MEADOW PARK SCHOOL

Combined Science H Revision

Biology Topics	Chemistry Topics	Physics Topics
Homeostasis Inheritance Infection and Response	Rates of Reaction Organic Chemistry Atomic Structure & Periodic table Structures of Bonding	Forces Waves Magnetism Particles

How to use this booklet?

This booklet contains the knowledge organisers and knowledge tests to help you revise for your mock exams. Write the answer to every question. Then rehearse the knowledge by testing yourself on the questions without looking at the answers.

AQA GCSE Biology (Combined Science) Unit 5: Homeostasis and Response Knowledge Organiser

Homeostasis

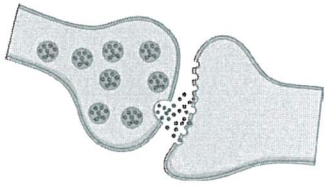
Homeostasis is the regulation of a **constant internal environment**. The conditions are maintained to ensure optimum conditions for metabolism and changes in response to both internal and external fluctuations.

In humans, homeostasis regulates the **blood glucose** (sugar) levels, the body **temperature, CO_2** levels and **water** levels.

The levels are monitored and regulated by automatic control systems which can be either nervous responses (coordinated by the **nervous system**) or chemical responses (coordinated by the **endocrine system**). Information about the environment is called a **stimulus** and is detected by a **receptor**. The information is processed by a **central coordination** system and a response is initiated by an **effector**.

Synapses

A **synapse** is the gap where the ends of two neurons meet.



The information needs to be passed from one neuron to the next, but cannot be passed as an electrical impulse over the synapse (gap). Instead, the message is transmitted by chemical neurotransmitters.

When the electrical impulse arrives at the terminal of the first neuron, it causes a release of neurotransmitter chemicals into the synapse. They travel across the gap and bind to receptor sites on the terminal of the next neuron.

The receptor sites are specific for each type of neurotransmitter. A nerve impulse will only be created in the second neuron when a complimentary chemical binds.

The Nervous Pathway

A stimulus is a change in the environment (internally or externally). In a typical response to stimuli, this information is received by the receptor and sent as an electrical impulse along a sensory neuron towards the central nervous system (CNS). The CNS is comprised of the brain and spinal cord. Here, the impulse is passed through relay neurons and a response to the stimulus is coordinated. This could be consciously or subconsciously. The CNS sends information about the response along a motor neuron as an electrical impulse. The effector receives the impulse and carries out the response.

[stimulus] → receptor → sensory neuron → CNS → motor neuron → effector → [response]

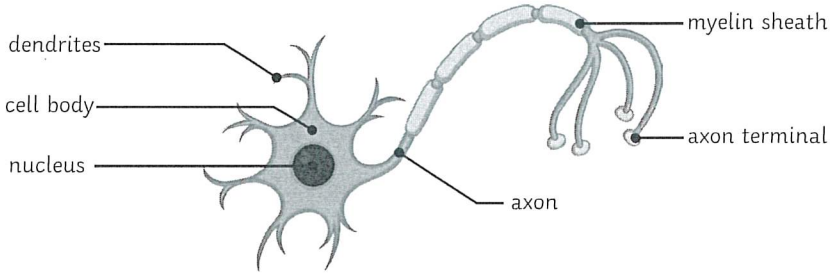
Examples of receptors include rod and cone cells within the eye which respond to light and allow us to see. Or it could be the cells in the skin which respond to pressure or temperature changes allowing us to feel.

An effector could be a muscle or a gland. In response, a muscle might contract to make a movement or a gland releases a chemical into the body.

The Human Nervous System

The nervous system allows a fast, short-lived response to a stimulus in the surroundings. The information is received by a receptor, passed along the neurons (nerve cells) as an electrical impulse and results in a response.

You might have to label the parts of a typical neuron:



- The axon is the main part of the nerve cell. It is a long, stretched-out fibre of cytoplasm which the electrical impulse will travel along.
- Some axons are surrounded in a layer of fatty cells called the myelin sheath and it helps to insulate the electrical impulse.
- The branched endings, dendrites, connect the neurons together to create a network.

sensory neuron	relay neuron	motor neuron
		

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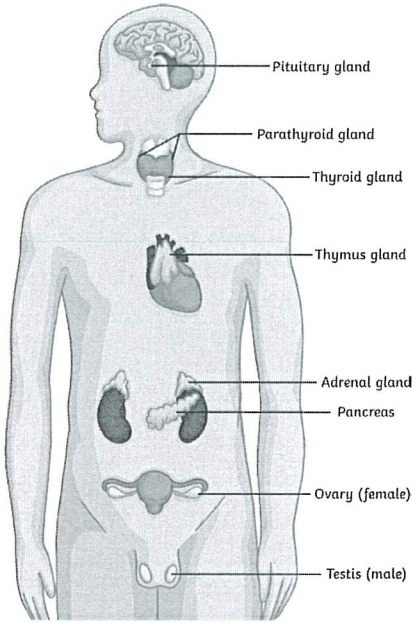
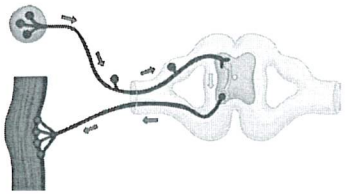
The Endocrine System

You should be able to identify the major glands of the endocrine system, as shown below.



Reflexes

A **reflex** is a fast and automatic response to a particular stimulus which may be harmful to the organism. They are quick because there is no conscious thought or process to deliver the response (they are an **involuntary** action). The pathway which carries the information about a reflex action is called a **reflex arc**.



A **reflex arc** begins with the **stimulus** e.g. a bee sting or a hot object on the skin. The stimulus is detected by the **receptor** cells and an electrical **impulse** is transmitted along the **sensory neuron**. The impulse is passed through **relay neurons** in the spinal cord or the **unconscious** areas of the brain. The response is coordinated **automatically** and sent along the **motor** neuron to the **effector** cells.

Hormones

Hormones are **chemical** messengers transported in the **bloodstream** to an effector where they can activate a response. They are produced and released from glands around the body which all make up the **endocrine system**. Hormones do a similar job to the neurons of the nervous system but there are some differences.

	neurons	hormones
speed	fast	slow
duration	short	long
target area	specific	general

The hormones released travel in the blood plasma to their **target cells** and affect only those certain cells. Hormones act on organs or cells where constant adjustments are made to maintain a stable state.

Some examples you should know:

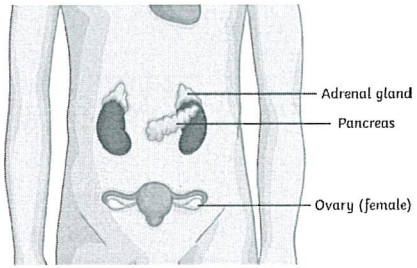
The **pituitary gland** produces a range of hormones including FSH and LH which help to regulate the menstrual cycle. The pituitary gland acts as a **master gland** because many of the hormones it releases control and coordinate the release of other hormones from other glands in the body.

Diabetes

There are two types of diabetes: type 1 and type 2.

Type 1 diabetes is a disorder affecting the pancreas. In type 1 diabetes, the pancreas does not produce enough insulin to control the blood sugar level and so the levels become higher than normal. Type 1 diabetes is usually treated by injections of insulin.

Type 2 diabetes is a disorder of effector cells which no longer respond to the hormones released from the pancreas. Type 2 diabetes can usually be managed through lifestyle choices such as maintaining a carbohydrate-controlled diet and regular exercise.



The risk of developing type 2 diabetes is higher in people who are obese (have a BMI >30).

Hormones in Human Reproduction

Oestrogen is the main reproductive hormone in females. It is produced in the **ovaries**. During puberty, this hormone increases and it stimulates an egg to be released from an ovary each month. This process is called **ovulation** and happens, on average, every 28 days.

Testosterone is the main reproductive hormone in males. It is produced in the **testes**. This hormone stimulates the production of sperm.

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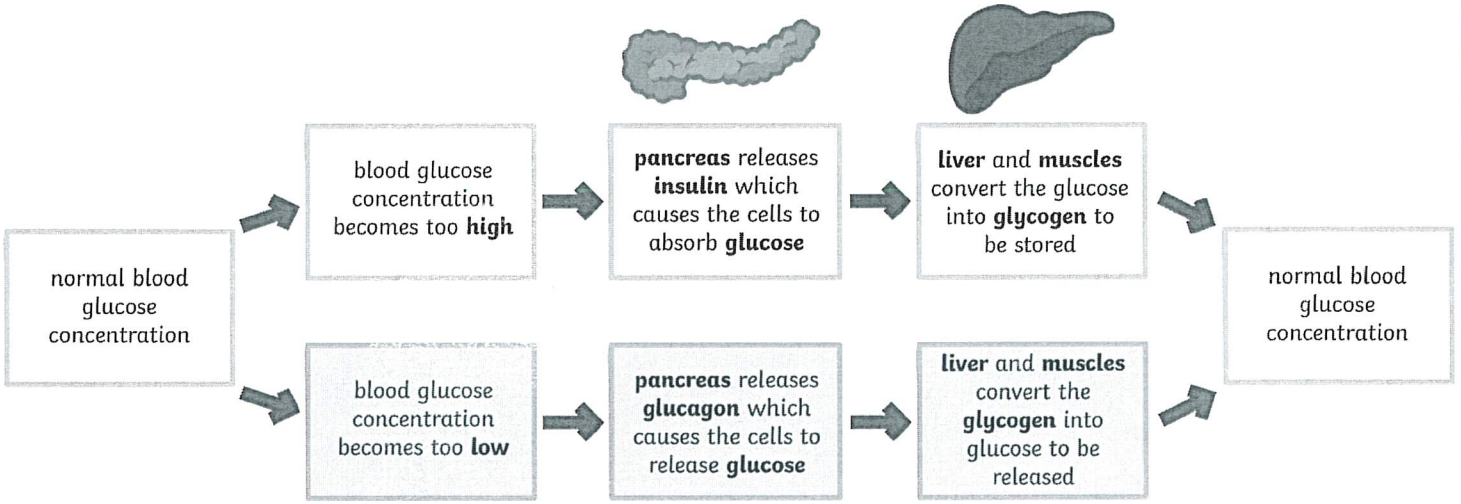
Control of Blood Glucose

The pancreas is the organ and gland which monitors and regulates the blood glucose concentration.

