidised paint

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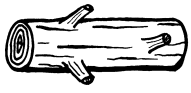
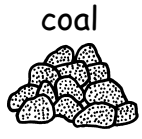
W.S.56. Energy from chemical reactions. Name ……

Heat may be taken in or given out during a reaction. Sound, light, movement or electrical energy may also be produced. When fuels are burnt they give out heat and light energy. Explosive fuels give out movement and sound energy as well. The chemical reaction that takes place inside a torch battery gives out electrical energy.

Energy from fuels.



Wood can be burnt as a fuel.



Fossil fuels form over millions of years.

Burning of fuels makes carbon dioxide, water and heat energy :

FUEL + OXYGEN ⇨ CARBON DIOXIDE + WATER + ENERGY

The heat energy can be used to keep our houses warm and to cook food. It can also be changed into movement energy to drive engines.

Effects on the environment.

Burning fuels release carbon dioxide into the air. This stops heat escaping from the surface of the Earth back into space. This is called the GREENHOUSE EFFECT and it may lead to GLOBAL WARMING.

Oil and coal release sulphur dioxide gas when they burn. This gas goes into the air and dissolves in rain droplets to form ACID RAIN. In some parts of Europe acid rain has destroyed plant and animal life in lakes and forests. Acid rain also causes corrosion of buildings and statues.

Exercise – Complete the sentences below.

1) Different types of E _ _ _ _ _ can be produced by chemical reactions.

2) When fuels are burnt they give out heat and L _ _ _ _ energy.

3) The reaction inside a battery produces E _ _ _ _ _ _ _ _ _ energy.

4) Extra carbon dioxide gas in the air may lead to G _ _ _ _ _ warming.

5) Burning of oil and C _ _ _ releases sulphur dioxide gas.

6) Sulphur dioxide gas forms A _ _ _ rain

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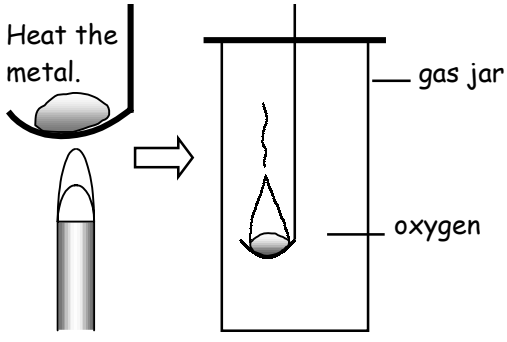
W.S.57. Reactivity of metals.

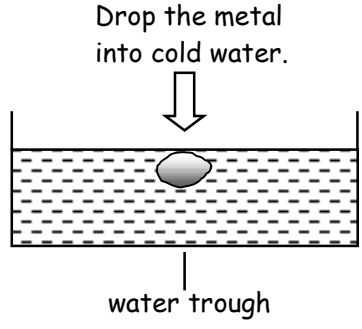
Name ……

We can arrange the metals in order of most to least reactive. The three tests below are used to judge how reactive different metals are :

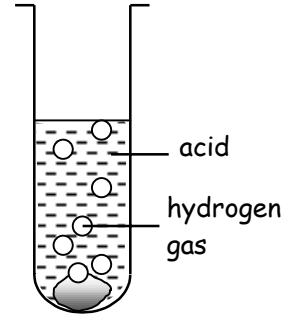
Reaction with oxygen.



Reaction with water.



Reaction with acid.



most reactive

Metal	Reaction with oxygen	Reaction with water	Reaction with acid
Potassium	Burns strongly with a lilac flame.	Very fierce and ignites (catches fire).	Too dangerous to perform.
Sodium	Burns strongly with a yellow flame.	Fierce but it does not ignite.	Too dangerous to perform.
Magnesium	Burns with a blinding white flame.	Very slow reaction but it reacts with steam.	Very fast reaction that produces hydrogen gas.
Zinc	Burns slowly with a dull red flame.	Reacts slowly with steam.	Quite a slow reaction. Some hydrogen produced.
Iron	Does not burn but it glows brightly.	Very slow reaction with steam.	Very slow reaction.
Lead	Melts but does not burn.	No reaction.	Extremely slow.
Copper	Does not burn but it forms a black coating.	No reaction.	No reaction.
Gold	No reaction.	No reaction.	No reaction.

least reactive

Exercise – Complete the sentences below.

1) _ _ _ _ _ _ _ _ _ _ is the most reactive metal.

2) _ _ _ _ is the least reactive metal.

3) Potassium and sodium are too reactive to add to _ _ _ _

4) You should not look at _ _ _ _ _ _ _ _ _ _ when it burns in oxygen.

5) _ _ _ _ does not corrode because it is an unreactive metal.

6) Metals react faster with _ _ _ _ _ than they do with water.

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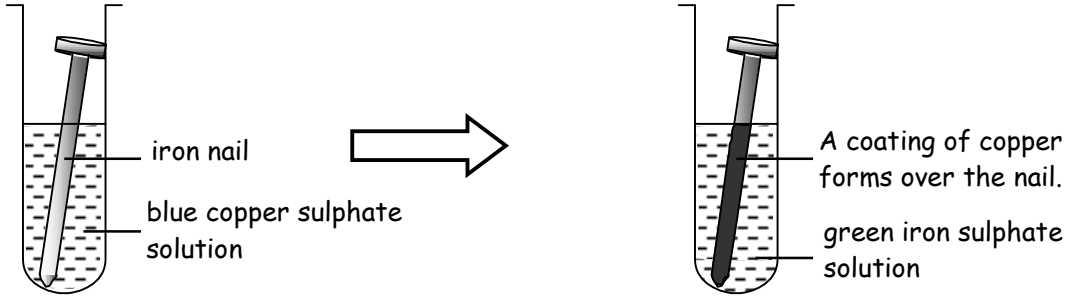
W.S.58. Displacement reactions. Name ……

If two metals are put together the more reactive metal will 'win' any competition to form a compound. The experiment below shows a reaction between an iron nail and copper sulphate solution.

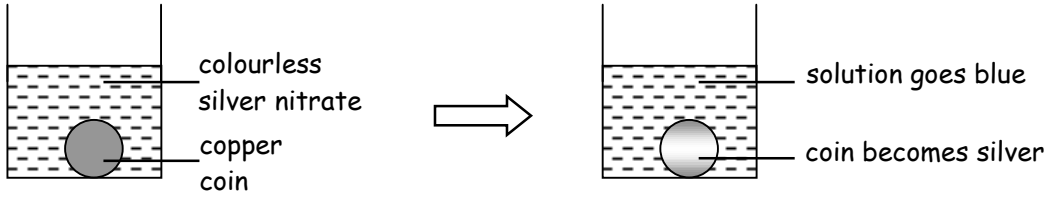


Iron and copper compete to be the compound in the solution. Iron is more reactive and so it DISPLACES (pushes out) the copper in the solution.

IRON + COPPER SULPHATE (blue solution) ⟹ IRON SULPHATE (green solution) + COPPER

A metal will always displace a less reactive metal from solutions of its compounds.

Exercise 1 – Study the experiment below and then try to complete the missing words.



COPPER + SILVER NITRATE (colourless) ⟹ COPPER _ _ _ _ _ _ _ (blue) + SILVER

Copper is _ _ _ _ reactive than silver so it displaces silver in the solution.

Displacement reactions with metal oxides.

Two metals can also compete for oxygen. For example, if magnesium powder is heated with copper oxide there is an explosive reaction :

MAGNESIUM + COPPER OXIDE ⟹ MAGNESIUM OXIDE + COPPER

Exercise 2 –Complete the missing words in the sentences below.

Magnesium 'wins' the competition for _ _ _ _ _ _ because it is higher in the reactivity series than _ _ _ _ _ _ When a metal is heated with the oxide of a _ _ _ _ reactive metal it will remove the oxygen from it.

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W.S.59. Acids and alkalis.

Name ……

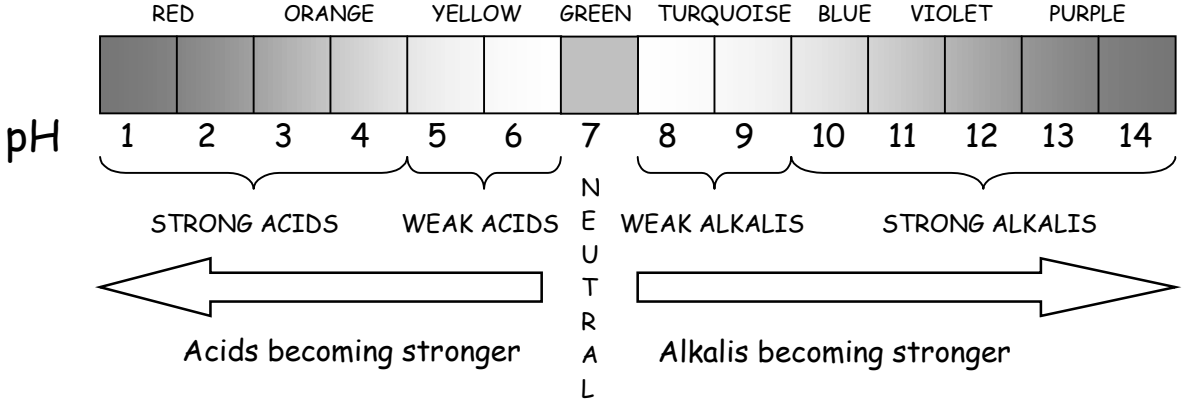
Acids are CORROSIVE (eat into materials). They react with some metals to form hydrogen gas and a salt. Acids have a sour taste, and many are poisonous. A purple dye called LITMUS changes to a **red** colour in acids.

Alkalis are the chemical opposites of acids, but some of them are also very corrosive. They dissolve in water and often have a soapy feel. Alkalis turn litmus **blue** and they can be used to NEUTRALISE (cancel out) acids. A NEUTRAL solution is neither acid or alkali.

Acids		**Alkalis**	
STRONG	WEAK	STRONG	WEAK
These are the poisonous mineral acids: - hydrochloric acid - sulphuric acid	ethanoic acid in vinegar citric acid in fruit juices carbonic acid in soda water	sodium hydroxide oven cleaner washing powder	soap sodium bicarbonate (baking powder)

Universal Indicator and the pH scale.

Universal indicator changes to different colours with acids and alkalis. The colour change tells us the pH number of the substance being tested which tells us how strong the acid or alkali is.



Exercise – Complete the sentences below.

1) If a chemical is _ _ _ _ _ _ _ _ _ _ it will eat into materials.

2) Acids react with some _ _ _ _ _ _ to produce hydrogen gas.

3) Litmus turns _ _ _ in acid and _ _ _ _ in alkali.

4) The pH is a measure of how _ _ _ _ _ _ the acid or alkali is.

5) A chemical with a pH number of six is a _ _ _ _ acid.

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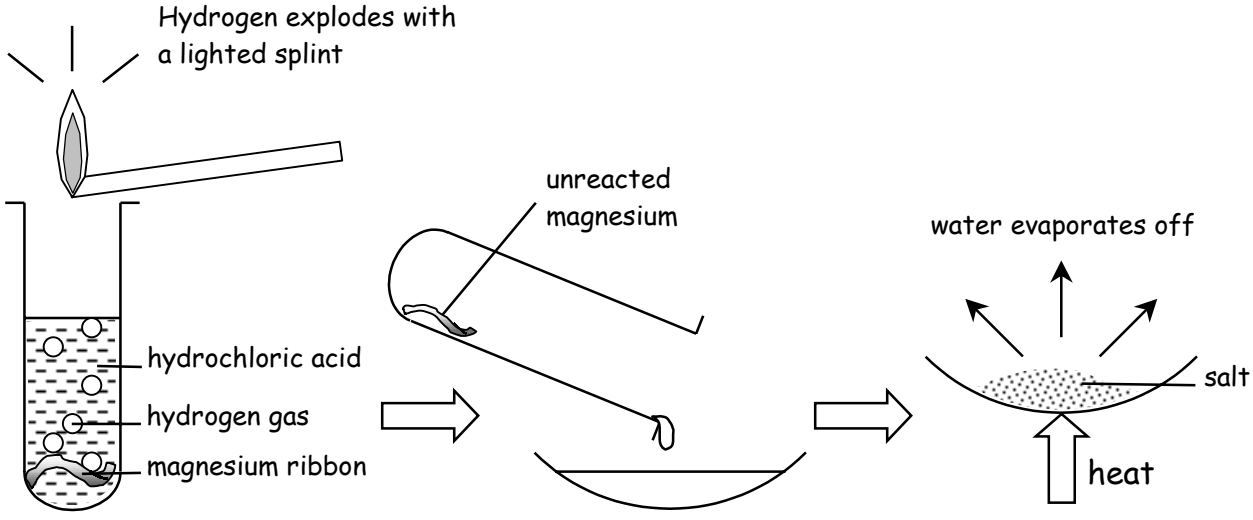
W.S.60. Acids and metals.

Name ……

Metals that are more reactive than copper will react with acids to form hydrogen gas and a salt.

ACID + METAL ⇨ HYDROGEN + SALT

The more reactive the metal is, the faster the reaction will be. The experiment below shows the reaction between hydrochloric acid and magnesium.



1) The magnesium reacts with the acid.

2) A solution of magnesium chloride has formed.

3) **Magnesium chloride** salt is left behind.

Exercise – Complete the missing words in the sentences and equations below.

1) A metal must be more reactive than C _ _ _ _ _ to react with an acid.

2) ACID + METAL ⇨ HYDROGEN + _____

3) Reactive metals produce hydrogen F _ _ _ _ _ than unreactive metals.

4) The test for H _ _ _ _ _ _ _ is a lighted splint.

5) Hydrogen is an E _ _ _ _ _ _ _ _ _ gas.

6) hydrochloric acid + magnesium ⇨ _____ + magnesium chloride

7) All of the A _ _ _ has reacted when there are no more hydrogen bubbles given off.

8) The S _ _ _ that has been made is magnesium chloride.

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W.S.61. Acids and bases.

Name ……

Bases can neutralise (cancel out) acids. Bases that dissolve in water are called alkalis. A base reacts with an acid to form a salt and water :

ACID + BASE ⟹ SALT + WATER

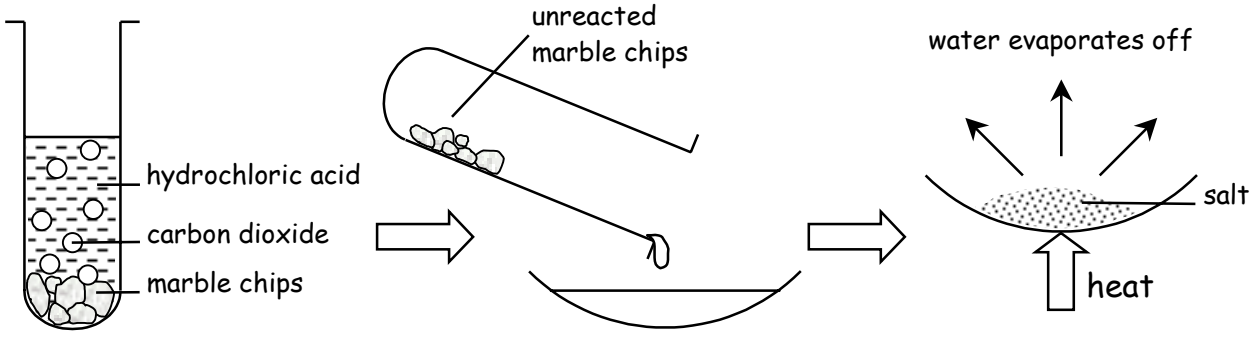
For example, if sodium hydroxide, which is a very strong alkali, is reacted with hydrochloric acid then sodium chloride (common salt) is formed.

Reaction with carbonates.

Carbonates are bases that contain the elements carbon and oxygen. They react with acids to form a salt, carbon dioxide gas and water. The reaction is fizzy due to the carbon dioxide gas given off :

ACID + CARBONATE ⟹ SALT + CARBON DIOXIDE + WATER

The experiment below shows the reaction between calcium carbonate (marble chips) and hydrochloric acid.



1) The marble chips react with the acid.

2) A solution of calcium chloride has formed.

3) **Calcium chloride** salt is left behind.

calcium carbonate + hydrochloric acid ⟶ calcium chloride + carbon dioxide + water

Exercise – Complete the missing words in the sentences and equations below.

1) A B _ _ _ is a chemical that can neutralise an acid.

2) Bases that dissolve in water are called A _ _ _ _ _ _

3) ACID + BASE ⟹ _____ + WATER

4) Sodium C _ _ _ _ _ _ _ is common salt.

5) Carbonates contain the elements carbon and O _ _ _ _ _

6) Carbonates react with acids to produce C _ _ _ _ _ D _ _ _ _ _ _

7) Marble chips will F _ _ _ in acid until it has all been neutralised.

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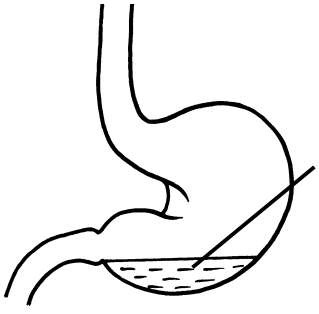
W.S.62. **Neutralisation.** Name ……

Sometimes we need to NEUTRALISE (cancel out) acids or alkalis. Acids and alkalis can be used to neutralise each other. The diagrams below show some examples of this.

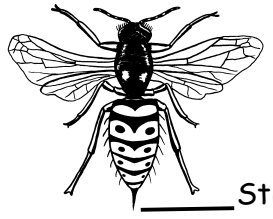
Acid indigestion



Stomach contains hydrochloric acid. Too much acid causes indigestion.

Indigestion tablets contain a weak alkali to neutralise the acid.

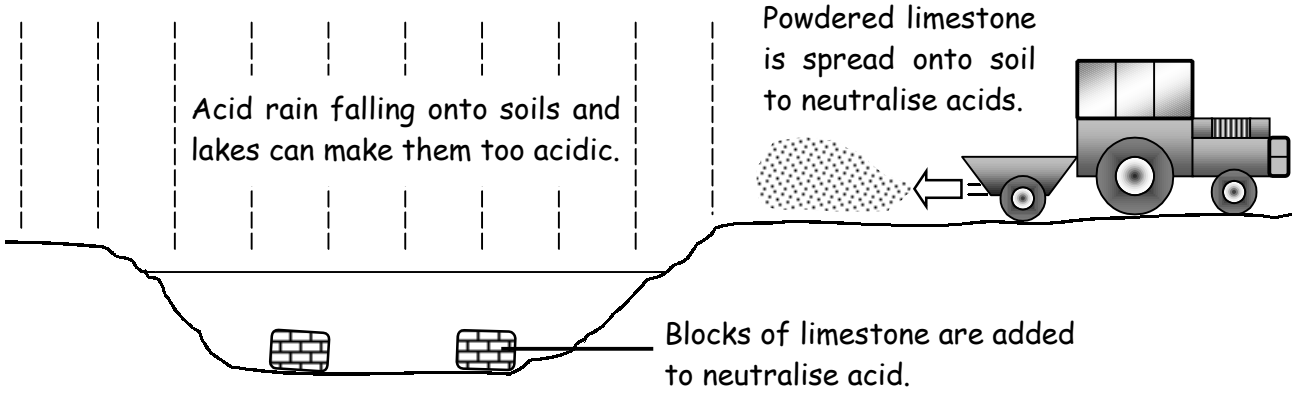
Insect stings



Sting injects poison.

WASP STING - alkaline so treat it with a weak acid such as vinegar.
BEE STING – acidic so treat it with a weak alkali such as sodium bicarbonate.

Acid soils and lakes



Exercise – Fill in the missing words in the passage below.

The stomach contains …… acid. If there is too much acid in the stomach it causes …… Tablets can be taken that contain a weak …… to neutralise the acid. A bee sting is …… and must be treated with a weak alkali such as sodium …… A wasp sting is alkaline and must be treated with a weak acid such as …… Soils and lakes can become too acidic in areas that are polluted with acid …… Blocks of …… can be added to lakes to neutralise the acid and …… limestone can be spread onto fields.

powdered vinegar hydrochloric acidic limestone rain alkali bicarbonate indigestion

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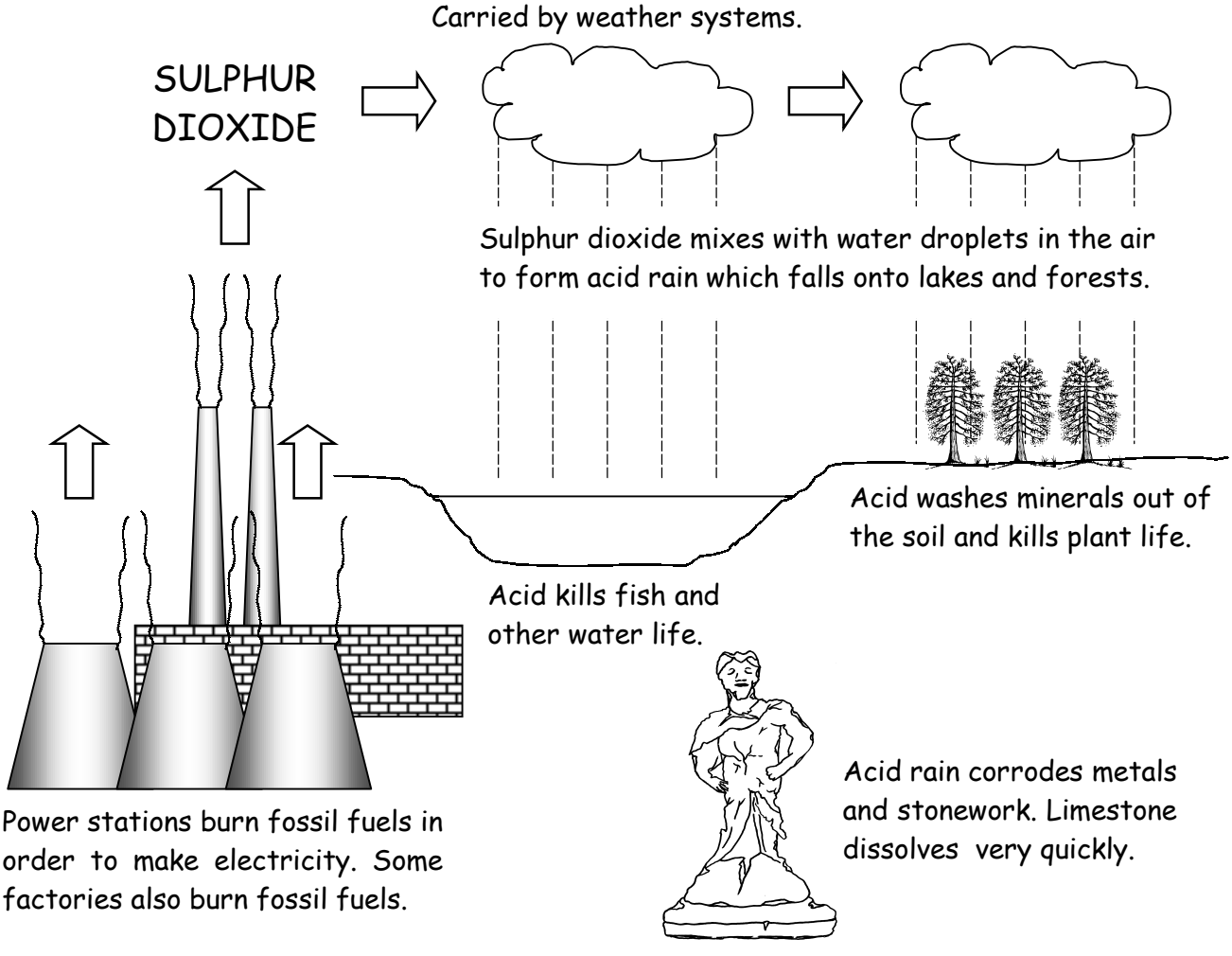
W.S.63. **Acid rain.**

Name ……

Oil and coal release sulphur dioxide gas when they burn. This gas goes into the air and dissolves in rain droplets to form ACID RAIN. In some parts of Europe acid rain has destroyed plant and animal life in lakes and forests. Acid rain also causes corrosion of metal and stonework.



Exercise – Use the diagrams above to help you complete the sentences below.

1) The main waste gas that causes acid rain is S _ _ _ _ _ _ dioxide.

2) Sulphur dioxide is given off from burning oil and C _ _ _

3) Power stations burn fossil fuels to make E _ _ _ _ _ _ _ _ _ _ _

4) Sulphur dioxide gas mixes with R _ _ _ in the atmosphere.

5) If a lake becomes too acidic the fish and other water life will D _ _

6) Acid rain washes M _ _ _ _ _ _ _ out of the soil.

7) Acid rain corrodes M _ _ _ _ _ and stonework.

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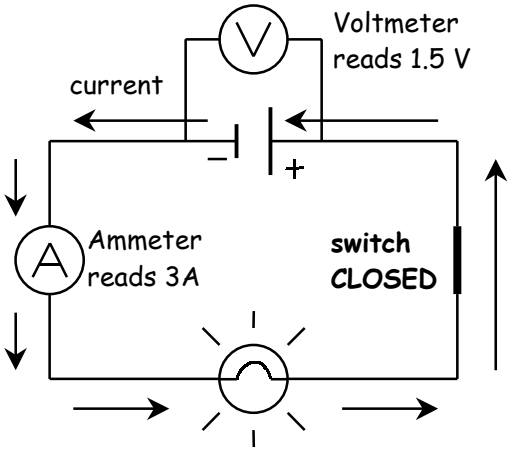
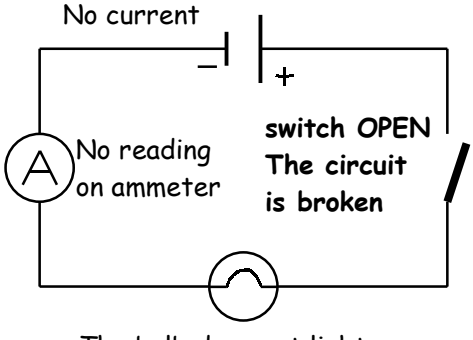
W.S.64. Electric current and voltage.

Name ……

Metals are good CONDUCTORS (carriers) of electricity. Most non-metals do not conduct electricity and we call them INSULATORS. An electric current will only flow through a COMPLETE circuit. A chemical reaction inside the battery pushes the current from the negative terminal to the positive terminal.



The bulb uses the electrical energy and lights up.



The bulb does not light up

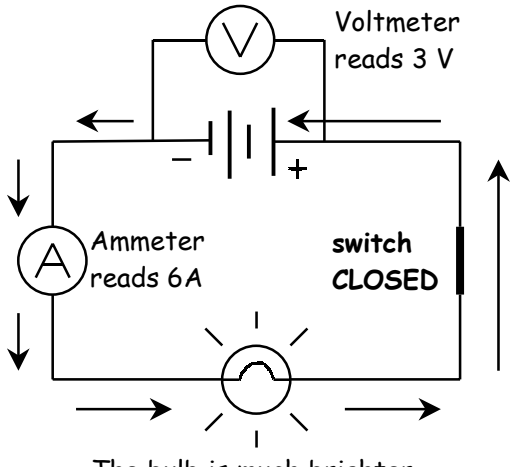
Symbols

- A cell (battery).
- A switch. This connects two leads.
- A voltmeter. This measures the voltage across the battery terminals.
- An ammeter. This measures the size of the electric current in AMPS (A).
- A bulb. The brightness gives some idea of how much electricity is flowing.

The effect of increasing the voltage.

The diagram opposite shows what happens if two batteries are put into the circuit. Carefully compare it to the first diagram at the top of this page and then try to complete the missing words in the passage below.

A battery pushes out the C _ _ _ _ _ _ The voltage across both batteries can be measured using a V _ _ _ _ _ _ _ _ _ With two batteries there is T _ _ _ _ as much voltage. This produces twice the current and so the bulb is much B _ _ _ _ _ _ _ The negative end of one battery must be connected to the P _ _ _ _ _ _ _ end of the other battery. If they are connected the wrong way round the current will not F _ _ _



The bulb is much brighter.

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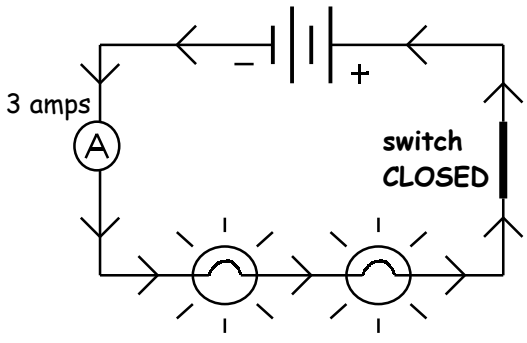
W.S.65. Series and parallel circuits. Name ……

Exercise 1

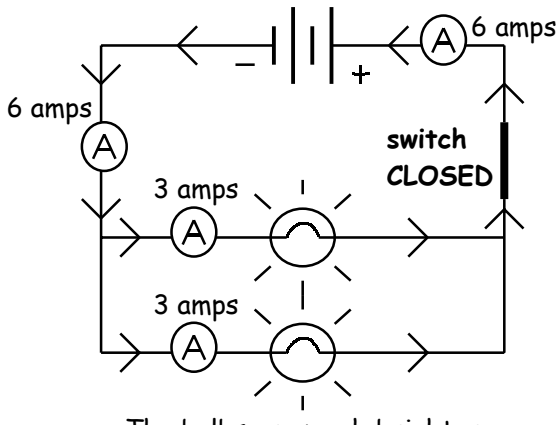
The diagrams below show the two ways of adding two bulbs to a circuit. Study them carefully and then try to fill in the missing words in the passages underneath. Choose from the list of words at the bottom.

Bulbs in series



The bulbs are dim.

Bulbs in parallel



The bulbs are much brighter.

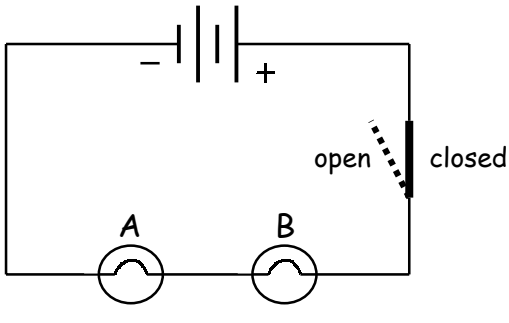
The current is …… because it is harder for it to travel through both bulbs. We say that there is a high …… The current does not get used up as it travels around the circuit. The …… gives the same reading anywhere in the circuit.

Both bulbs are connected directly across the two batteries therefore they are given the full …… The current is …… because it is easier for it to flow around the circuit. If another bulb was connected in parallel they would still be as ……

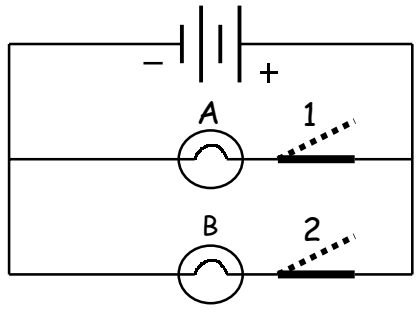
voltage **small** **bright** **resistance** **larger** **ammeter**

Exercise 2 – Study the two circuit diagrams below and then try to complete the sentences.

circuit 1



circuit 2



1) If the switch is opened in circuit 1 both bulbs would _____

2) If bulb A is removed from circuit 1 bulb B would get _____

3) If switch 1 is opened in circuit 2 only bulb ____ would light up.

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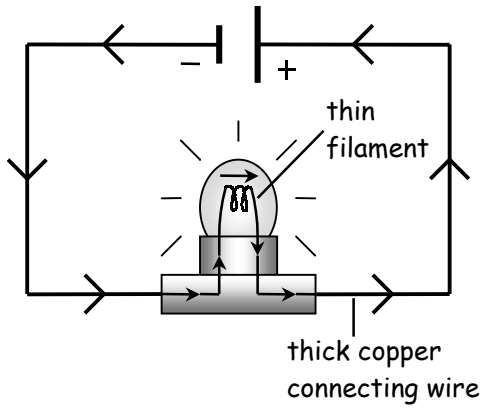
W.S.66. Electrical resistance.

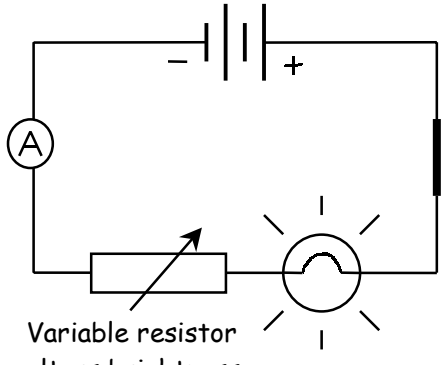
Name ……

When a bulb is connected into an electrical circuit the current passes from the thick copper connecting wires, into the thin filament wire of the bulb. The filament does not let the current pass through as easily. It has a bigger RESISTANCE than the connecting wires. This causes the filament to heat up and electrical energy is changed into heat and light energy.



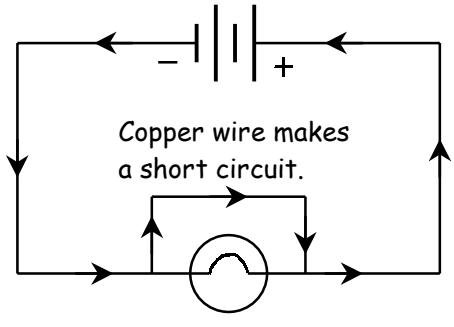
Using resistors.