(HT only)

If the blood glucose concentration becomes too low, a negative feedback loop is triggered and the pancreas releases another hormone, **glucagon**, which acts on the liver and muscles to cause the stored **glycogen** to be converted back into **glucose** and released into the bloodstream.

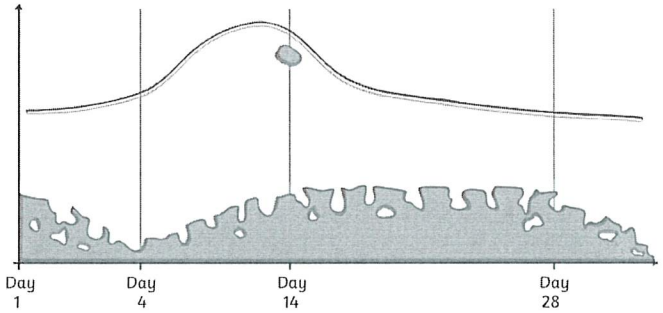


The Menstrual Cycle

The **menstrual cycle** occurs in females, approximately every **28 days**. It is a cyclical process of the building of the lining of the **uterus** and **ovulation**. If the **egg** become fertilised by a sperm, then **pregnancy** follows. If the egg is not fertilised, then the lining of the uterus is shed away and leaves the body as the **menstruation** (or period).

The whole cycle is controlled by four main reproductive hormones:

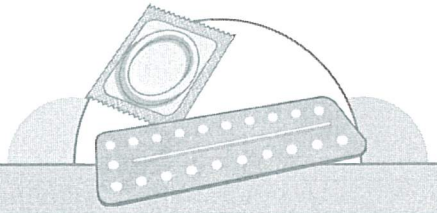
- **follicle stimulating hormone (FSH)**
- **oestrogen**
- **luteinising hormone (LH)**
- **progesterone**



Hormone	Where It Is Produced	Response Caused	Interaction with Other Hormones (HT only)
FSH	pituitary gland	An egg to develop in one of the ovaries.	Stimulates the production of oestrogen.
oestrogen	ovaries	The lining of the uterus builds up and thickens.	Stimulates the production of LH. Inhibits the production of FSH.
LH	pituitary gland	Ovulation (at around day 14 of the cycle).	Indirectly stimulates the production of progesterone.
progesterone	ovaries	The uterus lining to maintain.	Inhibits the production of LH.

Contraception

There are many different types of **contraceptive** (or birth control) methods. They are categorised as **hormonal** methods and **non-hormonal** methods.



Method	Hormonal or Non-Hormonal	How It Works	Pros and Cons
oral contraceptives ('the pill')	hormonal	Pill taken which contains hormones to **inhibit FSH** so that an egg does not mature.	Easily self-administered. Short-term effects. Can easily be reversed. Very reliable. May have mild side-effects associated. Could lead to pregnancy if missed. Does not protect from STIs.
injection, implant or skin patch	hormonal	Contains **progesterone** which is slowly released to inhibit the release of eggs for months or even years.	Administered through routine appointment at GP surgery. Requires little to no aftercare or maintenance. Very reliable. May take some time for effects to be reversed once removed. Does not protect from STIs.
condoms or diaphragm (female condom)	non-hormonal	Creates a **physical barrier** to prevent the sperm from reaching the egg.	Easy to use. Short-term effects. Very reliable. Provides protection from most STIs. Can fail.
intrauterine devices (coil)	hormonal	The device is attached to the lining of the uterus and **releases hormones or prevents the implantation** of an embryo.	Requires little to no aftercare or maintenance. Very reliable. May take some time for effects to be reversed once removed. Does not protect from STIs.
spermicidal agents	non-hormonal	Contains chemicals to **kill** or **immobilise sperm** cells.	Easy to use. Short-term effects. Does not protect from STIs. Less effective when used as the only method.
abstaining from intercourse (around the time of ovulation)	non-hormonal	Avoiding sexual intercourse when there is a likelihood of an egg being present in the oviduct.	inexpensive Not always reliable.
surgery	non-hormonal	A surgical procedure carried out in men or women. In males, the vas deferens tubes are sealed or blocked to prevent the passage of sperm from the testes. In females, the fallopian tubes (oviducts) are sealed or blocked to prevent the passage of the egg from the ovaries.	Risks associated with surgery (such as infection). Difficult to reverse (if at all possible). Can take several months to be reliable.

Infertility (HT Only)

Depending on the reason for the **infertility**, there are different methods of treatment and technologies to help women become pregnant.

The hormones **FSH** and **LH** can be given in a **'fertility drug'** to help stimulate the normal cyclic processes and enable the woman to become **pregnant** naturally.

In Vitro Fertilisation (IVF) is a treatment which involves several stages:

- The woman is given FSH and LH to **stimulate the ovaries** to mature and release several eggs.
- The **eggs** are then collected from the woman and **fertilised** using **sperm** collected from the man. This is done in the lab (in vitro means "outside the living organism").
- The fertilised eggs develop into **embryos**.
- At the early stage of development (blastocyst), one or two embryos are inserted into the woman's **uterus** for **implantation**.
- If successful, the **pregnancy** progresses as normal.

Fertility treatments offer couples the chance to have their own baby. However, the processes are often very stressful and emotional. The success rates are low. The underlying causes of the infertility are not usually being treated. Fertility treatments can carry a higher chance of multiple births (twins, triplets or more), which carries a risk to both the mother and the unborn babies.

Adrenaline and Thyroxine (HT Only)

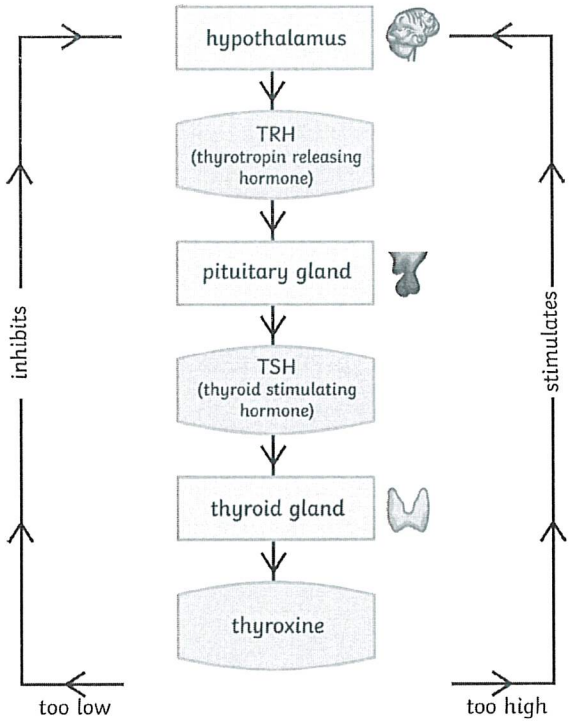
Adrenaline is a hormone produced by the **adrenal glands**. It is released in response to stress or fear. The hormone acts on major organs including the heart and lungs. The effect is to increase the heart rate and breathing rate and cause vasodilation (widening of the blood vessels), in order to supply the brain and muscles with more oxygen and glucose.

This prepares the body for a 'flight or fight' response to the fear or stress.

Thyroxine is a hormone produced by the **thyroid gland**. It stimulates the rate of **metabolism** in the body by controlling how quickly food products and oxygen are reacted, therefore controlling how quickly **energy** is released.

Negative Feedback of Thyroxine

A **negative feedback** system regulates the level of thyroxine in the body.



Required practical activity 7: plan and carry out an investigation into the effect of a factor on human reaction time.

The aim of the investigation is to **investigate out whether reaction times can be reduced with practice.**

Method:

In this experiment you are working with a partner and you are always using the opposite hand to your writing hand.

1. One of the pair sits upright on a chair and places their forearm on the table so that their hand is hanging over the edge of the table.
2. The other partner places a ruler vertically between the person sitting down's thumb and first finger. The thumb and first finger should be as far apart as possible.
3. Ensure the 0cm end of the ruler is pointing downwards.
4. Place the 0cm mark level with the top of the thumb and drop without telling your partner you are going to do it. Do tell them that the aim is for them to catch the ruler as quickly as possible.
5. Reading from the top of the thumb, record how many centimetres it took to catch.
6. Repeat nine more times.
7. Swap roles with your partner.
8. Using the reaction time conversion tables, convert your results from centimetres to reaction times (s).

The **independent variable** is the method for improvement e.g. amount of practice, use of caffeine

The **dependent variable** is the reaction time in seconds (converted from the cm taken to catch the ruler).

Knowledge Test for Homeostasis

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If you can answer these questions correctly, learn the answers and be able to recall them quickly in your mind, you will be successful in your end of unit test and your final exams.