The resistance of a wire increases if it is made thinner or longer. RESISTORS are lengths of wire that are used in circuits to reduce the current. They are used in electrical devices such as radios and televisions to keep the currents at the correct levels. A VARIABLE RESISTOR is a long coil of nichrome resistance wire. It has a sliding contact that can be moved along the coil to change the resistance. The bulb in the circuit diagram opposite can be gradually made dimmer or brighter by sliding the control on the resistor.



Short circuits.

An electric current always takes the easiest route around a circuit. In the diagram opposite the bulb does not light up because it is easier for the current to pass through the copper wire than through the bulb. The bulb has a bigger resistance than the wire. This is called a SHORT CIRCUIT.



Exercise – Complete the missing words in the passage below.

The thin wire inside a light bulb is called a F _ _ _ _ _ _ _ This does not let the C _ _ _ _ _ _ pass through it easily because it has a high electrical R _ _ _ _ _ _ _ _ _ When a bulb lights, electrical energy is being changed into H _ _ _ and light energy. C _ _ _ _ _ is a metal with a very low resistance which is why it is used for electric wires.
The thinner a wire is the M _ _ _ resistance it has. Resistors are used in electrical devices to stop currents getting too H _ _ _ A variable resistor is used to change the S _ _ _ of the current in a circuit. They are used as dimmer switches in household L _ _ _ _ _ Variable resistors are also used as V _ _ _ _ _ controls in televisions and radios.

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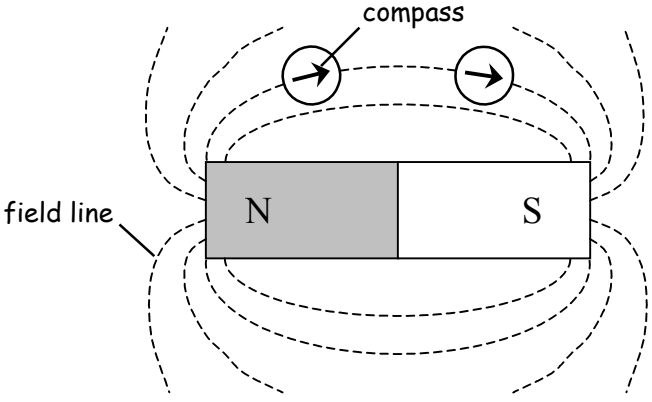
W.S.67. **Magnets.**

Name ……

The magnetic metals are iron, steel, cobalt and nickel. They are attracted to magnets and can become magnetized themselves. There are invisible magnetic forces around a magnet. This is called a MAGNETIC FIELD. The forces are strongest around the ends, which are called the NORTH (N) POLE and the SOUTH (S) POLE.



The field lines can be shown by placing a piece of paper over the magnet and then sprinkling iron filings on top. The iron filings follow the pattern of the field lines.

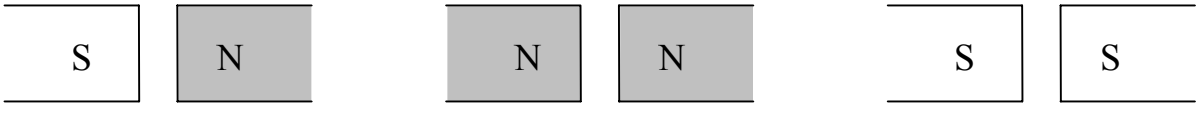
A compass always points from north to south along the field lines.

Forces between magnets.

If the poles of two bar magnets are brought close together they will exert a force on each other. They will either ATTRACT (pull together) or REPEL (push away from each other). This depends on what type of poles are brought together :

The rule is : LIKE POLES REPEL AND UNLIKE POLES ATTRACT.

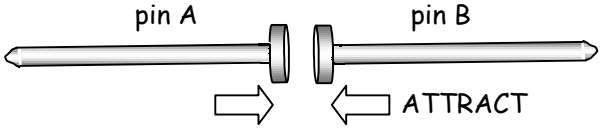
Exercise 1 – Underneath each diagram write down whether the magnets will attract or repel.

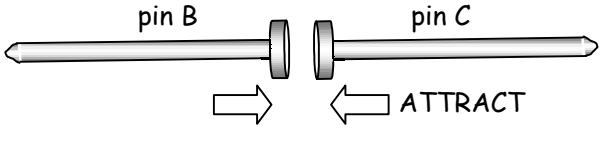


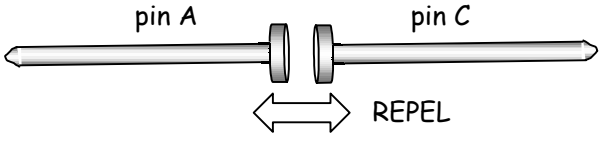
1) …… 2) …… 3) ……

Exercise 2

The diagrams below show three steel pins. Two of them are magnetized (have become magnets) and one is not. Try to work out which of the pins are magnets.







Therefore the magnetic pins are _____

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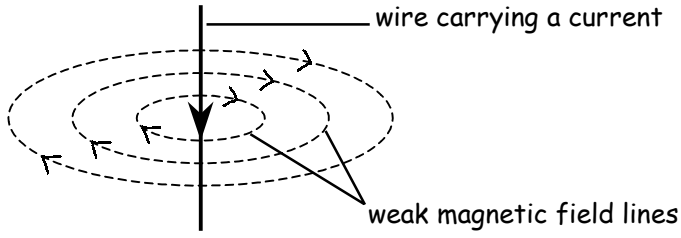
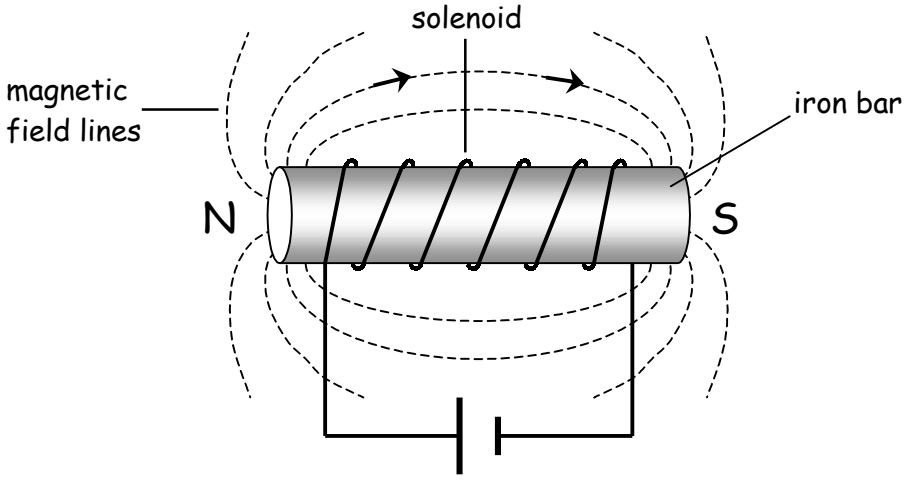
W.S.68. **Electromagnets.** Name ……

When a wire carries an electric current it produces a weak magnetic field around it. The field can be made **stronger** by increasing the **current** passing through the wire.



The magnetic field can also be made **stronger** by winding the wire into a **coil** called a SOLENOID. The magnetic field that is produced is like the one around a bar magnet. The greater the **number of turns** on the coil the **stronger** the magnetic field becomes.
If an **iron bar** is placed inside the solenoid the magnetic field becomes **much stronger**. This is called an ELECTROMAGNET and it can be used in many devices, e.g. electric bells. The diagram below shows how an electromagnet is made.



When the current is switched off the iron bar loses its magnetism. If a **steel** bar is put into the solenoid it stays a permanent magnet after the current is switched off.

Exercise – Complete the sentences below.

1) If a wire carries an electric current it produces a magnetic _ _ _ _ _

2) If the current is increased the magnetic field gets _ _ _ _ _ _ _ _

3) A coil of wire is called a _ _ _ _ _ _ _ _

4) The _ _ _ _ turns of wire on the coil the stronger the magnetic field.

5) An iron bar inside a solenoid makes an _ _ _ _ _ _ _ _ _ _ _ _ _ _

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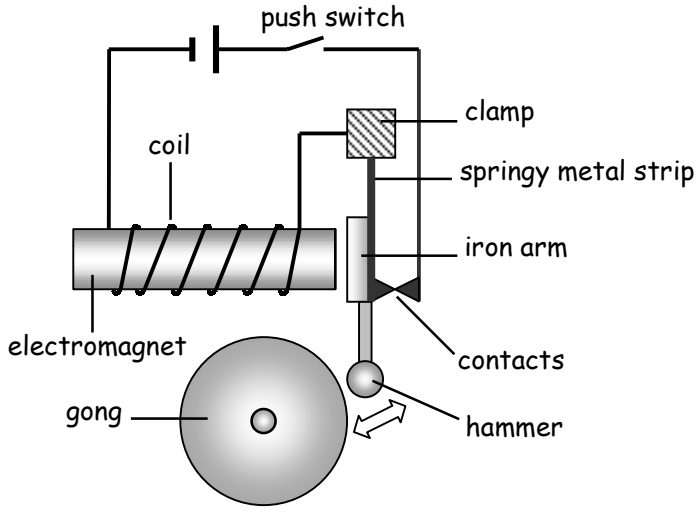
W.S.69. Uses of electromagnets.

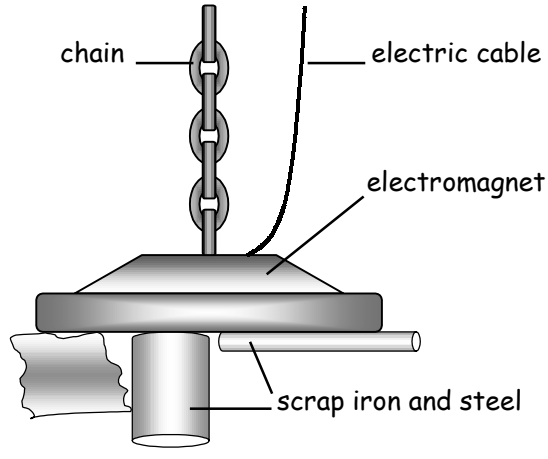
Name ……

The diagrams below show how electromagnets are used in various devices. Try to complete the missing words in the passages underneath each one.



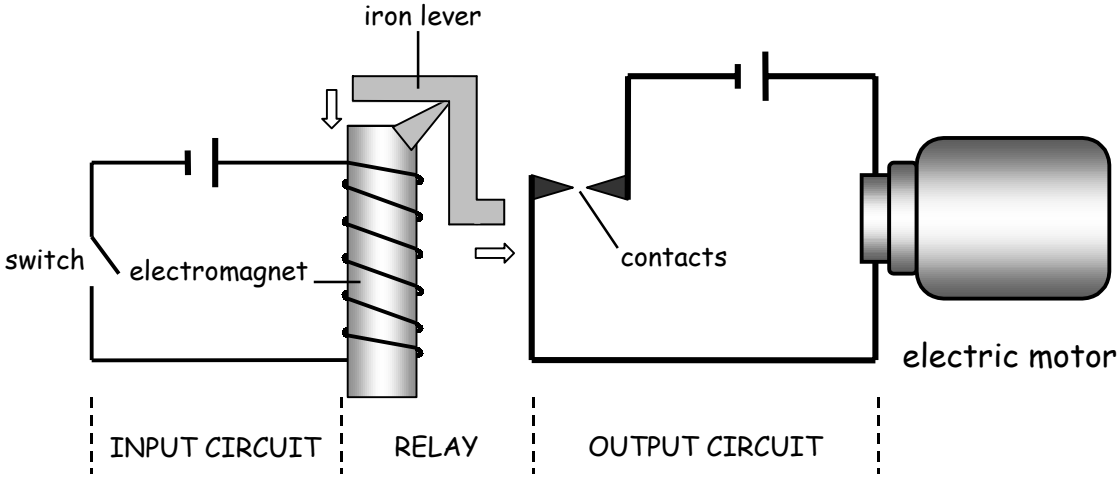
An electric bell.

When the push switch is closed the current flows through the _ _ _ _ The electromagnet then attracts the iron _ _ _ The hammer moves and strikes the _ _ _ _ As this happens the contacts separate and the circuit is broken. The electromagnet is switched _ _ _ and the hammer springs back.



Sorting scrap metal.

In a scrap yard electromagnets can be used to separate iron and _ _ _ _ _ objects from other materials. A thick _ _ _ _ _ supplies electricity to the magnet. The electricity is switched on to pick the metals up and then switched _ _ _ to put them down.



Electromagnetic switches – RELAYS.

Sometimes it is dangerous to switch on a circuit directly. For example, a car starting motor needs a current of over 100 amps. An electromagnetic switch called a _ _ _ _ _ can be used to switch the circuit on safely. When the switch in the _ _ _ _ _ circuit is closed the magnet is switched on. This pulls the iron _ _ _ _ _ towards it and the _ _ _ _ _ _ _ _ are closed. The motor in the _ _ _ _ _ _ circuit is now switched on.

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W.S.70. **Speed.**

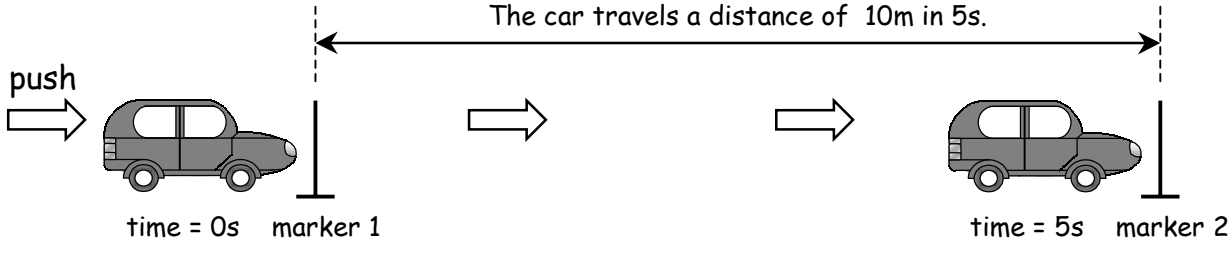
Name ……

The SPEED of a moving object is the DISTANCE it travels divided by the TIME that it takes.

SPEED = DISTANCE ÷ TIME or $\frac{\text{DISTANCE}}{\text{TIME}}$

Units for speed
metres per second (m/s)
miles per hour (mph)
kilometres per hour (km/h)

The example below shows how to work out the speed of a toy car.



The average speed of the car = $\frac{\text{distance}}{\text{time}}$ = $\frac{10\text{m}}{5\text{s}}$ = **2m/s**

Exercise 1 – Work out the answers to the problems below. REMEMBER UNITS.

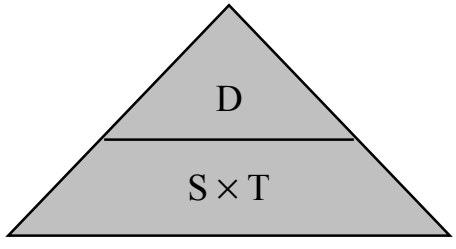
1) A sprinter runs 100m in 10 s. His average speed = $\frac{100\text{m}}{10\text{s}}$ = _____ m/s

2) A train travels 600km in 5 hours. Its average speed = $\frac{600\text{km}}{5\text{h}}$ = _____

3) A boy cycles 20 miles in 2 hours. His average speed = _____ = _____ mph

Working out distance and time.

You can use the formula triangle on the right to work out speed, distance or time. For example, if you wish to work out distance then place your finger over the distance part (D) and you will see that distance is speed × time (S × T).



Exercise 2 – Use the formula triangle to help you work out the problems below.

1) A car travels at 40 mph. What distance will it travel in 3 hours?

distance = _____ × _____ = 40 mph × 3 hours = _____

2) An athlete sprints at 10m/s. How long does it take him to complete a 200m race?

time = DISTANCE ÷ SPEED = _____ = _____

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W.S.71. Force and movement.

Name ……

A FORCE is a PUSH or PULL. Force is measured in NEWTONS (N). Forces can speed up or slow down objects. The diagrams below show how different forces can affect the movement of a car.

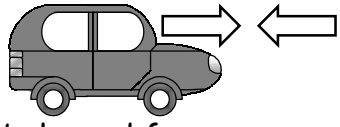
1. Force from the engine makes the car begin to move.

unbalanced force

2. As the car speeds up the force of air resistance gets bigger.

unbalanced force

3. The car reaches a steady speed when the two forces are equal.

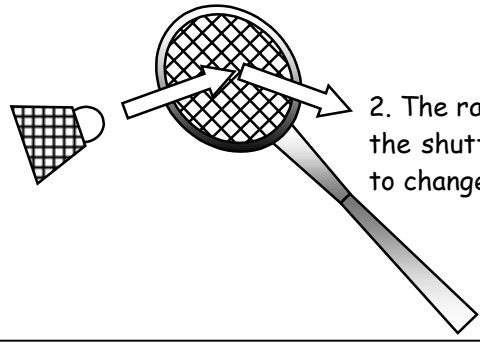


balanced force

When the force pushing against the car is the same size as the force from the engine the car stops accelerating and travels at a steady speed.

Forces can also make objects change direction. The diagram below shows this.

1. Shuttlecock moving in one direction hits the racket with a force.



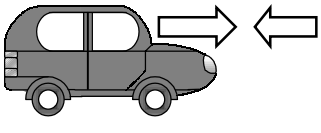
2. The racket gives a force to the shuttlecock and causes it to change direction.

The important rules from this are :

1. **Unbalanced forces change the speed and/or direction of moving objects.**
2. **Balanced forces produce no change in the movement of an object.**

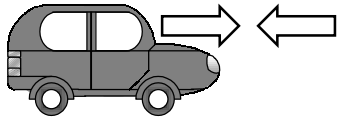
Exercise – Complete the sentences underneath each of the diagrams below.

Force from engine is 500N. Force of air resistance is 300N.



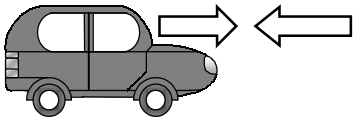
1) The car will _____

Force from engine is 500N. Force of air resistance is 500N.

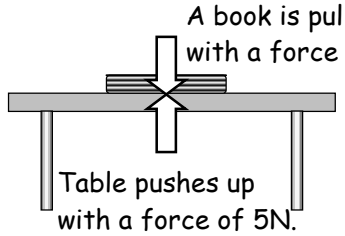


2) The car will _____

Force from engine is 500N. Force of air resistance is 700N



3) The car will _____



4) The book will not _____

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W.S.72. Friction.

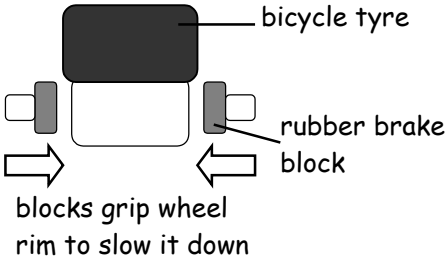
Name ……

Friction is a force that stops two surfaces sliding past each other. It is caused by tiny bumps on the surfaces which catch together.

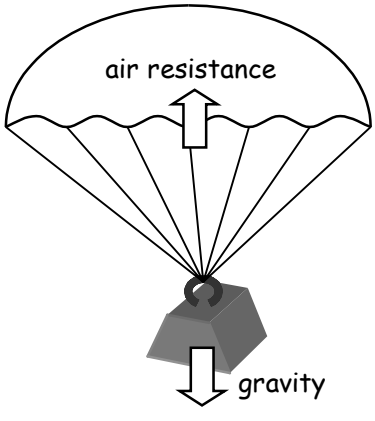
Uses of friction.

1. Friction gives grip for shoes and tyres. We could not move over the ground without friction.

2. Brakes on bicycles and cars use friction to slow down the wheels.



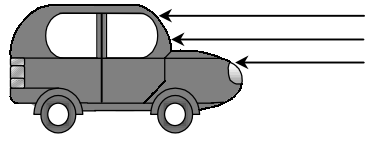
3. Air resistance is a type of friction that slows down parachutes.



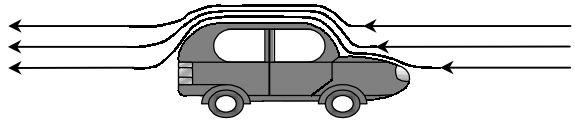
Problems caused by friction.

1. Friction slows down moving machinery. It can also make machinery over heat. Grease and oil must be used to reduce friction.

2. Air resistance is a type of friction that slows down vehicles. The faster the vehicle travels the greater the air resistance becomes. Car bodies are designed so that the air slips smoothly over the bonnet.



Poor design – air hits against bonnet and slows the car down. The engine must work hard to keep at a high speed.



Good design – air slips smoothly over the bonnet. The air resistance is low and the car travels at high speed easily.

Exercise – Complete the missing words in the passage below.

The force that stops two surfaces sliding past each other is called …… If there was no friction between our shoes and the ground our feet would …… when we tried to walk. Rubber brake blocks grip against the …… of a bicycle wheel in order to slow it down. A parachute reaches a steady speed when the force of …… pulling it down is balanced by the air resistance pushing …… Friction between the moving parts of machinery can cause it to over …… The friction can be …… by using oil or …… The …… a car moves the greater the air resistance is that pushes against it.

slip reduced friction faster heat rims gravity grease upwards

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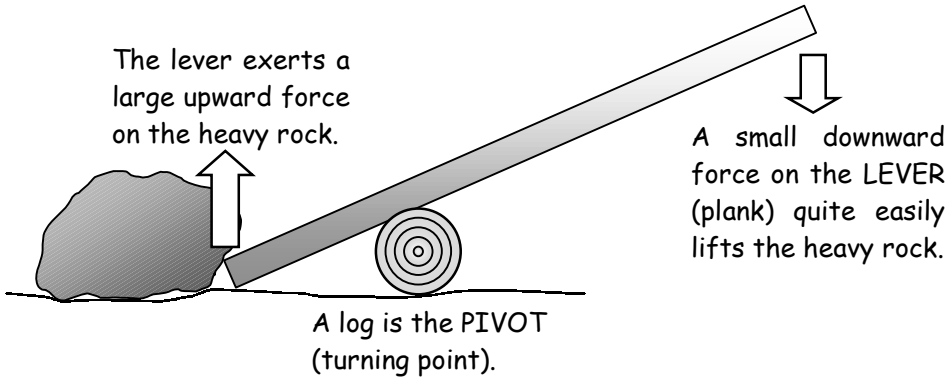
W.S.73. Turning forces.

Name ……

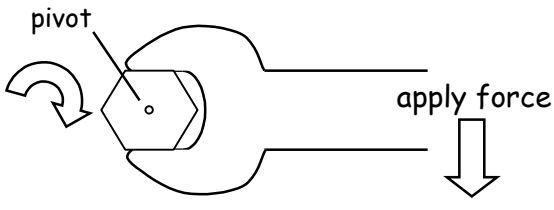
Forces can cause objects to turn around a pivot.



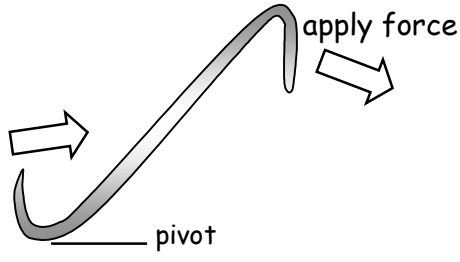
The important rule from this is :

The size of the turning force can be increased by increasing the length of the lever.

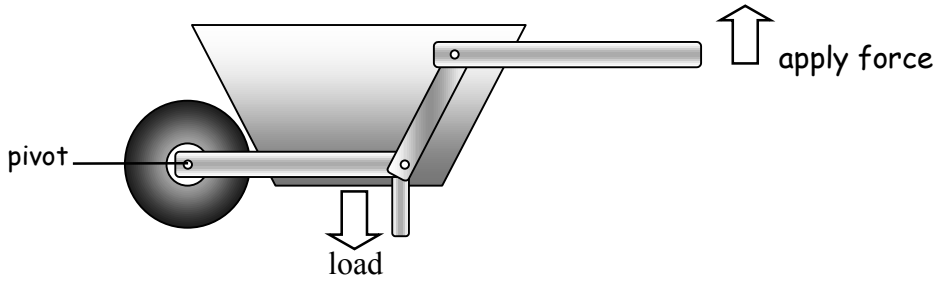
Some examples of how we use turning forces.



Using a spanner to loosen a nut.



Using a crowbar to force objects apart.



Using a wheelbarrow to carry heavy loads.

Exercise – Complete the sentences below.

1) A _ _ _ _ _ is a turning point.

2) A long _ _ _ _ _ makes it easy to move a heavy object.

3) The longer the lever the greater the _ _ _ _ _ _ _ _ _ _ _ _ _

4) A _ _ _ _ _ _ _ can be used to lever open a locked door.

5) A tight nut can be loosened easily if a _ _ _ _ spanner is used.

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W.S.74. Pressure.

Name ……

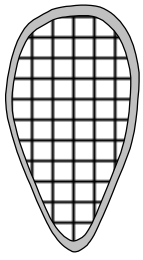
Pressure is the amount of force that is put onto a certain area.

$$\text{PRESSURE (N/m}^2\text{)} = \frac{\text{FORCE (N)}}{\text{AREA (m}^2\text{)}}$$

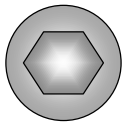
(Another unit for pressure is the pascal (Pa)
1 N/m² = 1 Pa)

Small pressure.

A force is spread over a **large** area.



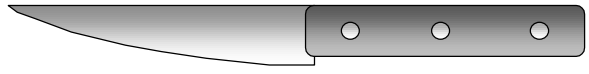
Snow shoes
These spread a person's weight over a large area which prevents them from sinking into soft snow.



Washers
A washer spreads the force from the nut which stops it being pulled into wood.

Large pressure.

A force is concentrated over a **small** area.

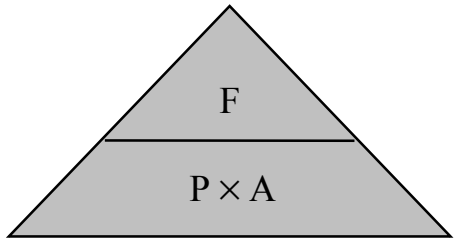


Knife edge – large pressure to cut into materials.

Stiletto heel
When all of the woman's weight is resting on the heel it produces a very large pressure. This can cause damage to floors with soft surfaces.

Working out force and area.

You can use the formula triangle on the right to work out pressure, force and area. For example, if you wish to work out force then place your finger over the force part (F) and you will see that force is pressure × area (P × A).



Exercise – Work out the answers to the questions below.

1) A man weighs 800N. The area of BOTH of his boots is 0.08m². What pressure does he place on the ground when he stands still?

$$\text{PRESSURE (N/m}^2\text{)} = \frac{\text{FORCE (N)}}{\text{AREA (m}^2\text{)}} = \frac{800\text{N}}{0.08\ \text{m}^2} = _____\ \text{N/m}^2$$

2) A woman weighs 500N. The area of ONE of her stiletto heels is 0.0002m². What pressure does she place on the ground when she puts her weight onto one heel?

$$\text{PRESSURE (N/m}^2\text{)} = \frac{\text{FORCE (N)}}{\text{AREA (m}^2\text{)}} = \frac{500\text{N}}{_____} = _____\ \text{N/m}^2$$

3) The base of a suitcase has an area of 0.2m². It places a pressure of 700N/m² on the ground. What must the weight of the suitcase be?

force is pressure × area (P × A) = 700N/m² × _____ m² = _____ N

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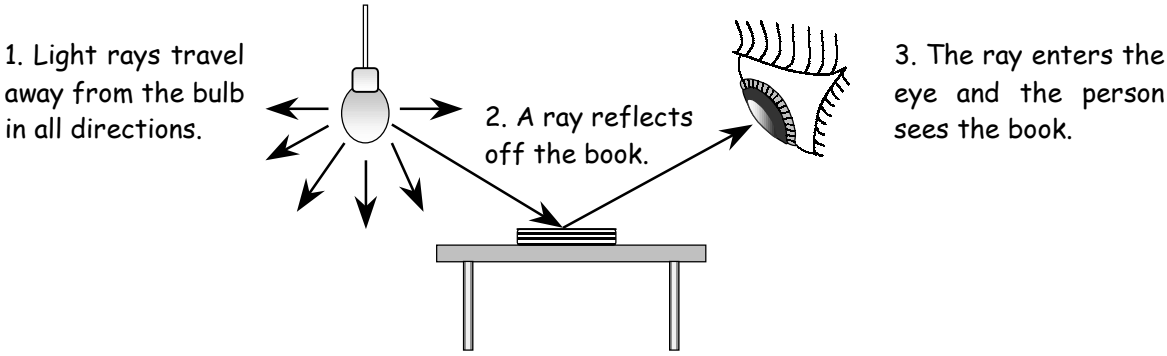
W.S.75. Reflection.

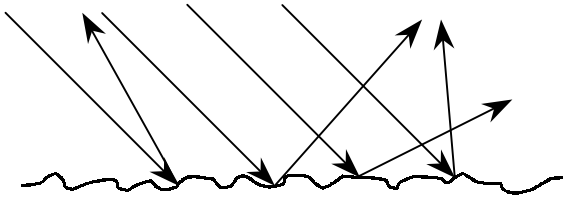
Name ……

We can see objects because light travels from them into our eyes. LUMINOUS objects make their own light, e.g. the Sun, a light bulb and a candle. Most objects do not make their own light. We see them because light bounces off them into our eyes. This is called REFLECTION.

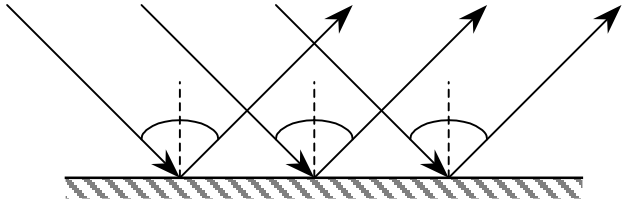


Mirrors.

Mirrors have a very smooth, shiny surface. All of the light rays bounce off them at the same angle. This is what makes a clear REFLECTION.



Light rays are reflected off the paper in all directions due to its rough surface.



Light rays hitting a mirror are all reflected at the same angle due to its smooth surface.

The rays that hit the mirror are called the INCIDENT RAYS. The diagram above shows that the **REFLECTED RAYS leave the surface of the mirror at the same angle that they came in at**.

Exercise – Complete the questions below.

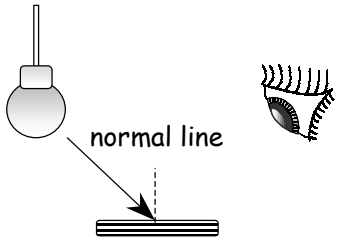
1) A L _ _ _ _ _ _ _ object gives off its own light.

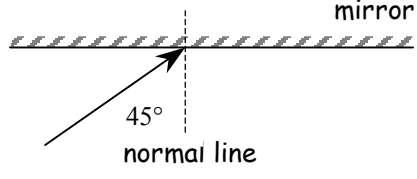
2) Underline the objects below that give off their own light.

TORCH BOOK CANDLE MIRROR GLOW WORM MOON SUN COIN FIREWORK

3) We can see our R _ _ _ _ _ _ _ _ _ _ in shiny, smooth surfaces.

4) Complete the diagrams below.





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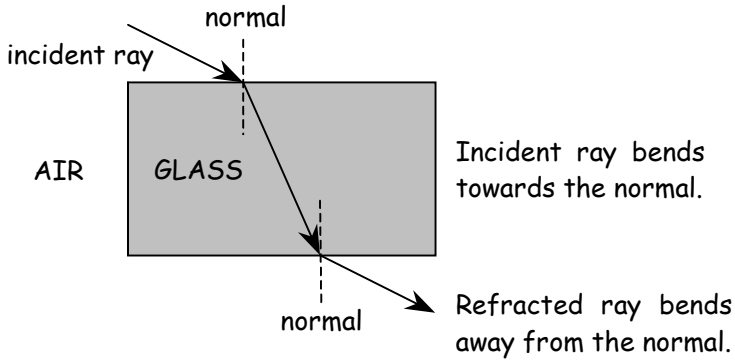
W.S.76. Refraction of light.

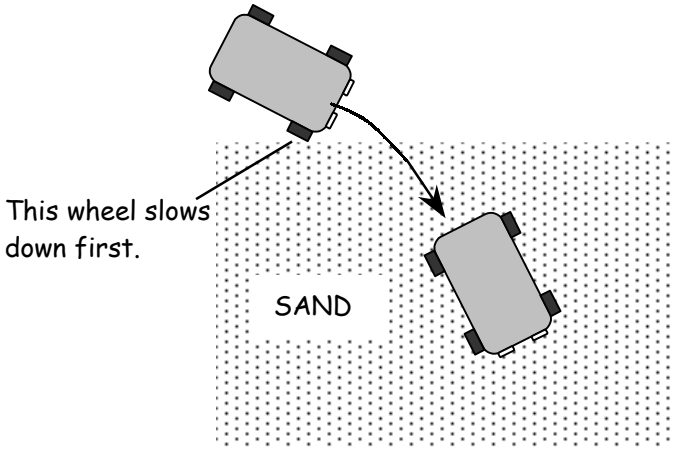
Name ……

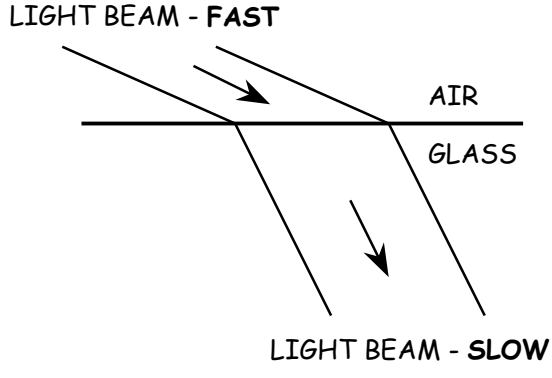
Any material that light can travel through is called a MEDIUM. When light rays travel from one medium to another they bend. This is called REFRACTION. The diagram shows how a ray of light bends as it travels from air, into a glass block, and out again.