1) What is homeostasis?
2) Name three conditions that have to be controlled in your body?
3) What is the central nervous system?
4) What are the five steps in bring about a nervous system response?
5) What name is given to a change in the environment?
6) What name to we give to the cells that detect changes in the environment?
7) What name do we give to a muscle or gland that responds?
8) What do sensory neurones do?
9) What do motor neurones do?
10) Where is a relay neurone found? What does it do?
11) What is a reflex action?
12) Why are reflex actions important?
13) Write a method of an investigation of how a factor affects human reaction time?
14) What are hormones?
15) What is the endocrine system?
16) How does the endocrine system compare to the nervous system?
17) Why is the pituitary gland known as the master gland?
18) Name the hormones released by these glands – pituitary, pancreas, thyroid, adrenal gland, ovary and testes?
19) Which gland is responsible for monitoring and controlling of blood sugar levels?
20) Describe what happens when blood sugar level is too high?
21) What are the causes and treatment for type 1 diabetes?
22) What are the causes and treatment for type 2 diabetes?
23) Do diabetics have a high or low blood sugar level? Why?
24) What does testosterone do? Where is it released from?
25) What does FSH do? Where is it released from?
26) What does oestrogen do? Where is it released from?
27) What does LH do? Where is it released from?
28) What does progesterone do? Where is it released from?
29) What is contraception?
30) Describe three hormonal methods of contraception?
31) Describe three non-hormonal methods of contraception?
32)

Higher tier only

1) Describe what happens when blood sugar level is too low?
2) What is IVF treatment?
3) When may a couple decided to have IVF treatment?
4) Describe the steps in IVF treatment?
5) What are the risks of IVF treatment?
6) What is meant by negative feedback?
7) What does adrenalin do? Where is it released from?
8) What does thyroxine do? Where is it released from?

Triple Science Higher Only

1) What is the brain made up of?
2) What does the cerebellum do?
3) What does the cerebral cortex do?
4) What does the medulla do?
5) Explain the difficulties of investigating brain function and treating brain damage / disease?
6) How does the eye change in bright light?
7) How does the eye change in dim light?
8) What does the retina, optic nerve, sclera, cornea, iris, suspensory ligaments, and ciliary muscles do?
9) What is meant by accommodation in relation to the eye?
10) How does the eye change to focus on near objects?
11) How does the eye change to focus on far objects?
12) What is meant by myopia and hyperopia?
13) Draw a ray diagram to explain how lenses can be used to correct myopia?

14) Draw a ray diagram to explain how lenses can be used to correct hyperopia?
15) Describe the new technologies that can be used to correct myopia and hyperopia? Explain how they work?
16) Describe how water enters the body?
17) Describe how water leaves the body?
18) Which part of the body removes excess water, ions and urea?
19) How are excess amino acids excreted in the body?
20) What is the function of the kidneys?
21) What is filtration?
22) What is selective reabsorption?
23) Describe the homeostatic mechanism when there is too much water in the bloodstream?
24) Describe the homeostatic mechanism for when there is too little water in the bloodstream?
25) How is kidney failure treated?
26) What are the basic principles of kidney dialysis?
27) What are plant growth responses called?
28) Describe the growth regions of plants?
29) What is auxin? Describe what it does?
30) How are auxins used?
31) Which tropisms do the shoot show? Explain how?
32) Which tropisms do the roots show? Explain how?
33) What do gibberellins do?
34) How are gibberellins used?
35) What does ethene do in plants?
36) How is ethene used?

Inheritance, Variation and Evolution Knowledge Organiser

Keywords

allele – An alternative form of a gene.

asexual reproduction – The production of offspring from a single parent by mitosis. The offspring are clones of the parent.

chromosome – Structures that contain the DNA of an organism and are found in the nucleus.

cystic fibrosis – A disorder of cell membranes that is caused by a recessive allele.

DNA - A polymer that is made up of two strands that form a double helix.

dominant – An allele that is always expressed, even if only one copy is present.

fertilisation – The fusion of male and female gametes.

gamete – Sperm cell and egg cell in animals; pollen and egg cell in plants.

gene – A small section of DNA that codes for a specific protein.

genome – The entire genetic material of an organism.

genotype – The combination of alleles.

heterozygous – A genotype that has two different alleles, one dominant and one recessive.

homozygous – A genotype that has two of the same alleles. Either two dominant alleles or two recessive alleles.

meiosis – The two-stage process of cell division that reduces the chromosome number of the daughter cells. It makes gametes for sexual reproduction.

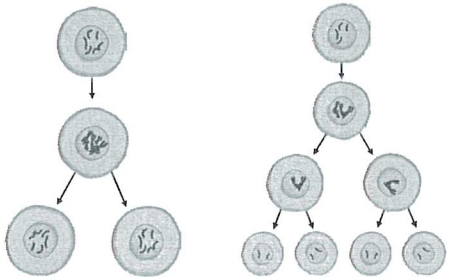
mutation – A change in DNA.

phenotype – The characteristic expressed because of the combination of alleles.

polydactyly – Having extra fingers or toes. It is caused by a dominant allele.

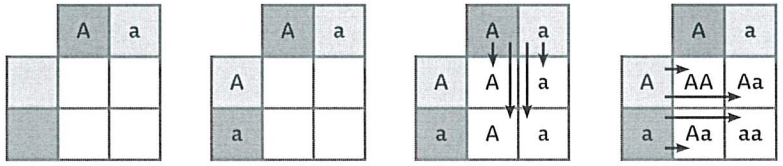
recessive – An allele that is only expressed if two copies of it are present.

sexual reproduction – The production of offspring by combining genetic information from the gametes of two parents. Leads to variation in the offspring.



Mitosis	Meiosis
Produces two daughter cells.	Produces four daughter cells.
Daughter cells are genetically identical.	Daughter cells are not genetically identical.
The cell divides once.	The cell divides twice.
The chromosome number of the daughter cells is the same as the parent cells. In humans, this is 46 chromosomes.	The chromosome number is reduced by half. In humans, this is 23 chromosomes.
Used for growth and repair, and asexual reproduction.	Produces gametes for sexual reproduction.

How to Complete a Punnet Square



Step 1:

Put the two alleles from one parent into the boxes at the top. This parent is a heterozygote. This means they have one dominant and one recessive allele.

Step 2:

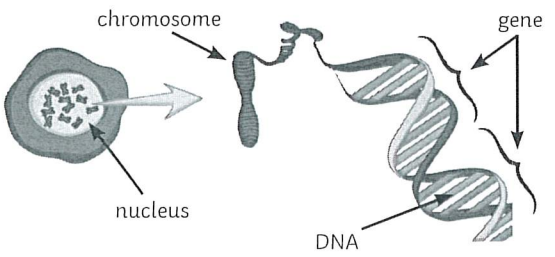
Put the two alleles from the second parent into the boxes on the left. This parent is also a heterozygote.

Step 3:

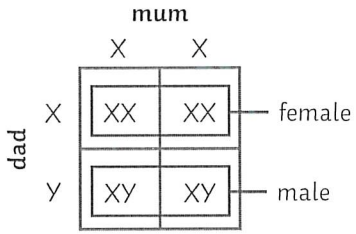
Put the alleles from the first parent into the two boxes underneath them.

Step 4:

Put the alleles from the second parent into the two boxes to the right of them.



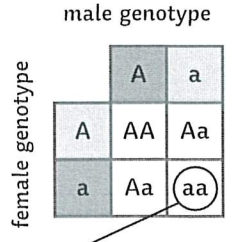
Sex Determination



Females carry two X chromosomes.
Males carry one X and one Y chromosome.

Probability

There are four possible combinations of gametes that offspring can inherit.



One of these four has the genotype aa – that's $\frac{1}{4}$, 25% or 0.25.

The recessive phenotype has a ratio of 1:3 because only one combination will show the phenotype while the other three will not.

Inheritance, Variation and Evolution Knowledge Organiser

Keywords

embryo screening – Genetic tests carried out on an embryo to see whether it carries a faulty allele.

evolution – A change in the inherited characteristics of a population over time through a process of natural selection.

evolutionary tree – A method used to show how scientists believe organisms are related.

extinction – The permanent loss of all members of a species.

fossils – The remains of organisms from millions of years ago which are found in rocks.

genetic engineering – The process by which scientists manipulate and change the genotype of an organism.

natural selection – The process by which organisms that are better suited to an environment are more likely to survive and reproduce.

selective breeding – Humans selecting animals or plants, that have a required characteristic, for breeding.

speciation – The process by which two species evolve from a single original species by natural selection. The two populations have become so different that they can no longer interbreed to produce fertile offspring.

variation - Differences in characteristics of individuals in a population.

Variation

Variation maybe be due to differences in:

- the genes that have been inherited (genetic causes);
- the conditions in which they have developed (environmental causes);
- a combination of genes and the environment.

Evolution

All species of living things have evolved from simple life forms by natural selection.

- If a variant/characteristic is advantageous in an environment, then the individual will be better able to compete.
- This means they are more likely to survive and reproduce.
- Their offspring will inherit the advantageous allele.

Fossils

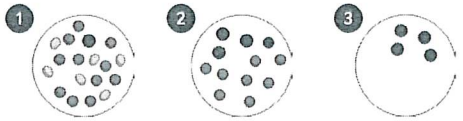
Fossils could be:

- the actual remains of an organism that has not decayed;
- mineralised forms of the harder parts of an organism, such as bones;
- traces of organisms such as footprints or burrows.

Many early life forms were soft-bodied so have left few traces behind.

Fossils help us understand how much or little organisms have changed as life developed on earth.

Resistant Bacteria



There is variation in the bacterial population. One bacterium develops a mutation by chance that means it is resistant to an antibiotic.

The antibiotic kills some of the bacteria, the resistant bacterium survives and reproduces.

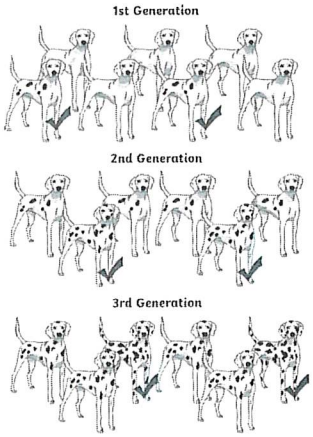
The antibiotic kills the rest of the non-resistant bacteria so the person may start to feel a little better. The resistant bacterium has survived the antibiotic and continues to multiply.