How refraction happens.

The light bends because it travels more slowly in glass than it does in air. This can be compared to a car that travels more quickly on a road than it does on sand :





Exercise – Complete the sentences and diagram below.

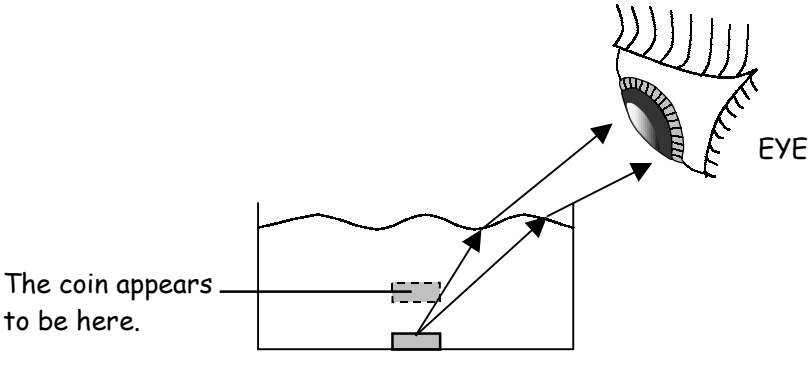
1) Any material that light can travel through is called a M _ _ _ _ _

2) The bending of light is called R _ _ _ _ _ _ _ _ _ _

3) Light travels more _ _ _ _ _ _ in glass than it does in air.

4) Light bends as it passes from air to glass because it changes _ _ _ _ _

Complete the diagram below to show why the coin appears higher in the water than it really is.



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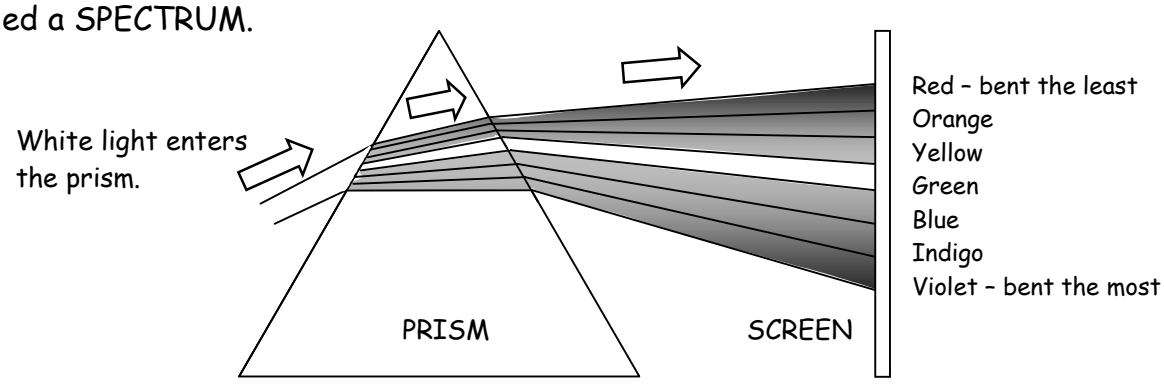
W.S.77. **The spectrum.**

Name ……

A PRISM is a triangular glass block. If a beam of white light is passed through a prism it is REFRACTED (bent). The light is also split up into seven different colours called a SPECTRUM.

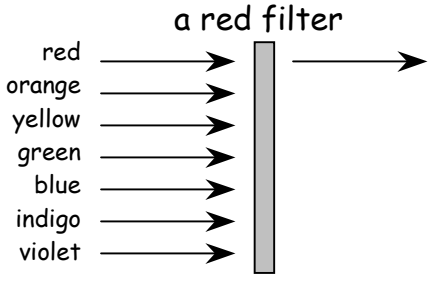


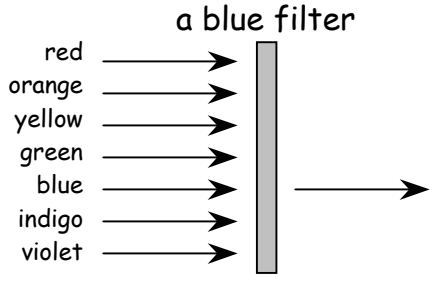
This spreading out of colours is called DISPERSION. It also happens when light hits rain drops which is how rainbows form. An easy way to remember the order that the colours appear in is to remember this rhyme :

Richard **O**f **Y**ork **G**ave **B**attle **I**n **V**ain.

The effect of coloured filters on white light.

A FILTER only allows one colour of light to pass through it. The filter ABSORBS the other colours so they do not pass through.





Exercise – Complete the sentences and diagram below.

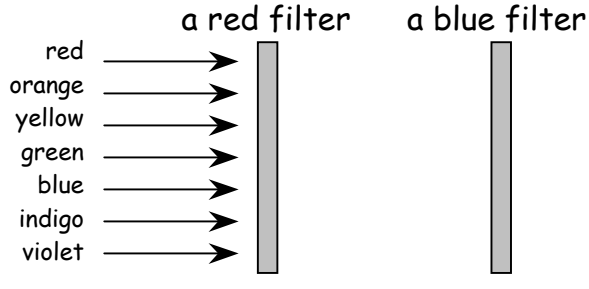
1) The range of colours in white light is called the S _ _ _ _ _ _ _

2) The spreading out of the seven colours is called D _ _ _ _ _ _ _ _ _ _

3) The colour that is bent the least by a prism is _ _ _

4) The colour that is bent the most by a prism is _ _ _ _ _ _

Complete the diagram below to show what would happen to the light as it meets the two filters.



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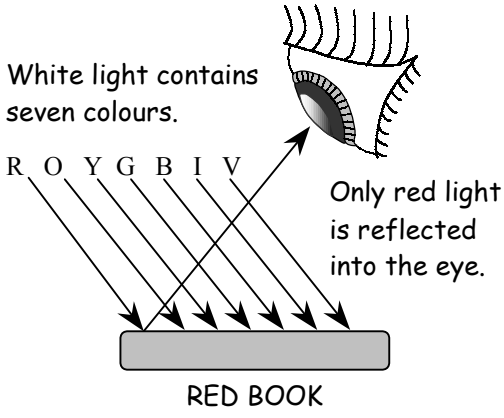
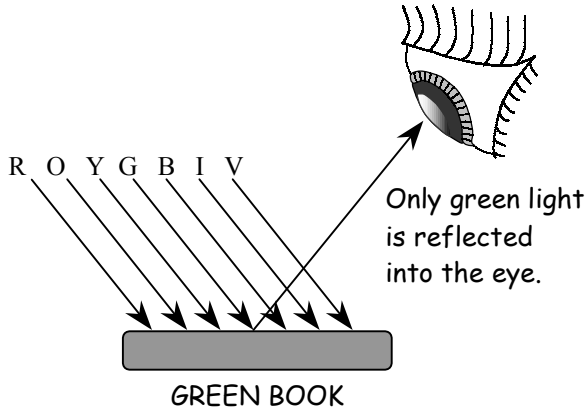
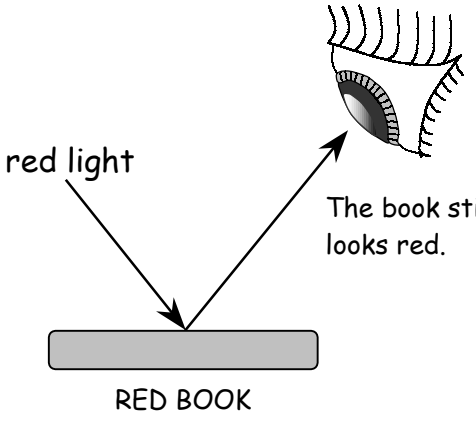
W.S.78. Coloured objects in coloured lights. Name .....

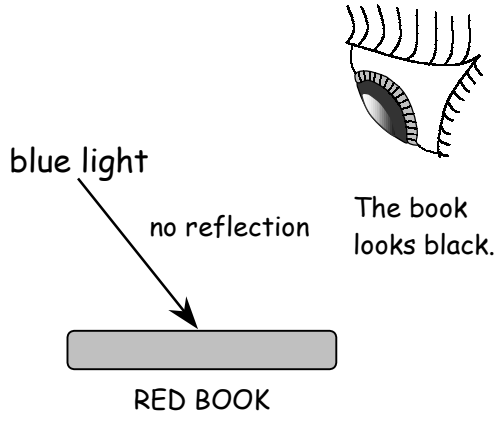
A white object reflects all seven colours of the spectrum. A red object looks red because it only allows red light to reflect off it. The rest of the colours of the spectrum are absorbed by the object.





In red light the red book still looks red because it reflects the red light. If the book is placed in any other colour of light it will absorb the light . No light is reflected off the book into the eye so it looks black.





The important rule from this is :

Coloured objects only reflect their own colour light.

Exercise – For the items of clothing in the table below write down the colours that they would look in the different lights shown. Some have been done for you.

Item of clothing	In white light	In red light	In green light	In blue light
white shirt			GREEN	
red tie	RED			
blue jeans				BLUE
green belt				BLACK

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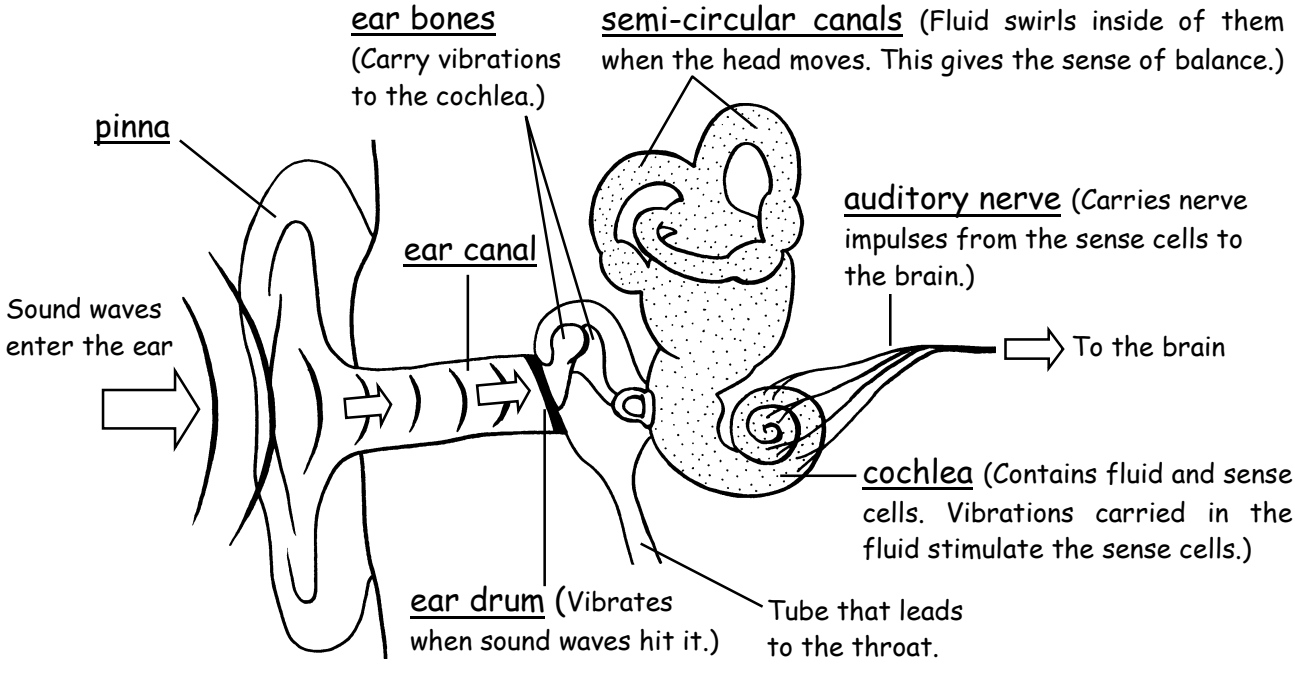
W.S.79. Hearing.

Name ……

We hear things when SOUND WAVES pass into our ears. The diagram below shows the parts of the human ear and how we hear.



Hearing ranges.

The range of pitches that a person can hear is called their HEARING RANGE. Different people have different hearing ranges. Young people can hear higher pitched sounds than older people. Young people can also hear quieter sounds.

Hearing damage.

The sense cells in the cochlea are very delicate. If a person is exposed to very loud noises over a long time the sense cells can become damaged and the person can become partially deaf. This is why people who work in very noisy places must wear ear protection. This is also the reason why it is dangerous to listen to personal stereos at too high a volume.

Exercise – Join up the parts of the ear with their correct descriptions below.

Part of ear	Description
ear drum	a tube that carries sound waves to the ear drum
ear canal	a tight sheet of skin that vibrates when sound waves hit it
auditory nerve	sends nerve messages to the brain
ear bones	contains the sense cells that detect vibrations
cochlea	pass the vibrations from the ear drum to the cochlea

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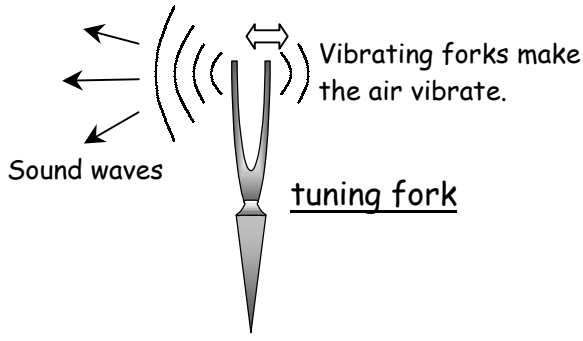
W.S.80. **Sound.**

Name ……

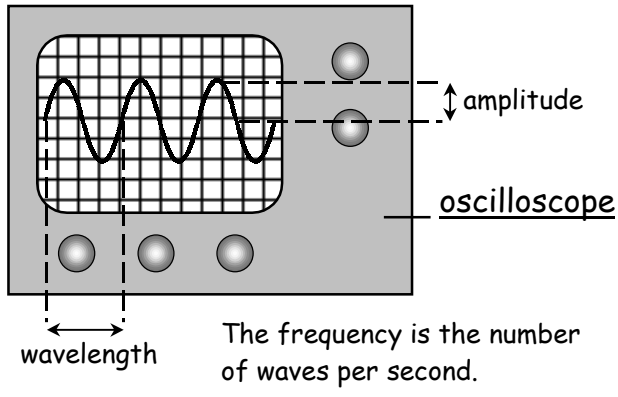
Sound waves.

Sound waves are made by vibrating objects. The diagram shows a tuning fork. The ends of the fork are vibrating (moving backwards and forwards) very quickly. This makes sound waves.



Loudness and pitch.

The diagram shows the shape of sound waves on an oscilloscope screen. The bigger the AMPLITUDE (height of the waves) the louder the sound. The greater the FREQUENCY (number of waves per second) the higher the PITCH. A short wavelength gives a high frequency.



Exercise 1 – Complete the sentences below.

1) Sounds are made by V _ _ _ _ _ _ _ _ objects.

2) Sound travels as W _ _ _ _

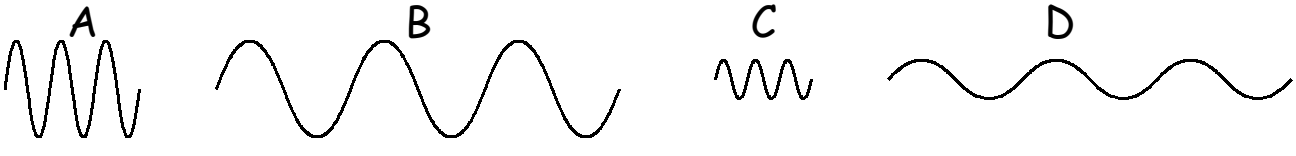
3) The A _ _ _ _ _ _ _ _ means the height of a sound wave.

4) The F _ _ _ _ _ _ _ _ means the number of waves in one second.

5) The greater the frequency the H _ _ _ _ _ the pitch.