To reduce the rate at which antibiotic-resistant strains appear:

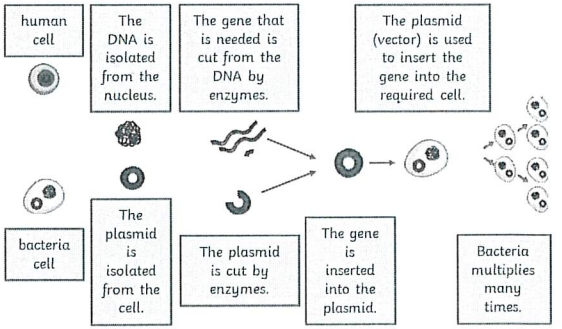
- Antibiotics should only be used when they are really needed, not for treating non-serious or viral infections.
- Patients should complete their courses of antibiotics, even if they start to feel better.
- The agricultural use of antibiotics should be restricted.

Selective Breeding

1. Choose parents who have the desired characteristic.
2. Select the best offspring and breed these to make the next generation.
3. These offspring are then bred again and again, over many generations, until a desired result is achieved.



Genetic Engineering



Classification

Linnaeus classified living things into kingdom, phylum, class, order, family, genus and species.

Organisms are named by the binomial system of genus and species.

Due to evidence from chemical analysis, there is now a 'three-domain system' developed by Carl Woese.

Domain	bacteria	archaea	eukaryota			
Kingdom	eubacteria	archaebacteria	protista	fungi	plantae	animalia

Knowledge Test for Inhertance

MEADOW PARK SCHOOL

If you can answer these questions correctly, learn the answers and be able to recall them quickly in your mind, you will be successful in your end of unit test

1. How many cells are produced at the end of mitosis?
2. How many cells are produced at the end of meiosis?
3. What are the male gametes in plants?
4. What the female gametes in plants?
5. What are the male gametes in animals?
6. What are the female gametes in animals?
7. What is the basic structure of DNA?
8. Define gene.
9. Define genome.
10. Define gamete.
11. Define chromosome.
12. Define allele.
13. Define dominant.
14. Define recessive.
15. What is polydactyly?
16. Is polydactyly dominant or recessive?
17. What is cystic fibrosis?
18. Is cystic fibrosis dominant or recessive?
19. How many pairs of chromosomes in human body cell?
20. What sex is XX?
21. What sex is XY?
22. Define evolution.
23. Define natural selection.
24. What evidence is there for evolution?
25. How do fossils arise?
26. Define extinction.
27. What things lead to extinction?
28. Why can bacteria evolve quickly?
29. What is MRSA?
30. Why is the development of antibiotics so slow?

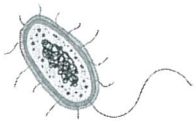
Higher tier only –

31. Define homozygous.
32. Define heterozygous.
33. Defined genotype.
34. Define phenotype.
35. Define speciation

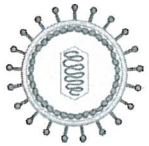
Infection and Response Knowledge Organiser – Foundation and Higher

Communicable Disease

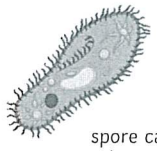
Pathogens are **microorganisms** that enter the body and cause communicable disease (infectious). Plants and animals can be infected by them.



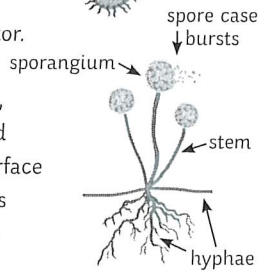
Bacteria are small cells that can reproduce very quickly in the body. They produce **toxins** that make you feel ill, damaging your cells and tissues.



Viruses are much smaller than bacteria; they can also reproduce quickly in the body. Viruses live inside your cell where they replicate. They then burst out of the cell, releasing new viruses.



Protists are eukaryotes (multicellular). Some are parasites which live on or inside other organisms, often carried by a vector.



Fungi are sometimes single celled, others have hyphae that grow and penetrate human skin and the surface of plants. They can produce spores which can spread to other plants.

How Pathogens Are Spread

Pathogens can be spread in many ways, for example:

Water – by drinking dirty water, e.g. cholera.

Air – carried by air and breathed in, e.g. influenza.

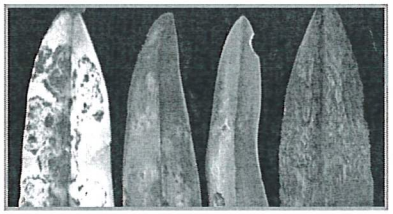
Direct contact – touching contaminated surfaces including the skin, e.g. athlete's foot.

Viral Diseases

Measles is spread by droplets of liquid from sneezes and coughs etc., symptoms include a red rash on the skin and a fever. Measles can be serious or even fatal, it can lead to pneumonia. Most people are vaccinated against measles when they are very young.

HIV is spread by sexual contact or exchanging body fluids. HIV can be controlled be antiviral drugs; this stops the viruses replicating. The virus attacks the cells in the immune system. If the immune system is badly damaged, the body cannot cope with other infections. This is the late stage and is called aids.

Tobacco mosaic virus affects plants, parts of the leaves become discoloured. This means plants cannot carry out photosynthesis; this will affect the plants growth.



Fungal and Protist Diseases

Fungal

Rose black spot shows as black spots on the leaves of the plant, this means less photosynthesis occurs. As a result, the plant does not grow as well. It is spread by the wind or the water. They can be treated by using fungicides and taking the leaves off the infected plant.

Protists

Malaria is caused by a protist, mosquitoes are the vectors. They become infected when they feed on an infected animal. The protist is inserted into the blood vessel. Malaria can cause fever, it can also be fatal.

Bacterial Diseases

Salmonella bacteria causes food poisoning. Symptoms include fever, stomach cramps, vomiting and diarrhoea. The symptoms are caused by the toxins produced by the bacteria. Food contaminated with salmonella can give you food poisoning. Most poultry in the UK will have had a vaccination against salmonella.

Gonorrhoea is a sexually transmitted bacterial disease, passed on by sexual contact. Symptoms include pain when urinating and thick yellow/green discharge from the vagina or penis. To prevent the spread, people should be treated with antibiotics and use a condom.

How to prevent the spread:

Being hygienic –

washing hands thoroughly.

Destroying vectors –

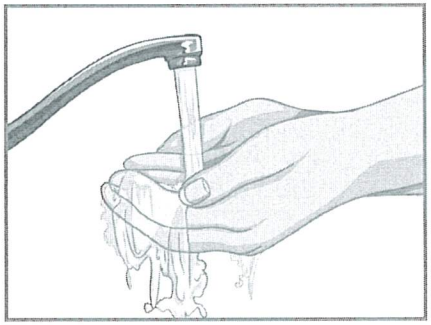
killing vectors by using insecticides or destroying their habitat.

Isolation –

isolating an infected person will prevent the spread.

Vaccination –

people cannot develop the infection and then pass it on.



Infection and Response Knowledge Organiser – Foundation and Higher

Fighting Diseases

Defence System

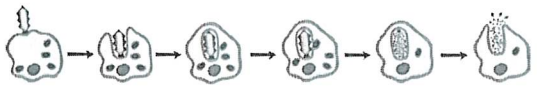
1. The skin acts as a barrier to pathogens.
2. Hairs and mucus in your nose trap particles.
3. The trachea and bronchi secrete mucus to trap pathogens. They also have cilia which move backwards and forwards to transport the mucus towards the throat. This traps any pathogens and the mucus is usually swallowed.
4. The stomach contains hydrochloric acid to kill any pathogens that enter the body via the mouth.

The Immune System

This kills any pathogens that enter the body.

White blood cells:

- **Phagocytosis** is when white blood cells engulf pathogens and then digest them.
- They produce **antitoxins** to neutralise the **toxins**.
- They also produce **antibodies**. Pathogens have **antigens** on their surface, antibodies produced by the white blood cells lock on to the antigen on the outside of the pathogen. White blood cells can then destroy the pathogens. Antibodies are specific to one antigen and will only work on that pathogen.



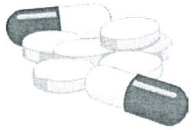
Vaccinations

Vaccinations have been developed to protect us from future infections. A vaccination involves an injection of a **dead** or **weakened** version of the pathogen. They carry antigens which cause your body to produce antibodies which will attack the pathogen. If you are infected again, the white blood cells can produce antibodies quickly.

Pros	Cons
Helps to control communicable diseases that used to be very common.	They don't always work.
Epidemics can be prevented.	Some people can have a bad reaction to a vaccine – however, that is very rare.

Fighting Disease – Drugs

Painkillers relive the pain and symptoms, but do not tackle the cause.



Antibiotics kill the bacteria causing the problem, but do not work on viruses. Viruses are very difficult to kill because they live inside the body cells.

Developing Drugs

There are three main stages in drug testing:

Pre-clinical testing:

1. Drugs are tested on human cells and tissues.
2. Testing carried out on living animals.

Clinical testing:

3. Tested on healthy human volunteers in clinical trials. Starts with a very low dose, then tested on people with the illness to find the optimum dose.

Placebo is a substance that is like the drug, but does not do anything.

Placebo effect is when the patient thinks the treatment will work even though their treatment isn't doing anything.

Blind trial is when the patient does not know whether they are getting the drug or the placebo.

Double-blind trial is when both the doctor and the patient do not know whether they are getting the drug.

Drugs from Plants

Chemicals produced by plants to defend themselves can be used to treat human diseases or help with symptoms.

Drug	Plant/Microorganism
aspirin	willow
digitalis	foxglove
penicillin	mould - penicillium

New drugs are now made by chemists, who work for the pharmaceutical industry, in laboratories.

Key Vocabulary

antibodies
antigens
antitoxins
bacteria
blind trial
double-blind
fungus
microorganism
phagocytosis
placebo
protist
toxins
vaccination
vector
virus

Knowledge Test for Infection and Response

MEADOW PARK SCHOOL

If you can answer these questions correctly, learn the answers and be able to recall them quickly in your mind, you will be successful in your end of unit test and your final exams.

1. Define pathogen.
2. What is a virus?
3. What is bacteria?
4. What is a protist?
5. What is fungi?
6. How can diseases be spread in plants?
7. How can diseases be spread in animals?
8. How do bacteria reproduce inside the body?
9. How do viruses reproduce inside body?
10. How can bacteria make a person feel ill?
11. How can a virus make a person feel ill?
12. What is measles?
13. What is HIV?
14. What is TMV?
15. What is salmonella?
16. What is gonorrhoea?
17. What is Rose Black Spot?
18. What is malaria?
19. How does the skin help protect the body?
20. How does the nose help protect the body?
21. How does the trachea help protect the body?
22. How does the bronchi help protect the body?
23. How does the stomach help protect the body?
24. What is the role of the immune system?
25. What do white blood cells do?
26. How do vaccinations work?
27. What are antibiotics?
28. What is antibiotic resistance?
29. What are painkillers for?
30. Where it is digitalis come from?
31. Where does aspirin come from?
32. Where does penicillin come from?
33. What are the three things that new drugs need to be tested for?

AQA GCSE Chemistry (Combined Science) Unit 6: The Rate and Extent of Chemical Change

Calculating Rates of Reactions

Reactions happen at **varying rates**. For example, a firework exploding is a fast reaction whereas a piece of iron rusting would take place over a longer period of time.

The **rate of a chemical reaction** tells us how quickly a **product is formed** or how quickly a **reactant is used up**.

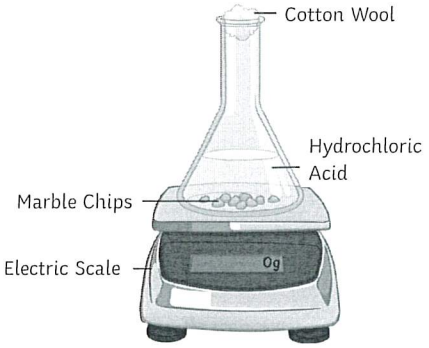
For a chemical reaction to occur, the reactant particles must collide with enough energy. Those collisions that produce a chemical reaction are called successful collisions.

$$\text{mean rate of reaction} = \frac{\text{quantity of reactant used}}{\text{time taken}}$$

$$\text{mean rate of reaction} = \frac{\text{quantity of product formed}}{\text{time taken}}$$

Measuring the Mass of a Reaction Mixture

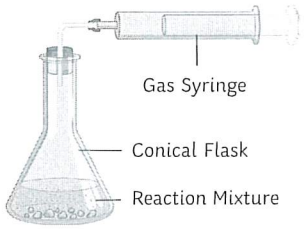
The changing mass of a reaction mixture can be measured during a reaction. This method is particularly useful when gases, such as carbon dioxide, are given off. **Gas escapes during the reaction and the mass of the reaction mixture decreases.** The mass can be measured at regular time intervals.

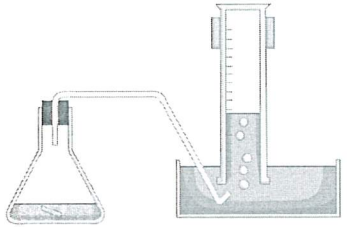


units = g/s or g/min

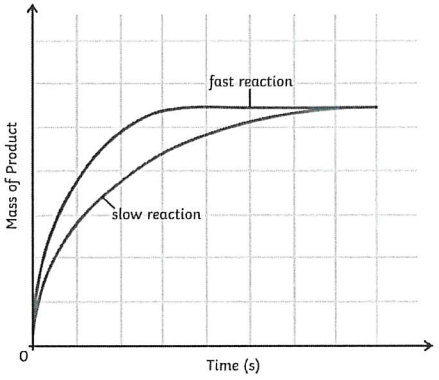
Measuring the Volume of a Reaction Mixture

The changing volume of a reaction mixture can be measured during a reaction. This method is particularly useful when gases, such as carbon dioxide, are given off. The gas can be collected and its volume measured at regular time intervals. Different types of measuring equipment can be used to collect the gas such as a gas syringe, measuring cylinder or upside-down burette.





units = cm^3/s or cm^3/min



Graphs are a useful way to **analyse** the results from a rate of reaction investigation. The graph above shows two lines, one red and one blue.

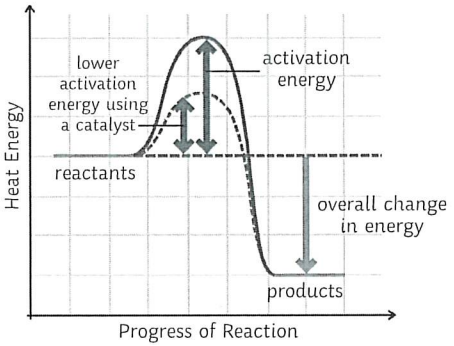
The red line represents a fast reaction and the blue line a slow reaction. We know the fast reaction occurs at a much faster rate as the line is steep. The fast reaction finishes before the slow reaction as the line plateaus sooner.

Factors Affecting the Rate of a Chemical Reaction

- concentration and pressure
- catalyst
- surface area
- temperature

The rate of a chemical reaction will be increased if there are more frequent successful collisions between reactant particles.

Catalyst



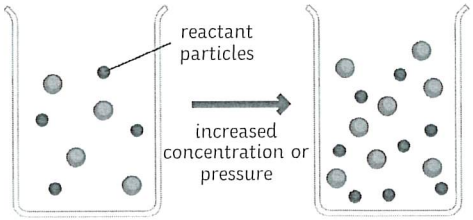
A catalyst is a **substance** that speeds up a chemical reaction without getting used up itself. Catalysts are able to offer an **alternative pathway** at a **lower activation energy**.

Biological catalysts are called **enzymes**.

When a catalyst is used in a chemical reaction (not all reactions have a catalyst that is suitable to use), the **frequency of collisions** is **unchanged**. More **particles** are able to react. The particles have **energy greater** than that of the **activation energy**. Consequently, there is in an **increase** in the **rate successful of collisions**.

Concentration and Pressure

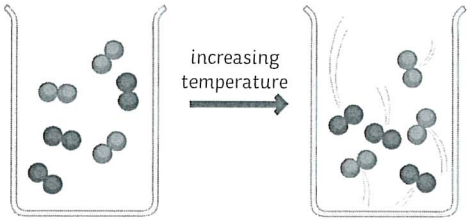
If the **number of reactant particles** in a given space is **doubled**, there will be **more frequent successful collisions** between reactant particles, therefore, **increasing** the **rate of reaction**.



AQA GCSE Chemistry (Combined Science) Unit 6: The Rate and Extent of Chemical Change

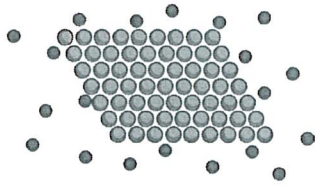
Temperature

When the temperature of the reaction mixture is increased, the reactant particles **gain kinetic energy** and move much more quickly. This results in **more frequent successful collisions** between the reactant particles, therefore, **increasing the rate of the reaction**.



Surface Area

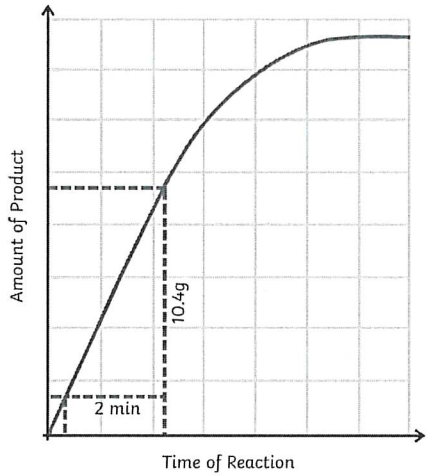
Large lumps of a solid have a **small surface area to volume ratio**. If the solid is broken up into smaller lumps or crushed into a powder, this will increase the surface area to volume ratio.



A larger area of the solid is now exposed to other reactant particles. This increases the frequency of successful collisions thus increasing the rate of reaction.

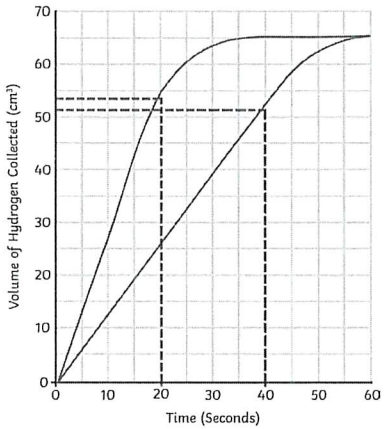
Calculating Gradient (Higher Tier Only) gradient = $\frac{y}{x}$

On the graph, draw construction lines on the part of the graph that has a straight line. Measure the values of x and y.



In the graph below, the gradient of the first line is much steeper than the second line. This indicates that a faster reaction is taking place. Remember, the steeper the line, the faster the reaction.

To calculate the reaction rate at a specific time period, construction lines must first be drawn on the straightest part of the graph.



For the first line, what is the rate of reaction at 20 seconds?

$54 \div 20 = 2.7 cm^3/s$

For the second line, what is the rate of reaction at 40 seconds?

$52 \div 40 = 1.3 cm^3/s$

Dynamic Equilibrium

In a **closed system** (this means nothing can get in or out), a reversible reaction can reach **dynamic equilibrium**. This is where the **forward** and **reverse reactions** are occurring at the **same rate** and the **concentrations** of all the substances that are reacting remain constant.