6) The longer the wavelength the L _ _ _ _ the frequency.

Exercise 2 – Match the diagrams to their correct descriptions below.



HIGH PITCH AND QUIET = ___

HIGH PITCH AND LOUD = ___

LOW PITCH AND QUIET = ___

LOW PITCH AND LOUD = ___

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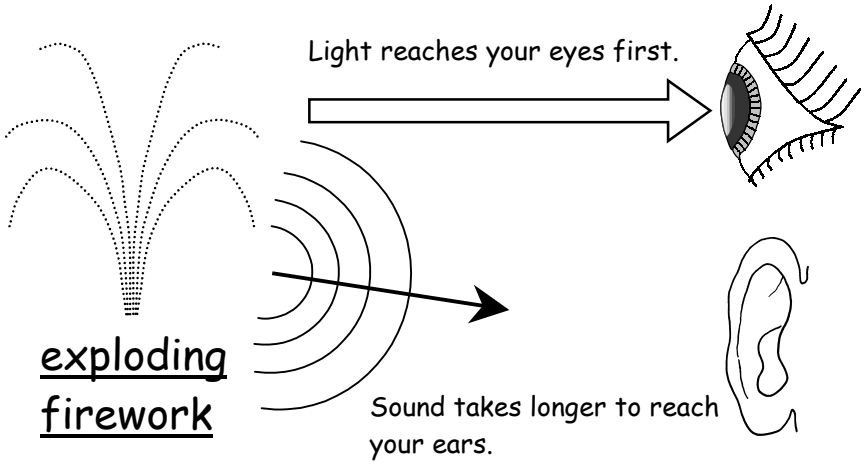
W.S.81. Comparing Light and Sound. Name ……

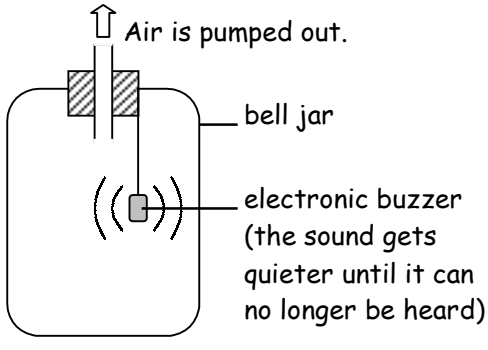
In air light travels at a speed of 300,000,000 metres per second. Sound travels much more slowly at a speed of about 330 metres per second. This is why we see an exploding firework before we hear it.



Light can only travel through TRANSPARENT materials such as water and glass. Sound must have a MEDIUM (substance) to travel through because something is needed to pass on the vibrations. Sound travels better through solids than it does through air.

Sound in a vacuum.

Sound can travel through solids, liquids and gases. The diagram shows a bell jar that contains an electronic buzzer. As the air is pumped out of the jar the sound of the buzzer becomes quieter. When there is no air left inside the jar (a vacuum) the buzzer cannot be heard because there is nothing to carry the vibrations. SOUND CANNOT TRAVEL THROUGH A VACUUM.



Exercise - Complete the sentences below.

1) The speed of light is much _____ than the speed of sound.

2) Light can only travel through _____ materials.

3) You _____ a firework before you _____ it.

4) Sound needs a _____ to travel through.

5) _____ cannot travel through a vacuum.

6) _____ can travel through a vacuum.

see light transparent hear sound faster medium

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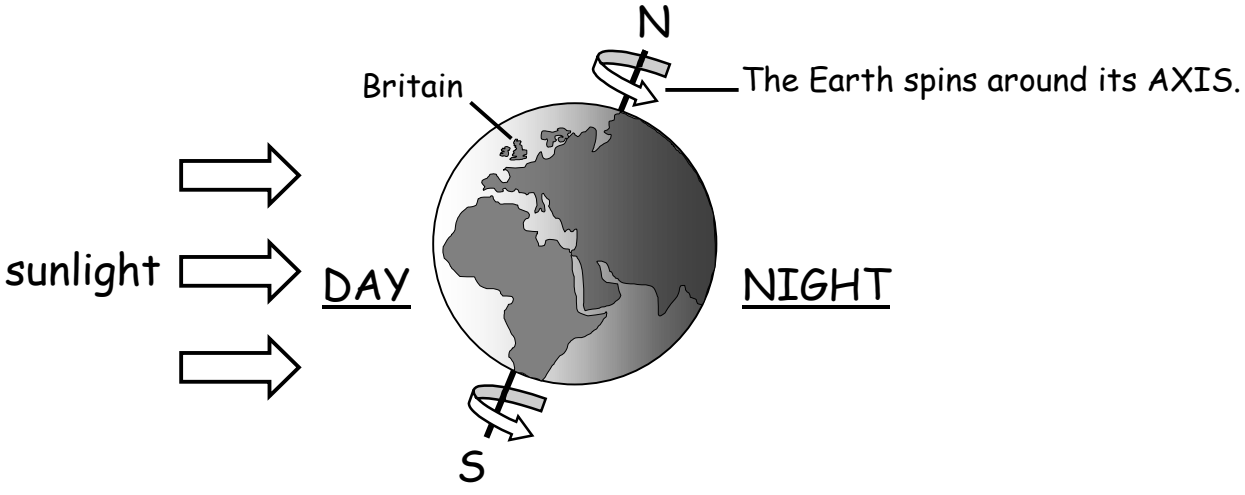
W.S.82. Day and night.

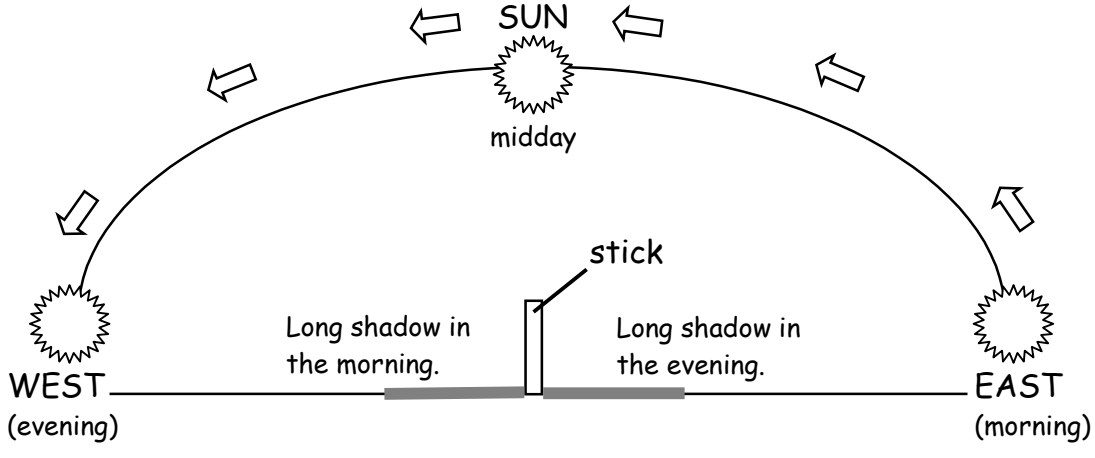
Name ……

The Earth spins around an imaginary line called its AXIS. The axis runs from the North to the South pole. The Earth turns once every twenty four hours (one day). During the day we face towards the Sun and at night we face away from the Sun.



Sunrise and sunset.

The Sun and other stars APPEAR to slowly move across the sky because the Earth is turning. The sun rises in the EAST and sets in the WEST.



Exercise – Complete the sentences below.

1) The imaginary line that the Earth spins around is called its _ _ _ _

2) It takes one _ _ _ for the Earth to turn once.

3) During the day we face _ _ _ _ _ _ _ the Sun.

4) The Sun rises in the _ _ _ _ and sets in the _ _ _ _

5) Our shadows are longest in the _ _ _ _ _ _ _ and in the evening.

6) At _ _ _ _ _ _ the Sun is at its highest in the sky.

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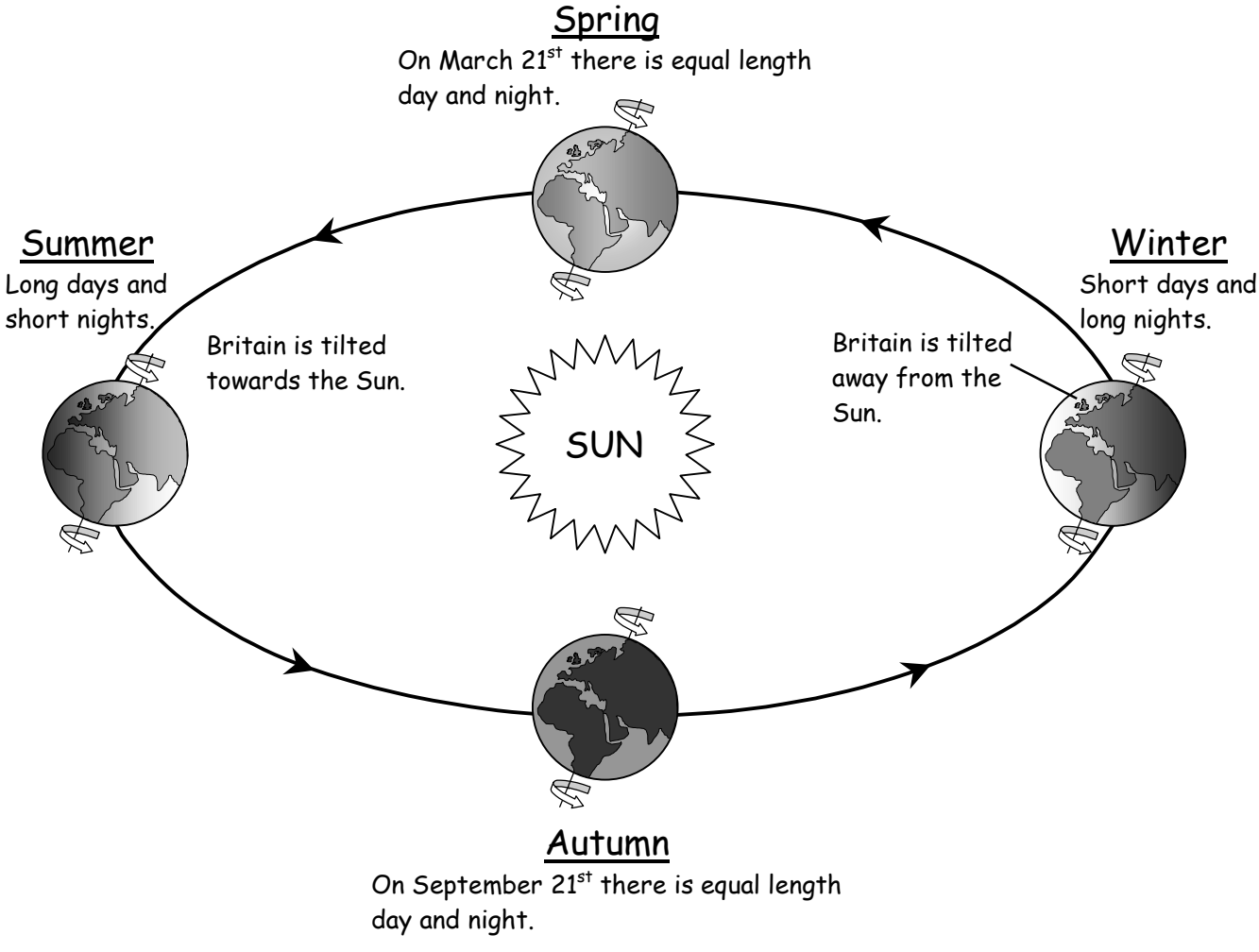
W.S.83. The seasons.

Name ……

It takes 365 days and 6 hours for the Earth to complete one orbit of the Sun. We make one year 365 days but every four years we need to add on an extra day to make up for the six extra hours. This is why a LEAP year has 366 days.
During a year in Britain the weather gradually changes from warm Summer to cold Winter and back again. The different SEASONS are caused by the tilt of the Earth on its axis. The diagram below shows how this happens.



Exercise – Study the diagram above and then try to complete the sentences below.

1) One complete circle around the Sun is called an _ _ _ _ _

2) It takes one _ _ _ _ for the Earth to orbit the Sun.

3) In _ _ _ _ _ _ the Sun is at its highest in the sky.

4) In _ _ _ _ _ _ the Sun is at its lowest in the sky.

5) In Summer the Northern Hemisphere is tilted _ _ _ _ _ _ _ the Sun.

6) Australia is in the _ _ _ _ _ _ _ _ Hemisphere so in December it is their _ _ _ _ _ _

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W.S.84. The solar system.

Name ……

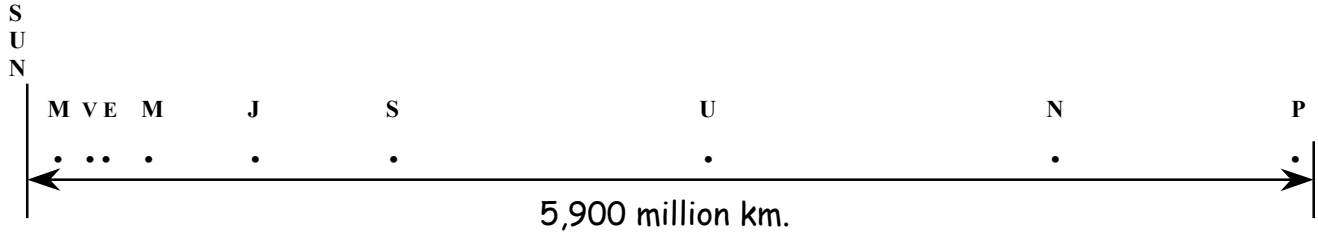
The Sun and other stars are sources of light. Planets orbit stars and do not make their own light. We can sometimes see the moon and some of the planets at night because they REFLECT light from the Sun. The SOLAR SYSTEM is our Sun together with the nine planets that orbit it. The order of the nine planets starting with the one closest to the Sun is :

Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune Pluto

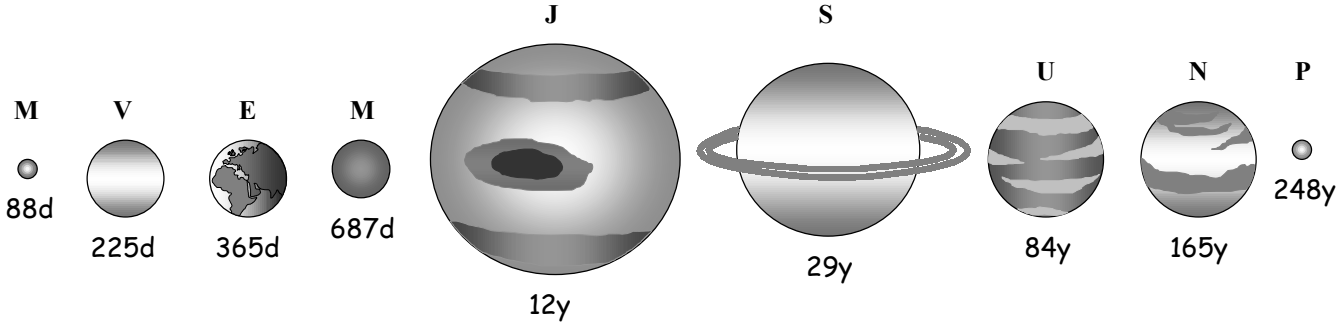
An easy way to remember the order of the planets is to remember this rhyme :

My Very Easy Method Just Speeds Up Naming Planets.

The diagram below gives an idea of how far the planets are from the Sun.



The diagram below shows how the planets compare in size. The length of each planet's year (orbit time) is also given underneath each one (d = days, y = years.)



THE FURTHER THE PLANET IS FROM THE SUN THE LONGER IT TAKES TO ORBIT.

Exercise – Complete the sentences below.

1) The planet that is closest to Earth is _ _ _ _ _

2) The largest planet is _ _ _ _ _ _ _

3) The further the planet is from the Sun the _ _ _ _ _ _ is its year.

4) The planet with a year about twice as long as Earth's is _ _ _ _

5) Planets that are close to the Sun have very _ _ _ _ temperatures.

6) The rings around _ _ _ _ _ _ are easily seen.