Changing Conditions and the Effect on the Position of Equilibrium (Higher Tier Only)

The reaction between nitrogen and hydrogen to make ammonia is an industrial process called the Haber process. It requires a high temperature, high pressure and an iron catalyst.

The symbol equation for the reaction is as follows:

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

According to **Le Chatelier's Principle**, the position of equilibrium can be altered by changing the conditions of the reaction i.e. the pressure, concentration and/or the temperature. The **position** of the **equilibrium** will shift to **counteract** any changes made.

Increasing the **temperature** of the reaction in the forward direction (exothermic) will result in the equilibrium shifting in favour of the reverse direction (endothermic) to reduce the temperature.

From the equation, it is clear that on the **left-hand side,** there are **four molecules** and on the **right-hand side,** there are **two molecules**. If the **pressure** in the system were **increased**, the equilibrium **position would shift to the right** as there are fewer molecules. If the pressure in the system were **decreased**, the equilibrium **position would shift to the left** as there are a larger number of molecules.

If the **concentration** of one of the **reactants were increased**, then the equilibrium position would move in **favour of the products**. This would result in more product being produced. If the concentration of the **products were decreased**, equilibrium would shift to **favour the products**. More reactants would react until equilibrium is reached.

AQA GCSE Chemistry (Combined Science) Unit 6: The Rate and Extent of Chemical Change

Reversible Reactions

A reversible reaction is one in which the **reactants form products**. The products are then able to react together to **reform the reactants**.

For example:
A reacts with B to form C and D.
C and D are able to react to form A and B.

The equation would be as follows (where the **double arrow symbol** represents a **reversible reaction** is taking place):

$A + B \rightleftharpoons C + D$

The **forward reaction** goes to the **left** and the **backwards reaction** goes to the **right**. For example, if the forward reaction is exothermic then the backward reaction will be endothermic. The amount of energy that is transferred is the same for both the forward and reverse reaction.

Hydrated copper sulfate is a blue substance. We say that the copper sulfate is hydrated as it **contains water**. The copper sulfate is heated and the water evaporates leaving a white substance known as **anhydrous** copper sulfate. Anhydrous meaning **no water**.

The word equation for the reaction is as follows:

hydrated copper sulfate $\rightleftharpoons$ anhydrous copper sulfate + water

$CuSO_4.5H_2O(s) \rightleftharpoons CuSO_4(s) + H_2O(l)$

The reaction can be reversed when water is added to the anhydrous copper sulfate.

Required Practical 5: Measuring the Production of a Gas

This method outlines one way to carry out an investigation to collect a gas from a chemical reaction.

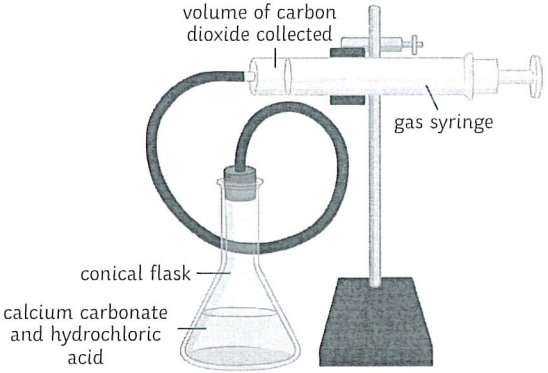
The practical involves changing the concentration of hydrochloric acid and measuring the volume of carbon dioxide gas produced when the acid reacts with calcium carbonate.

The word equation for the reaction is as follows:

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

The symbol equation for the reaction is:

$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$



Method

Step 1 – Clamp a gas syringe to a retort stand using a boss and clamp. Ensure the syringe is a quarter of the way from the top of the stand. Place the delivery tube to the end of the gas syringe.

Step 2 – Measure out 50ml of hydrochloric acid using a measuring cylinder and pour into a conical flask.

Step 3 – Using a top pan balance, measure out 0.5g of powdered calcium carbonate and place in the conical flask.

Step 4 – Immediately connect the bung and delivery tube to the conical flask. Start the stopwatch.

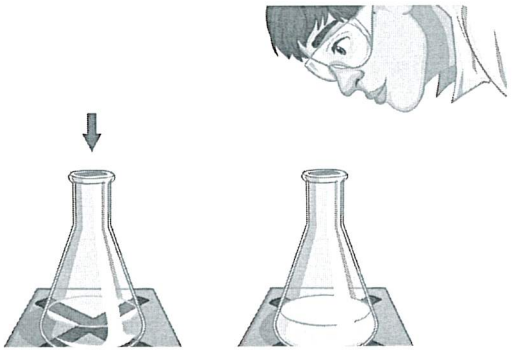
Step 5 – Record the volume of carbon dioxide gas produced every 10 seconds.

Step 6 – When the reaction has finished and there are no more bubbles of gas being produced, clean the equipment and repeat using four other different concentrations of hydrochloric acid.

When analysing the results from the practical investigation, plot a graph of Time (s) against Volume of Gas Produced (cm^3). Draw a curve of best fit through the points. A graph should be plotted for each concentration of acid.

Calculate the mean rate of reaction (cm^3/s) for each concentration of acid used. This can be calculated by dividing the total mass of gas produced (cm^3) by the reaction time (s).

Required Practical 5: Investigating a Change in Colour



This method outlines one way to carry out an investigation into the effect of increased temperature on the rate of a reaction.

The word equation for this reaction is as follows:

sodium thiosulfate + hydrochloric acid → sodium chloride + water + sulfur dioxide + sulfur

The symbol equation for this reaction is:

$Na_2S_2O_3 + 2HCl \rightarrow 2NaCl + H_2O + SO_2 + S$

The reaction between sodium thiosulfate and hydrochloric acid produces a **precipitate**. **Sulfur** is responsible for the formation of the precipitate. A precipitate is a **solid** that is formed in a solution. It is the formation of this precipitate that causes the reaction mixture to become **cloudy**; the cloudiness is a way to measure the **reaction time**.

Method

Sodium thiosulfate from three different temperatures may be used, for example, ice cold, room temperature and hot.

Step 1 – Place a black cross on a white tile.

Step 2 – Using the first temperature, measure out $35cm^3$ of sodium thiosulfate using a measuring cylinder. Place the liquid in a conical flask and position over the black cross on the white tile.

Step 3 – Measure out $5cm^3$ of water and $10cm^3$ of hydrochloric acid in separate measuring cylinders.

Step 4 – Pour the water and acid into the conical flask.

Step 5 – Pour the measured amount of sodium thiosulfate into the conical flask and immediately start the stopwatch.

Step 6 – Look down through the conical flask to the black cross below. When the black cross is no longer visible, stop the stopwatch and record the results in a table.

Step 7 – Repeat the steps with the remaining temperatures of sodium thiosulfate.

Knowledge Test for Rates of Reaction

MEADOW PARK SCHOOL

If you can answer these questions correctly, learn the answers and be able to recall them quickly in your mind, you will be successful in your end of unit test and your final exams.

1. Describe two formula to calculate the rate of reaction?
2. Give units for the rate of reaction?
3. What would you need to calculate on a product formed over time graph to find the rate of reaction?
4. What would you need to calculate on a reactant used over time graph to find the rate of reaction?
5. What do particles do during a chemical reaction?
6. Name five factors that affect the rate of a chemical reaction?
7. Describe how concentration and pressure affects the number of collisions?
8. Describe how temperature affects the number of collisions?
9. Describe how surface area affects the number of collisions?
10. What is a catalyst?
11. What is activation energy?
12. Describe how a catalyst affect the rate of chemical reactions?
13. Draw a reaction profile labelling both with and without a catalyst?
14. Describe an experiment to show how concentration of sodium thiosulfate affects the time taken for the X to disappear?
15. Describe an experiment to show how the volume of gas produced changes with the length of magnesium added to hydrochloric acid?
16. What is a reversible reaction?
17. What is meant by dynamic equilibrium?
18. In a reversible reaction is the forwards reaction is exothermic, what does this tell us about the backwards reaction?

Higher tier only

1. What is Le Chatelier's principle?
2. Give an example of how Le Chatelier's principle can show the affect of changing concentration on the position of equilibrium?
3. Give an example of how Le Chatelier's principle can show the affect of changing pressure on the position of equilibrium?
4. Give an example of how Le Chatelier's principle can show the affect of changing temperature on the position of equilibrium?

AQA GCSE Chemistry (Combined Science) Unit 7: Organic Chemistry Knowledge Organiser

Crude Oil

Hydrocarbons are compounds that are made up of the elements **hydrogen** and **carbon** only.

Crude oil is a **non-renewable resource**, **a fossil fuel**. Crude oil is made up of a mixture of compounds, most of which are long- and short-chain hydrocarbons.

Most of the compounds in crude oil are hydrocarbons called **alkanes**. The alkanes form a **homologous series**. This is a family of hydrocarbons that all share the **same general formula** and have **chemical properties** that are **similar**.

Alkanes are held together by **single bonds**.

The general formula for an alkane is C_nH_{2n+2}.

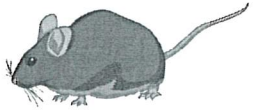
They differ from the neighbouring alkane with the addition of a CH_2.

Alkanes are **saturated hydrocarbons**. This means that all their bonds are taken up and they cannot bond to any more atoms.

Alkanes have **similar chemical properties** but have **different physical properties** due to differences in chain length. The longer the chain, the higher the boiling point of the hydrocarbon.

The first four alkanes are: methane, ethane, propane and butane.

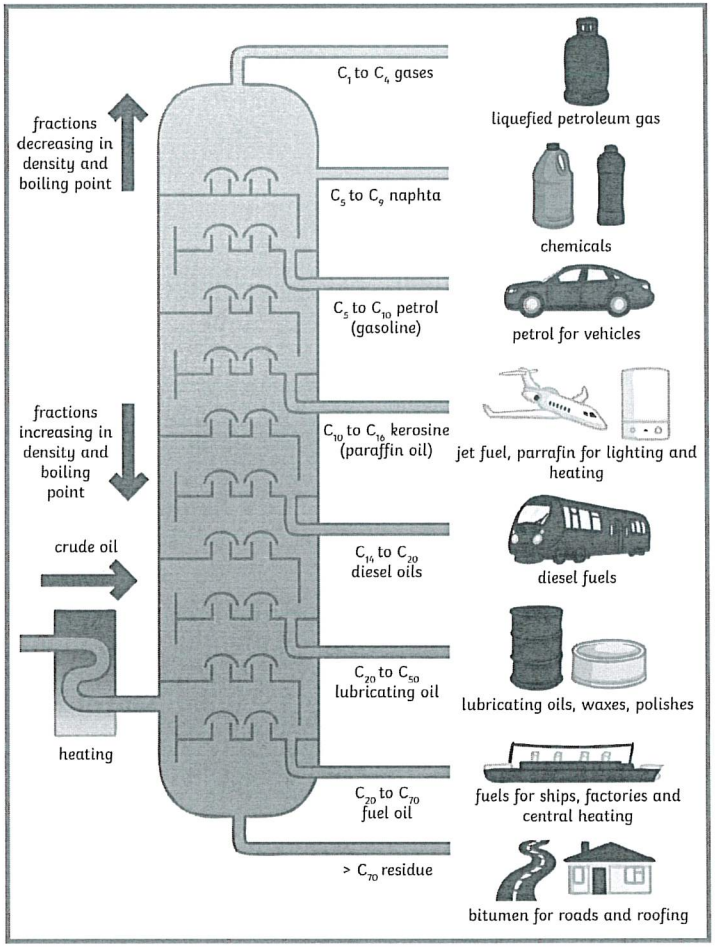
A mnemonic to help you remember the order of the alkanes: **m**ice **e**at **p**aper **b**ags.



Fractional Distillation

Fractional distillation is used to **separate** a mixture of long-chain hydrocarbons in crude oil into smaller, more useful fractions.

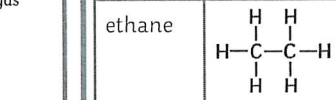
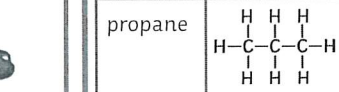
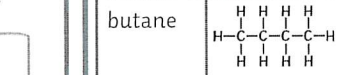
Hydrocarbons have different boiling points depending on their chain length. **Each fraction contains hydrocarbons of a similar chain length**. These fractions will boil at different temperatures due to the difference in sizes of the molecules. The different parts of crude oil are called fractions because they are a small part of the original mixture.



Crude oil is heated and enters at all column called a **fractioning column**. The column is **hot at the bottom** and decreases in temperature toward the top. As the crude oil is heated, it begins to evaporate and its vapours begin to rise up through the column. These vapours condense at the different fractions.

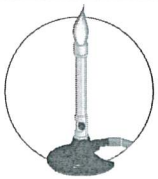
Short-chain hydrocarbons are found at the **top** of the column. This is because shorter chain molecules are held together by **weak intermolecular forces** resulting in low boiling points. These shorter chain hydrocarbons leave the column as gas.

Long-chain hydrocarbons are found at the bottom of the column and are held together by **strong intermolecular forces**, resulting in high boiling points.

Name of Alkane	Structural Formula	Molecular Formula
methane		CH_4
ethane		C_2H_6
propane		C_3H_8
butane		C_4H_{10}

Combustion

Complete combustion occurs when there is **enough oxygen** for a fuel to burn. A hydrocarbon will react with oxygen to produce carbon dioxide and water.



Incomplete combustion occurs when there **isn't enough oxygen** for a fuel to burn. The products in this reaction are water and poisonous **carbon monoxide**.

AQA GCSE Chemistry (Combined Science) Unit 7: Organic Chemistry Knowledge Organiser

Cracking

Cracking is an example of a **thermal decomposition reaction. Long-chain** hydrocarbons can be **broken** down into **shorter**, more useful hydrocarbon chains.

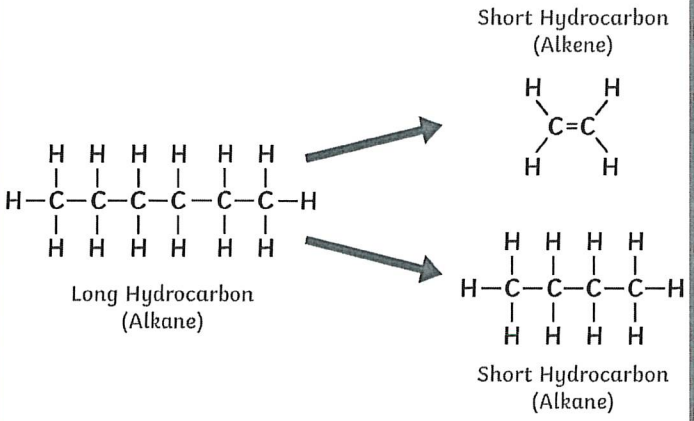
Cracking can be carried out with a catalyst in **catalytic cracking** or with steam in **steam cracking**.

Catalytic cracking involves heating a hydrocarbon to a high temperature (550°C) and passing over a hot catalyst.

Cracking of a long-chain hydrocarbon **produces** a **short-chain alkane** and an **alkene**.

Alkenes are another type of hydrocarbon that is double bonded. The general formula for an alkene is C_nH_{2n}.

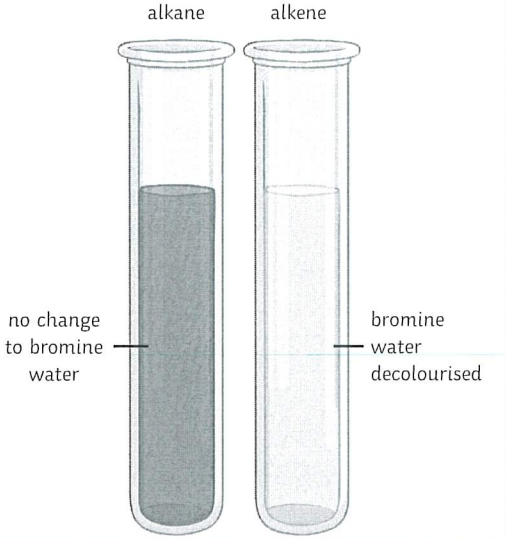
Alkenes are **unsaturated hydrocarbons**. In a chemical reaction, the double bond of the alkenes can break. This allows other atoms to bond to it.



Test for Alkanes

Bromine, when added to an **alkane**, will **remain brown/orange**. Alkanes are saturated hydrocarbons, they have no double bonds which could be broken to accept the bromine molecule and so remain orange.

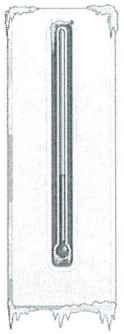
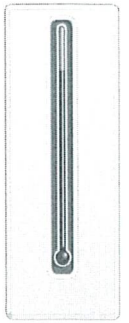
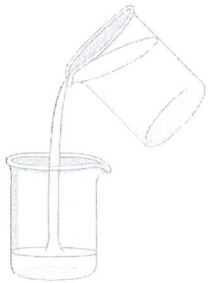
Bromine, when added to an **alkene**, will **change from brown/orange to colourless**. This is because alkenes are unsaturated hydrocarbons. The double bond breaks and the bromine molecule is accepted.



Making Polymers

The fractional distillation of crude oil and cracking produces an array of hydrocarbons that are key to our everyday lives.

Alkenes are used to produce plastics such as poly(ethene) which is used to make plastic bags, drinks bottles and dustbins. Poly(propene), another polymer, forms very strong, tough plastic.

Short-Chain Molecules	Increasing Chain Length →	Long-Chain Molecules
	As chain length increases, the **boiling point** of the hydrocarbon chains also increases. →	
thin 	**Viscosity** describes how easily a substance can flow e.g. treacle is very viscous; it is thick. →	thick 
	**Flammability** is a measure of how easily a substance burns. →	

Knowledge Test for Organic Chemistry

MEADOW PARK SCHOOL

If you can answer these questions correctly, learn the answers and be able to recall them quickly in your mind, you will be successful in your end of unit test .

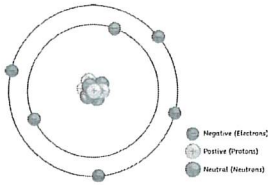
1. What is crude oil?
2. How is crude oil formed?
3. What is the generic formula of alkanes?
4. Name the first five alkanes?
5. Draw the first five alkanes?
6. What is meant by a fraction of crude oil?
7. On what physical property is crude oil separated?
8. Describe the process of fractional distillation?
9. What is meant by viscosity?
10. What is meant by flammability?
11. Describe how the properties of long chain hydrocarbons different from the properties of short chain hydrocarbons?
12. Name some fractions produced by crude oil?
13. What is required and produced during the combustion of hydrocarbons?
14. Give a word equation for the combustion of hydrocarbons?
15. Give a symbol equation for the combustion of hydrocarbons?
16. What is the generic formula for alkenes?
17. How are alkanes different to alkenes?
18. Name the first 5 alkenes?
19. Draw the first 4 alkenes?
20. How do we test for alkenes?
21. What is the difference between a saturated and unsaturated hydrocarbon?
22. What is cracking?
23. Why are hydrocarbons cracked?
24. What are the conditions needed for cracking?
25. What is produced by cracking?
26. Use structural formula to draw an example of cracking?

Atomic Structure and the Periodic Table – Foundation and Higher

Atoms

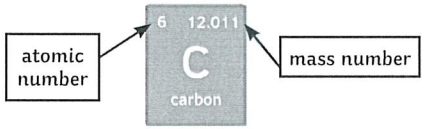
Contained in the nucleus are the **protons** and **neutrons**. Moving around the nucleus are the **electron** shells. They are negatively charged.