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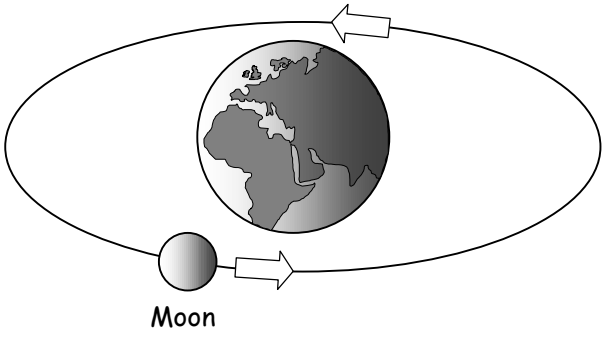
W.S.85. **Satellites.**

Name ……

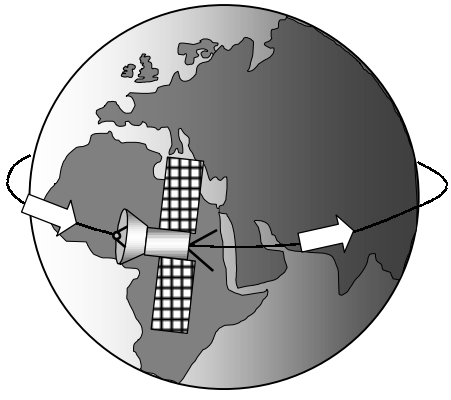
The planets are attracted towards the sun by an invisible force called GRAVITY. This is what keeps the planets in orbit. In the same way the Moon orbits the Earth because of the pull of gravity between them. Any object that travels around a planet in this way is called a SATELLITE. Humans have sent artificial satellites into space. These are very useful in several ways.

The Moon is our natural satellite.



The Moon travels anticlockwise around the Earth. It takes 27.3 days to complete one orbit. During this time the Moon changes from a full moon to nothing and then back to a full moon again. This happens because we only see the part of the Moon which reflects light from the Sun. The part that is in shadow does not show up. We see different amounts of the lit side as the Moon travels around the Earth. Early people used this cycle to keep track of the months.

Artificial satellites.



Artificial satellites have the following uses :

1. To observe and photograph the Earth.
2. To study weather systems.
3. To send radio and TV signals around the world.
4. To look deeper into Space. In Space there is no atmosphere (air) to cloud our view. The Hubble telescope is a satellite that has helped us to discover more about the Universe.

Exercise - Fill in the missing words in the passage below.

The Moon orbits the Earth because of the pull of …… Any object that orbits the Earth is called a …… The …… is the Earth's natural satellite. It takes about twenty seven days for the Moon to complete one …… During this time the Moon appears to change shape from a …… moon to nothing and then back again.
If a satellite is given too much …… it will escape into Space. If it has too little speed the force of gravity will pull it back down to …… The Hubble …… is a satellite that helps us to see much more clearly into Space. It can do this because in Space there is no …… to block our view.

Earth full air speed telescope gravity Moon satellite orbit

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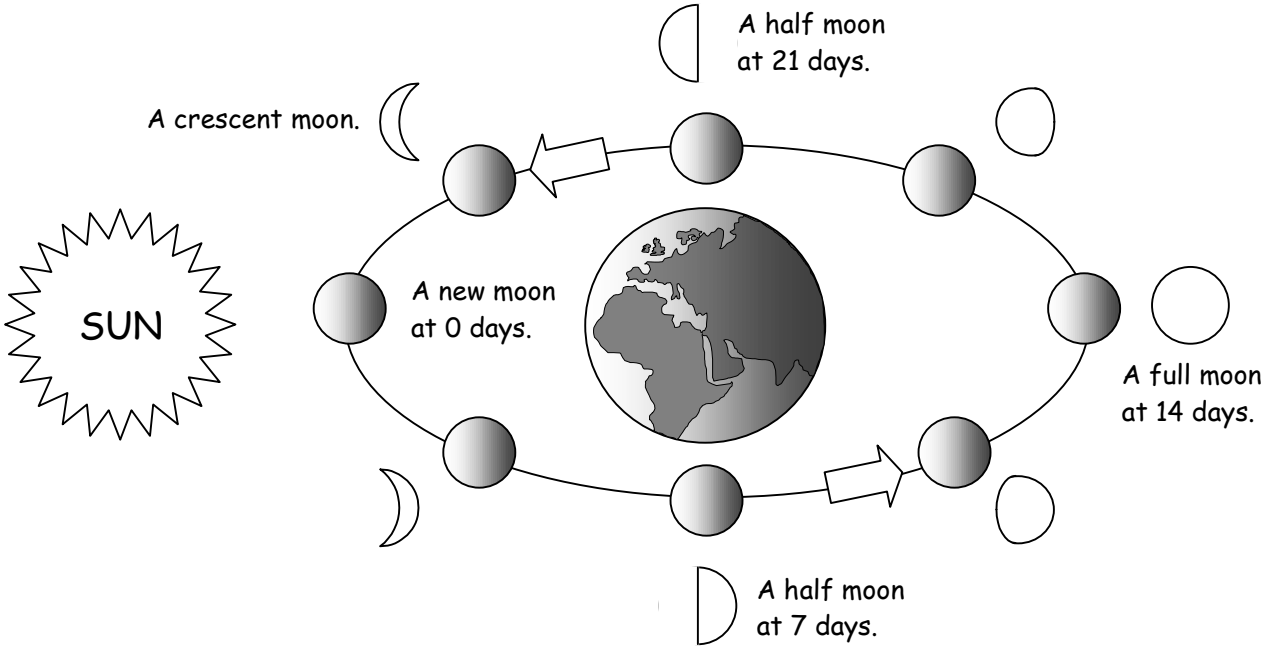
W.S.86. The Moon and its phases. Name ……

The Moon appears to change shape as it travels around the Earth. This happens because we only see the part of the Moon that reflects light from the Sun. The diagram below shows how this happens.



The changing appearance of the Moon is called its PHASES. The complete cycle from one new Moon to the next takes 29.5 days even though it only takes the Moon 27.3 days to completely orbit the Earth. The difference between these two times is because the Earth also slowly changes position as it orbits the Sun.

Gravity on the Moon.

The Moon has a much smaller mass than the Earth. This makes its pull of gravity six times smaller than the Earth's. This means that if you weigh 600N on Earth you would only weigh 100N on the Moon. This is why an astronaut feels very light on the Moon and can jump six times higher than they can on Earth. The bigger the mass of a planet the bigger its force of gravity.

Exercise – Complete the sentences below.

1) The changing appearance of the Moon is called its _ _ _ _ _ _

2) We cannot see the Moon when it is a _ _ _ Moon.

3) A _ _ _ _ Moon appears 14 days after a new Moon.

4) The Moon has a much smaller _ _ _ _ than the Earth.

5) You would weigh _ _ _ times less on the Moon.

6) The smaller a planet is the _ _ _ _ _ _ _ its gravitational force is.

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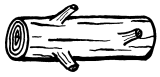
W.S.87. **Energy resources.** Name ……

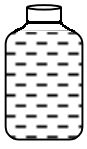
Most of the energy that we use to heat our homes and to power our machines comes from FOSSIL FUELS. These are coal, oil and natural gas. It takes millions of years for fossil fuels to form from the remains of dead plants and animals. We say that they are NON-RENEWABLE because once we have used them up we cannot replace them. In the future we will need to rely more upon RENEWABLE energy resources (those that will not run out).

Renewable energy resources.

Biofuels – from plants and animals.

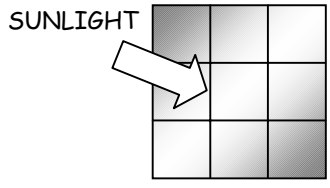


Wood can be burnt.



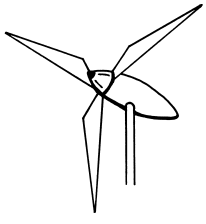
Alcohol can be made from plants and then used instead of petrol.

Solar power



Solar panels and solar cells capture the Sun's energy. It must be a sunny day.

Wind power

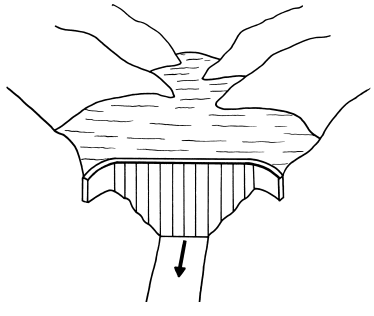


Sailing-boats use wind power to move them. Wind turbines are used to produce electrical energy. It needs windy weather.

Wave power

The movement of waves on the sea can be used to drive generators. This is expensive to set up.

Gravitational energy



Water is stored at a height in dams. As it rushes downhill gravitational energy is changed into moving energy. This can be used to turn turbines which produce electricity.

Exercise – Complete the sentences below.

1) Most of the energy we use comes from F _ _ _ _ _ fuels.

2) Fossil fuels are non-renewable because they cannot be R _ _ _ _ _ _ _

3) R _ _ _ _ _ _ _ _ energy resources do not run out.

4) Biofuels come from P _ _ _ _ _ and animals.

5) Weather conditions must be suitable to use W _ _ _ and solar power.

6) The energy in waves can be used but it is E _ _ _ _ _ _ _ _ to set up.

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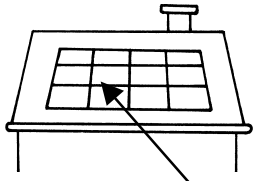
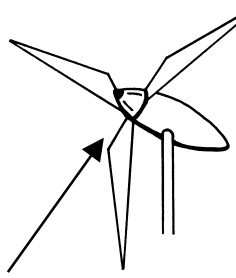
W.S.88. The Sun and energy resources. Name ……

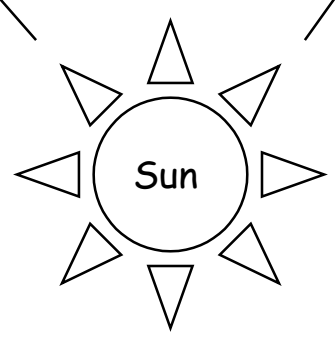
Most of the energy on Earth comes from the Sun. The diagram below shows how we can always trace energy resources back to energy from the Sun.

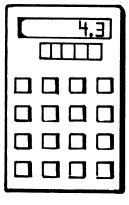
Solar panels absorb energy and use it to heat water.



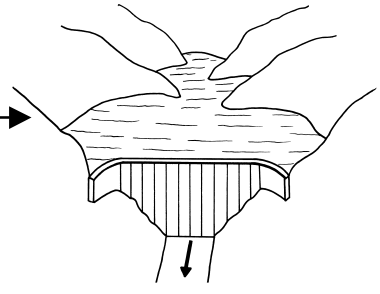


Heat is absorbed by the atmosphere and causes winds which can be used to turn wind turbines and produce electrical energy.



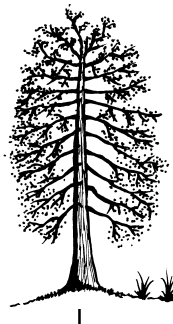


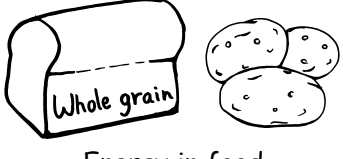
Solar cells absorb light energy and convert it into electrical energy.



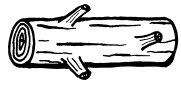
Heat absorbs water vapour from the oceans which then falls as rain onto the land. As water rushes down from dams it can be used to turn turbines which produce elecricity.

Plants trap light energy and store it in food.

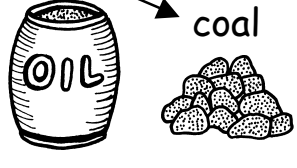




Energy in food.



Wood can be burnt as a fuel.



Fossil fuels form over millions of years.

Exercise – Complete the sentences below.

1) Plants absorb the Sun's E _ _ _ _ _ to make food.

2) Fossil fuels are formed from dead P _ _ _ _ _ and A _ _ _ _ _ _

3) S _ _ _ _ panels can be used to absorb heat directly from the Sun.

4) Solar C _ _ _ _ change light energy into electrical energy.

5) Winds are caused by H _ _ _ from the Sun.

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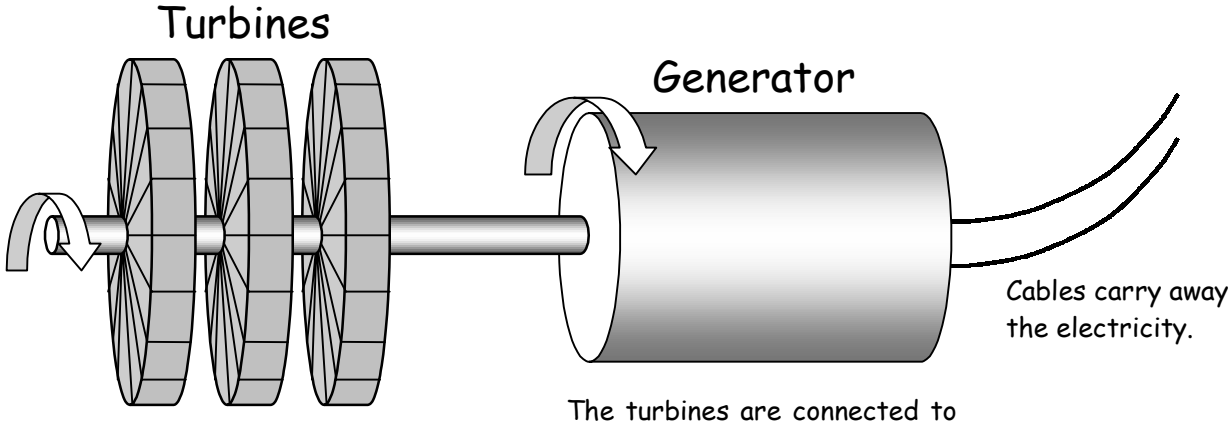
W.S.89. Generating electricity.

Name ……

Most people use electricity many times every day. Electricity is GENERATED (produced) in power stations before it is sent to homes and factories. A number of energy resources can be used to generate electricity. Large TURBINES that are connected to GENERATORS are made to turn. As the generators turn they produce the electricity. The diagram below shows how this works.



TURBINES are made to turn by some form of energy. This can be wind, moving water, or steam under high pressure.

The turbines are connected to a GENERATOR. As this spins around it generates electricity.

Many power stations burn coal to heat water. As the water boils steam is produced under high pressure. The turbines are pushed around by the force of the steam. Only about one third of the chemical energy inside the coal is changed into electrical energy. The other two thirds of the energy is lost to the surroundings as heat.
Some power stations use wind power to push the turbines around. In a HYDROELECTRIC power station water rushing downhill is used to turn the turbines.

Exercise – Complete the sentences below.

1) In order to generate electricity turbines must be made to _ _ _ _

2) In many power stations pressure from _ _ _ _ _ is used to turn the turbines.

3) Many power stations use _ _ _ _ as the fuel to heat water.

4) Coal powered electricity stations are wasteful because only about one _ _ _ _ _ of the chemical energy inside the coal is changed into electrical energy.

5) Hydroelectricity is generated by using energy from moving _ _ _ _ _

6) In the future _ _ _ _ and water power may become the main ways of generating electricity because they will never run out.

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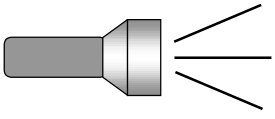
W.S.90. Energy changes.

Name ……

There are several forms of energy. These are :

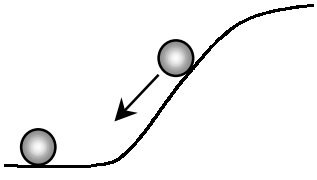
KINETIC ENERGY - movement energy.
GRAVITATIONAL ENERGY - energy stored in objects at a height.
ELASTIC ENERGY - energy stored in stretched objects e.g. a spring.
CHEMICAL ENERGY - energy stored in chemicals e.g. fuels, batteries and food. It is released by chemical reactions.
HEAT ENERGY
LIGHT ENERGY
SOUND ENERGY
ELECTRICAL ENERGY

Energy is always changing from one form into another. The diagram below shows the energy changes in a torch.

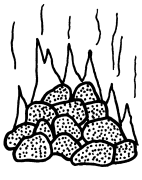


CHEMICAL ⟶ ELECTRICAL ⟶ HEAT + LIGHT

Exercise – Write down the energy changes for the objects below.

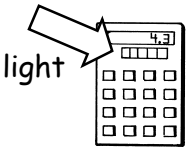


1) GRAVITATIONAL ⟶ ……



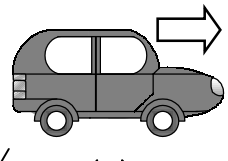
coal

2) …… ⟶ HEAT + ……

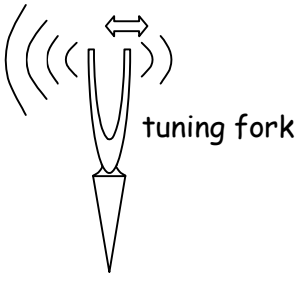


light

3) …… ⟶ ELECTRICAL



4) CHEMICAL ⟶ HEAT ⟶ ……



tuning fork

5) …… ⟶ SOUND

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Worksheet 1 Life processes.

Exercise 1 1) animals 2) energy 3) sensitivity 4) reproduce 5) excrete

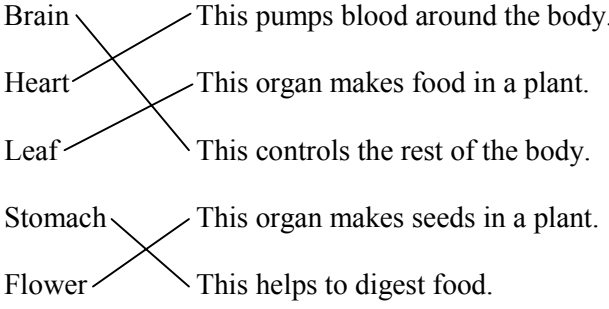
Exercise 2

Processes a car does show	Processes a car does not show
movement	growth
nutrition (takes in petrol)	**sensitivity**
respiration	**reproduction**
excretion	

Worksheet 2 Plant and animal organs.

Exercise 1 type organs body jobs healthy plants system intestines

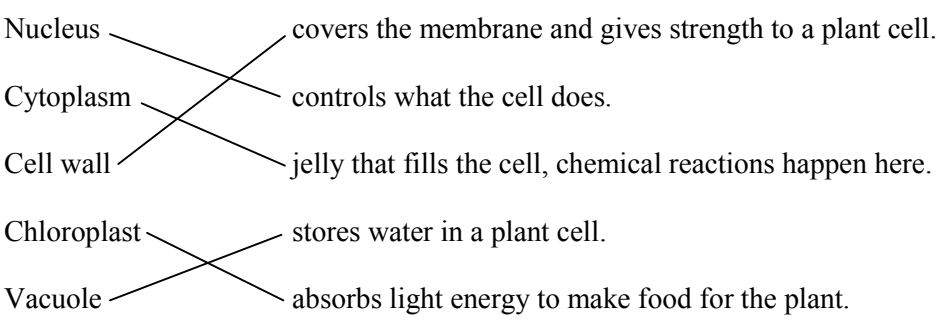
Exercise 2



Worksheet 3 Animal and plant cells.

Exercise 1 animals cells single millions types parts

Exercise 2



Worksheet 4 Different cells for different jobs.

Exercise 1 nucleus different size adapted body job better

Exercise 2 palisade cell ciliated cell root hair cell sperm cell

Worksheet 5 A balanced diet.

Exercise 1 healthy types fats correct starch energy warm protein vitamins intestines

Exercise 2 potato – carbohydrate, fish – protein, fruit – vitamins, minerals and fibre,
sausages – protein and fat, whole grain bread – carbohydrate and fibre,
milk – protein and minerals, chicken – protein, cake – carbohydrate

Worksheet 6 Food and digestion.

Exercise 1 repair energy heat cells digestive intestines

Exercise 2 **clockwise from top right :**

gullet stomach pancreas small intestine rectum anus appendix large intestine
liver gall bladder salivary gland tongue

Worksheet 7 Stages of digestion.

mouth gullet stomach small intestine pancreas liver large intestine appendix rectum

Worksheet 8 Blood.

plasma red dissolved oxygen germs platelets cut scabs

Worksheet 9 The blood system.

1) vessels 2) veins 3) pump 4) heart 5) walls 6) cells 7) waste

Worksheet 10 Moving the body.

1) fibres 2) shortens 3) tendons 4) push 5) pairs 6) biceps 7) triceps

Worksheet 11 Growing up.

Exercise 1 children puberty body attracted hormone changes oestrogen

Worksheet 12 The human reproductive system.

sperm tube penis duct swim urine ova month oviducts food

Worksheet 13 The menstrual cycle.

1.) month 2) ovulation 3) 14 days 4) feeds 5) die 6) uterus

Worksheet 14 Ovulation and fertilisation.

1) ovulation 2) fertilisation 3) oviduct 4) divide 5) cells 6) uterus

Worksheet 15 The developing baby.

1) foetus 2) amnion 3) protects 4) oxygen 5) waste 6) umbilical cord

Worksheet 16 Breathing (1).

oxygen trachea cartilage bronchus alveoli capillaries blood

Worksheet 17 Breathing (2).

1) muscle 2) inhale 3) exhale 4) contract 5) volume 6) decrease 7) relax 8) increase

Worksheet 18 Keeping the lungs clean.

1) mucus 2) hairs 3) acid 4) beating 5) oxygen 6) cancer

Worksheet 19 Respiration.

Exercise 1 oxygen on left-hand side, water and carbon dioxide and on right-hand side

Exercise 2 1) energy 2) move 3) glucose 4) burning 5) carbon dioxide 6) breathing 7) oxygen

Worksheet 20 Drugs and health.

addict reactions alcoholic liver nervous lung hallucinate dangerously solvents

Worksheet 21 Germs and health.

1) inside 2) small 3) cells 4) poisonous 5) viruses 6) living 7) DNA

Worksheet 22 Fighting germs.

harmless defend skin breathed trachea swallowed stomach phagocytes eat antibodies vaccine medicines

Worksheet 23 Photosynthesis.

1) food 2) light 3) leaf 4) carbon dioxide 5) chlorophyll 6) respiration 7) oxygen

Worksheet 24 Plant nutrition.

elements dissolved hair stem increase magnesium nitrogen root

Worksheet 25 Classification.

groups features chlorophyll roots spores cones

Worksheet 26 Flowering plants.

seeds pollen insects nectar scented coloured join ovules fruit disperse

Worksheet 27 Animals without backbones (1).

1) vertebrates 2) invertebrates 3) tentacles 4) tapeworm 5) segments 6) snail 7) spines

Worksheet 28 Animals without backbones (2).

1) arthropods 2) insect 3) six, four 4) eight 5) sting 6) shrimps 7) segments

Worksheet 29 Animals with backbones.

gills reptiles amphibians damp birds feathers wings mammals hair milk

Worksheet 30 Variation

1) variation 2) continuous 3) height 4) genes, environment 5) ovum 6) growth 7) minerals

Worksheet 31 Selective breeding.

1) changed 2) features 3) fastest 4) tallest 5) evolution 6) selection

Worksheet 32 A place to live.

Exercise 1 shark – ocean, buttercup – meadow, newt – pond, monkey – jungle, fox - woodland

Exercise 2 1) habitat 2) adaptation 3) waterproof 4) environment 5) water

Worksheet 33 Changing habitats.

Exercise 1 nocturnal hibernation migrate

Exercise 2 changing cold nocturnal food thicker fat energy

Worksheet 34 Food chains and pyramids of numbers.

plants animals eaten predators prey greater food fewer

Worksheet 35 Food webs.

TADPOLE SMALL FISH

1) large fish, grebes 2) tadpoles 3) small fish, newts 4) water louse

5) tadpole, water snail, water louse 6) large fish, grebe

Worksheet 36 Poisoned food chains.

1) pesticides 2) chains 3) birds 4) poisoned 5) streams, ponds 6) biological

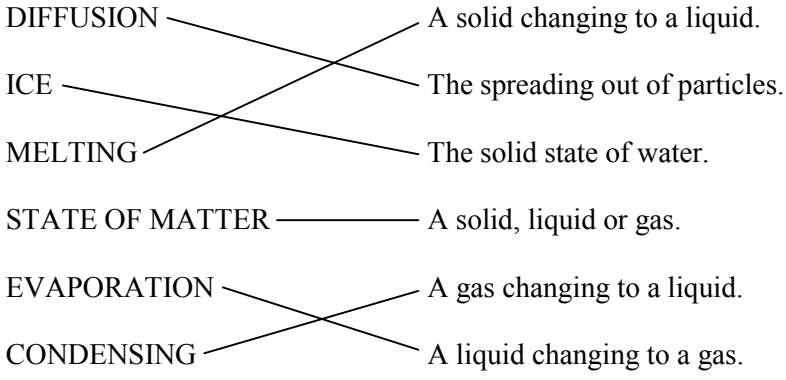
Worksheet 37 Populations.

population grow food greater die prey killed survive size deaths

Worksheet 38 Solids, liquids and gases.

Property	Solids	Liquids	Gases
Density	High density	**High density**	Low density
How easy are they to compress?	Hard	**Hard**	Easy
Do they flow?	**No**	Yes	Yes
Do they keep the same shape?	**Yes**	No	**No**
Do they keep the same volume?	Yes	**Yes**	**No**

Worksheet 39 Changes of state.



Worksheet 40 Elements.

1) element 2) atom 3) nucleus 4) negative 5) positive 6) protons

Worksheet 41 The periodic table.

properties protons hydrogen oxygen reactive magnetic halogens noble two five

Worksheet 42 Compounds.

Exercise 1 C oxygen NaCl

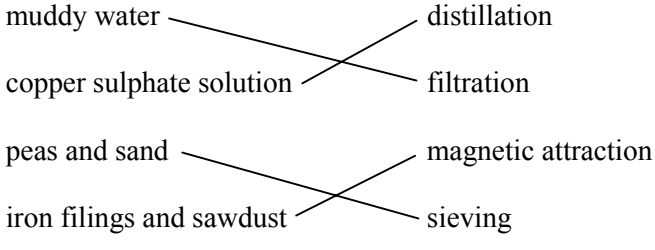
Exercise 2 chemical physical chemical physical

Worksheet 43 Separating mixtures.

Filtration water sand paper

Distillation water cooled flask

Chromatography paper speeds



Worksheet 44 Metals and non-metals.

Exercise 1 iron – metal bromine – non-metal copper – metal sulphur – non-metal

Exercise 2 1) mercury 2) graphite 3) magnetic 4) metals

Worksheet 45 Changes of state.

1) gas 2) ethanol 3) sulphur 4) 119 °C 5) 1,540 °C 6) oxygen 7) lower

Worksheet 46 Solubility.

Exercise 1 dissolves solvent gloss water spirit

Exercise 2 1) dissolve 2) saturated 3) more

Worksheet 47 Expansion.

expand contract vibrate apart buckle snap thermometer scale

Worksheet 48 Rocks and weathering.

1) weathering 2) rain 3) sand 4) contraction 5) expands

Worksheet 49 The rock cycle.

sediments transported layers sedimentary mudstone metamorphic magma eruptions igneous

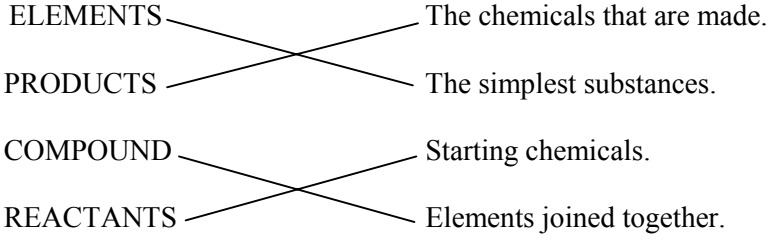
Worksheet 50 Types of rock.

1) magma 2) large 3) sediments 4) strata 5) crumble 6) heat 7) marble

Worksheet 51 Chemical reactions.

Exercise 1 1) equal 2) properties 3) heat 4) reverse

Exercise 2



Worksheet 52 Types of chemical reaction.

Exercise 1 join breaks oxygen

Exercise 2 1) synthesis 2) decomposition 3) oxidation

Worksheet 53 Burning.

1) oxygen 2) carbon dioxide 3) energy 4) splint 5) fuel 6) air 7) heat

Worksheet 54 Products from chemical reactions.

1) reactions 2) metal 3) carbon 4) mixture 5) nylon

Worksheet 55 Harmful chemical reactions.

rusting water coating air paint oxidised taste cool oxidation

Worksheet 56 Energy from chemical reactions.

1) energy 2) light 3) electrical 4) global 5) coal 6) acid

Worksheet 57 Reactivity of metals.

1) potassium 2) gold 3) acid 4) magnesium 5) gold 6) steam

Worksheet 58 Displacement reactions.

Exercise 1 COPPER + SILVER NITRATE (colourless) ⟶ COPPER **NITRATE** (blue) + SILVER

Copper is **more** reactive than silver therefore it displaces silver in the solution.

Exercise 2 oxygen copper less

Worksheet 59 Acids and alkalis.

1) corrosive 2) metals 3) red, blue 4) strong 5) weak

Worksheet 60 Acids and metals

1) copper 2) salt 3) faster 4) hydrogen 5) explosive 6) hydrogen 7) acid 8) salt

Worksheet 61 Acids and bases.

1) base 2) alkalis 3) salt 4) chloride 5) oxygen 6) carbon dioxide 7) fizz

Worksheet 62 Neutralisation.

hydrochloric indigestion alkali acidic bicarbonate vinegar rain limestone powdered

Worksheet 63 Acid rain.

1) sulphur 2) coal 3) electricity 4) rain 5) die 6) minerals 7) metals

Worksheet 64 Electric current and voltage.

current voltmeter twice brighter positive flow

Worksheet 65 Series and parallel circuits.

Exercise 1 Bulbs in series small resistance ammeter

Bulbs in parallel voltage larger bright

Exercise 2 1) go out 2) brighter 3) B

Worksheet 66 Electrical resistance.

filament current resistance heat copper more high size lights volume

Worksheet 67 Magnets.

Exercise 1 1) attract 2) repel 3) repel

Exercise 2 A and C

Worksheet 68 Electromagnets.

1) field 2) stronger 3) solenoid 4) more 5) electromagnet

Worksheet 69 Uses of electromagnets.

An electric bell. coil arm gong off

Sorting scrap metal steel cable off

Electromagnetic switches relay input lever contacts output

Worksheet 70 Speed.

Exercise 1 1) 10 m/s 2) 120 km/h 3) 10 mph

Exercise 2 1) $S \times T = 40 \text{ mph} \times 3\text{h} = 120 \text{ miles}$

2) $\frac{D}{S} = \frac{200\text{m}}{10\text{m/s}} = 20\text{s}$

Worksheet 71 Force and movement.

1) speed up
2) travel at a steady speed
3) slow down
4) move

Worksheet 72 Friction

friction slip rims gravity upwards heat reduced grease faster

Worksheet 73 Turning forces.

1) pivot 2) lever 3) turning force 4) crowbar 5) long

Worksheet 74 Pressure.

1) 10,000N/m^2 2) 2,500,000N/m^2 3) 140N

Worksheet 75 Reflection.

1) luminous 2) torch, candle, glow worm, Sun, firework 3) reflection

4) diagrams are drawn to show that the angle of reflection = the angle of incidence

Worksheet 76 Refraction of light.

1) medium 2) refraction 3) slowly 4) speed light rays traced back to where the coin appears to be

Worksheet 77 The spectrum.

1) spectrum 2) dispersion 3) red 4) violet

only the red light passes through the red filter but it does not pass through the blue filter.

Worksheet 78 Coloured objects in coloured lights.

Item of clothing	In white light	In red light	In green light	In blue light
white shirt	**white**	**red**	green	**blue**
red tie	red	**red**	**black**	**black**
blue jeans	**blue**	**black**	**black**	blue
green belt	**green**	**black**	**green**	black

Worksheet 79 Hearing.

Part of ear	Description
ear drum	a tube that carries sound waves to the ear drum
ear canal	a tight sheet of skin that vibrates when sound waves hit it
auditory nerve	sends nerve messages to the brain
ear bones	contains the sense cells that detect vibrations
cochlea	pass the vibrations from the ear drum to the cochlea

Worksheet 80 Sound

Exercise 1 1) vibrating 2) waves 3) amplitude 4) frequency 5) higher 6) lower

Exercise 2 HIGH PITCH AND QUIET = C HIGH PITCH AND LOUD = A

LOW PITCH AND QUIET = D LOW PITCH AND LOUD = B

Worksheet 81 Comparing light and sound

1) faster 2) transparent 3) see, hear 4) medium 5) sound 6) light

Worksheet 82 Day and night.

1) axis 2) day 3) towards 4) East, West 5) morning 6) midday

Worksheet 83 The seasons.

1) orbit 2) year 3) summer 4) winter 5) towards 6) southern, summer

Worksheet 84 The solar system.

1) Venus 2) Jupiter 3) longer 4) Mars 5) high 6) Saturn

Worksheet 85 Satellites.

gravity satellite Moon orbit full speed Earth telescope air

Worksheet 86 The Moon and its phases.

1) phases 2) new 3) full 4) mass 5) six 6) smaller

Worksheet 87 Energy resources.

1) fossil 2) replaced 3) renewable 4) plants 5) wind 6) expensive

Worksheet 88 The Sun and energy resources.

1) energy 2) plants, animals 3) solar 4) cells 5) heat

Worksheet 89 Generating electricity.

1) turn 2) steam 3) coal 4) third 5) water 6) wind

Worksheet 90 Energy changes.

1) GRAVITATIONAL ⟶ **KINETIC / MOVEMENT**

2) **CHEMICAL** ⟶ HEAT + **LIGHT**

3) **LIGHT** ⟶ ELECTRICAL

4) CHEMICAL ⟶ HEAT ⟶ **KINETIC / MOVEMENT**

3) **MOVEMENT** ⟶ SOUND