Particle	Relative Mass	Charge
proton	1	+1
neutron	1	0
electron	Very small	-1



Overall, atoms have no charge; they have the same number of protons as electrons. An ion is a charged particle - it does not have an equal number of protons to electrons.

Atomic Number and Mass Number



Elements

Elements are made of atoms with the same atomic number. Atoms can be represented as symbols.

N = nitrogen **F** = fluorine **Zn** = zinc **Ca** = calcium

Isotopes – an isotope is an element with the **same number of protons** but a **different number of neutrons**. They have the same atomic number, but different mass number.

Isotope	Protons	Electrons	Neutrons
$^{1}_{1}H$	1	1	1 - 1 = 0
$^{2}_{1}H$	1	1	2 - 1 = 1
$^{3}_{1}H$	1	1	3 - 1 = 2

Compounds – a compound is when two or more elements are chemically joined. Examples of compounds are carbon dioxide and magnesium oxide. Some examples of formulas are CO_2, NaCl, HCl, H_2O, Na_2SO_4. They are held together by chemical bonds and are difficult to separate.

Equations and Maths

To calculate the relative atomic mass, use the following equation:

relative atomic mass (A_r) =

$$\frac{\text{sum of (isotope abundance} \times \text{isotope mass number)}}{\text{sum of abundances of all isotopes}}$$

Balancing Symbol Equations

There must be the same number of atoms on both sides of the equation:

$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$

C = 1

O = 4

H = 4

Chemical Equations

A chemical reaction can be shown by using a **word equation.**

e.g. magnesium + oxygen → magnesium oxide

On the left-hand side are the reactants, and the right-hand side are the products.

They can also be shown by a **symbol equation.**

e.g. $2Mg + O_2 \rightarrow 2MgO$

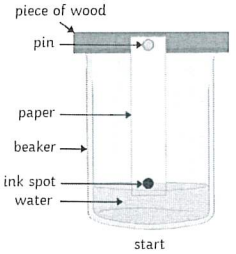
Equations need to be **balanced,** so the same number of atoms are on each side. To do this, numbers are put in front of the compounds.

$CH_4 + \mathbf{2}O_2 \rightarrow \mathbf{2}H_2O + CO_2$

Mixtures, Chromatography and Separation

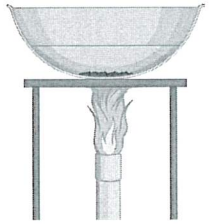
Mixtures – in a mixture there are no chemical bonds, so the elements are easy to separate. Examples of mixtures are air and salt water.

Chromatography – to separate out mixtures.



Filtration – to separate solids from liquids.

Evaporation – to separate a soluble salt from a solution; a quick way of separating out the salt.



Crystallisation - to separate a soluble salt from a solution; a slower method of separating out salt.

Separating out salt from rock salt:

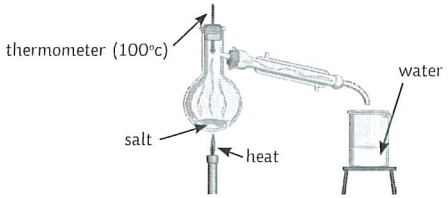
1. Grind the mixture of rock salt.
2. Add water and stir.
3. Filter the mixture, leaving the sand in the filter paper
4. Evaporate the water from the salt, leaving the crystals.

Atomic Structure and the Periodic Table – Foundation and Higher

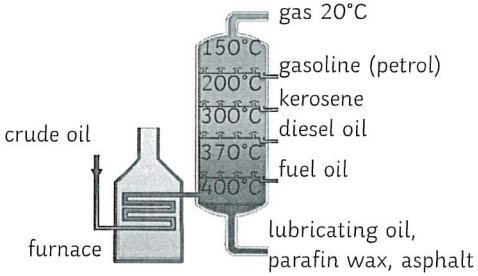
Distillation

To separate out mixtures of liquids.

1. **Simple distillation** – separating a liquid from a solution.



2. **Fractional distillation** – separating out a mixture of liquids. Fractional distillation can be used to separate out crude oil into fractions.



Metals and Non-metals

They are found at the **left** part of the periodic table. Non-metals are at the **right** of the table.

Metals

Are strong, malleable, good conductors of electricity and heat. They bond metallically.

Non-Metals

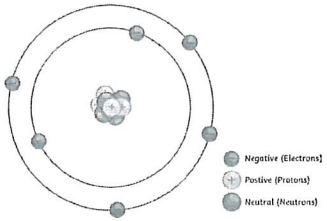
Are dull, brittle, and not always solids at room temperature.

History of the Atom

Scientist	Time	Discovery
John Dalton	start of 19th century	Atoms were first described as solid spheres.
JJ Thomson	1897	Plum pudding model – the atom is a ball of charge with electrons scattered.
Ernest Rutherford	1909	Alpha scattering experiment – mass concentrated at the centre; the nucleus is charged. Most of the mass is in the nucleus. Most atoms are empty space.
Niels Bohr	around 1911	Electrons are in shells orbiting the nucleus.
James Chadwick	around 1940	Discovered that there are neutrons in the nucleus.

Electronic Structure

Electrons are found in shells. A maximum of two in the most inner shell, then eight in the 2nd and 3rd shell. The inner shell is filled first, then the 2nd then the 3rd shell.



Group 7 Elements and Noble Gases

Halogens

The halogens are **non-metals**: fluorine, chlorine, bromine, iodine. As you go down the group they become less reactive. It is harder to gain an extra electron because its outer shell is further away from the nucleus. The melting and boiling points also become higher.

Noble Gases

The **noble gases** (**group 0** elements) include: **helium**, **neon** and **argon**. They are un-reactive as they have full outer shells, which makes them very stable. They are all colourless gases at room temperature.

The boiling points all increase as they go down the group – they have greater intermolecular forces because of the increase in the number of electrons.

Development of the Periodic Table

In the early 1800s, elements were arranged by atomic mass. The periodic table was not complete because some of the elements had not been found. Some elements were put in the wrong group.

Dimitri Mendeleev (1869) left gaps in the periodic table. He put them in order of **atomic mass**. The gaps show that he believed there was some undiscovered elements. He was right! Once found, they fitted in the pattern.

The Modern Periodic Table

Elements are in order of **atomic mass/proton number**. It shows where the metals and non-metals are. **Metals** are on the **left** and **non-metals** on the **right**. The **columns** show the **groups**. The **group number** shows the number of **electrons** in the **outer shell**. The rows are **periods** – each period shows another full shell of electrons.

The periodic table can be used to predict the reactivity of elements.

Alkali Metals

The alkali metals (**group 1 elements**) are soft, very reactive metals. They all have **one electron** in their **outer shell**, making them **very reactive**. They are **low density**. As you go down the group, they become more reactive. They get bigger and it is easier to lose an electron that is further away from the nucleus.

They form ionic compounds with non-metals.

They react with water and produce hydrogen.

E.g.

lithium + water → lithium hydroxide + hydrogen

$2Li + 2H_2O \rightarrow 2LiOH + H_2$

They react with chlorine and produce a metal salt.

E.g.

lithium + chlorine → lithium chloride

$2Li + Cl_2 \rightarrow 2LiCl$

They react with oxygen to form metal oxides.

Knowledge Test for Atomic Strucuture and the Periodic table

MEADOW PARK SCHOOL

If you can answer these questions correctly, learn the answers and be able to recall them quickly in your mind, you will be successful in your end of unit test and your final exams.

1. Define what is an element? Give an example?
2. Define what is a compound? Give an example?
3. Define what is a mixture? Give an example?
4. Name of methods of separating mixtures?
5. How is salt separated from rock salt?
6. Describe the processes within distillation?
7. When is chromatography used?
8. Give an example of a balanced symbol equation?
9. Describe how to balance symbol equations?
10. Who thought of the idea of atoms?
11. Who discovered electrons?
12. Who discovered the nucleus?
13. Who discovered that electrons exist on shells?
14. Who discovered neutrons?
15. How did Rutherford's experiment lead to the discovery of the nucleus? What other conclusions did his reach?
16. Describe the plum pudding model of the atom?
17. Describe the nuclear model of the atom?
18. What is inside an atom?
19. Name the subatomic particles found inside the nucleus?
20. Which subatomic particle orbits the outside of an atom?
21. What do electrons travel on?
22. What are the charge values for protons, neutrons and electrons?
23. What are the mass values for protons, neutrons and electrons?
24. What is the maximum number of electrons that the first shell holds?
25. What is the maximum number of electrons subsequent shells can hold?
26. What is the radius of an atom?
27. Where is the atomic number found in the periodic table? What does the atomic number tell us?
28. Where is the atomic mass found in the periodic table? What does the atomic mass tell us?
29. How do you calculate the number of neutrons?
30. What is an isotope?
31. Give an example of an isotope? Explain why it is an isotope?
32. How many groups are the in the periodic table?
33. Name groups 1, 2, 7 and 8?
34. What name is given to the middle section of the periodic table?
35. How do you divide the periodic table into metals and non-metals?
36. What does the group number of the periodic table tell us about the number of electrons of the other shells of the elements within that group?
37. What were the problems with earlier versions of the periodic table?
38. What did Mendeleev do? Why did he do it?
39. Describe the properties of group 1 metals?
40. Describe the trends of group 1 metals?
41. What happens to group 1 metals when placed in water?
42. Explain why the reactivity of group 1 metals increase as you go down the group?
43. Describe the properties of Halogens?
44. Describe the trends of Halogens?
45. What is a displacement reaction?
46. Explain why reactivity decreases down group 7?
47. Describe the trends of Noble gases?
48. Explain why Noble gases are unreactive?