

Year 10 Science Knowledge Booklet

Term 2

Name:

Class:

Year 11 Knowledge and Pillars Test Timetable and Workbook Deadlines

Homework 1	19 th November	
Homework 2	3 rd December	
Homework 3	10 th December	





Science Homework 1

Complete the section of the homework workbook identified on the front of this Knowledge organiser and learn the key knowledge questions and answers in this knowledge organiser ready for the knowledge quiz.

C6 Rate of Reaction

Big questions: How can the rate of a chemical reaction be changed?

What is the rate of reaction?

How can we increase the rate of reaction?

Why does putting food in the fridge keep it fresher for longer?

Why does concentration affect the rate of reaction?

Why do medicines come in pill form?

How do we easily increase rate in industry?

Do all reactions go to completion?

How can we control reversible reactions? (Higher Tier only)

Key vocabulary

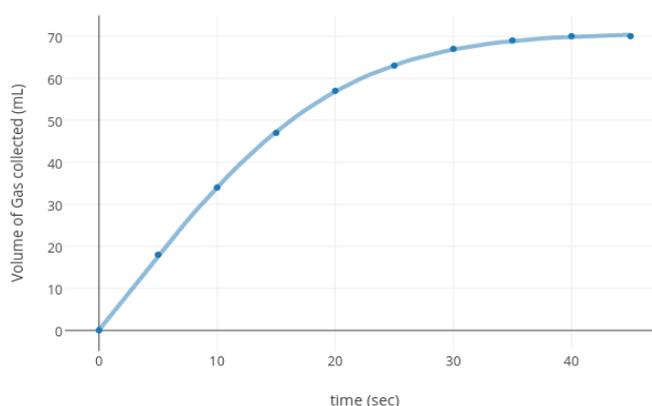
Collisions	Particles need to come together in order for a reaction to occur. For these collisions to be successful, they must have an energy greater than the activation energy
Activation energy	The minimum amount of energy needed for a collision to be successful to form the product.
Temperature	A measure of the average kinetic energy of the molecules. Increasing the temperature increases the average kinetic energy
Rate of reaction	The speed at which a reactant is converted into a product.
Pressure	Pressure is calculated by Force / area. In gases it is linked to the number of collisions per second with the container
Catalyst	A chemical that lowers the activation energy by providing an alternative route for the reaction to take place by. It is not used up in the reaction
Surface Area	The surface area is a measure of how many exposed particles are available to react.
Concentration	The number of particles present in a certain volume. Units are g/dm ³ or mol/dm ³
Limiting reactant	Whichever reactant is present in the smallest number of moles
Gradient	The steepness of the curve calculated by the change in y / the change in x (rise over run)
Plateau	The level (horizontal section) on a graph
Dynamic equilibrium (H)	When a reversible reaction reaches a point where the rate of the forward reaction equals rate of the reverse reaction in a closed system
Reversible	When the reactants can react to form the products but the reverse reaction can also take place.
Moles	A term used to describe the amount of a substance.
Closed system	Where the reactants and products cannot escape, e.g in a sealed container.

What is the rate of reaction?

Rate of reaction is the speed at which a reaction takes place. It measures the change in amount of substance per unit time

Ways to calculate rate of reaction:

- Rate = change in amount of reactant/time
- Rate = change in amount of product/time
- Rate = 1/time (used if there's a colour change or no gas is produced)



Initially a lot of gas is produced in a short period of time, this the initial rate

Over time, the gradient decreases → It is less steep showing the reaction has slowed down

The reaction stops (shown by graph plateauing)

Rate isn't consistent through a reaction, it changes throughout due to the amount of reactants changing with time (they get used up so less of them)

By drawing a tangent we can find the rate at a specific time

- Identify the **time** on the x axis and mark a dot on the curve at this time.
- Use a ruler to **draw a straight line** that only touches curve at this point.
- Pick two points on the straight line, draw lines to **make a triangle**.
- Calculate rise/run. (change in y / change in x)

How can we increase the rate of reaction?

Collision theory: Need to collide with correct orientation (right way round), and need to collide with an energy greater than the activation energy

The factors that affect the rate of reaction

- Concentration (of acid / alkali) or Pressure (gas) - the greater the concentration the more collisions per second. The particles have the same energy regardless of concentration
- Temperature - the particles have more energy. This increase the proportion of particles with an energy greater than the activation energy, whilst also increasing the number of collisions per second
- Surface area (of solid) - the greater the surface area the more collisions per second
- Catalyst - lower the activation energy. Although the particles have the same energy more particles now have an energy greater than the activation energy

Why does putting food in the fridge keep it fresher for longer?

Temperature is a measure of the average kinetic energy of the particles in a substance, by increasing the temperature we increase the average kinetic energy of the particles

Why does concentration affect the rate of reaction?

Concentration is the **number of particles** per unit of **volume**. A simple way of measuring the concentration is looking at the mass of a substance (solute) dissolved in water (solvent) The greater the concentration, the more reactant particles there are per unit of volume

Why do medicines come in pill form?

The surface area is important when using solids in a chemical reaction, as it affects the number of **exposed particles** that are **available** to react from the **start** of the reaction. Increasing the surface area increases the number of exposed particles from the start of the reaction

How do we easily increase rate in industry?

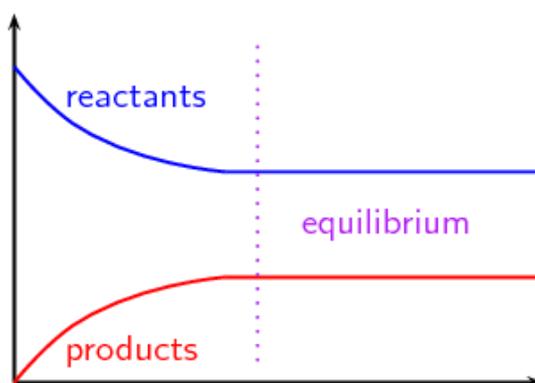
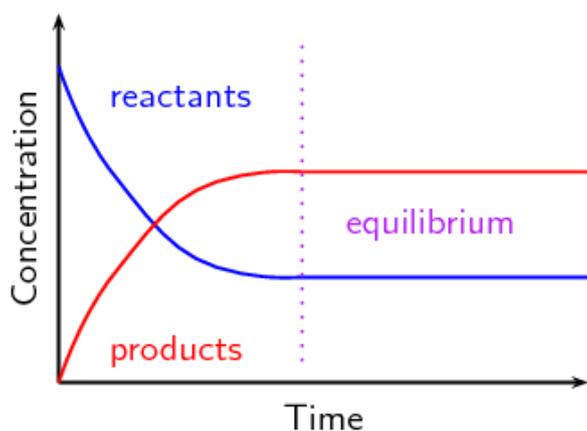
A **catalyst** is a substance that **lowers** the **activation energy** by providing an **alternative** route for the reaction to take place by. The particles **DO NOT** have any extra energy, nor are there more particles.

Do all reactions go to completion?

In **chemical** reactions, we typically represent the equation using an \rightarrow to show the reactants react to form the products. This arrow suggests that the reaction is **irreversible**, which is typical for many reactions. Reversible reactions are those where the products can react / breakdown to reform the reactants, ie the reverse reaction happen.

Dynamic equilibrium - Reaction is reversible, in a closed system. The rate of the forward reaction = rate of reverse reaction \rightarrow The concentration of each substance doesn't change

The appearance of the graph depends on which direction the equilibrium favours (it is rarely exactly in the middle)



We can make simple statements about equilibrium based on these graphs, in terms of which direction the reaction is favouring, just because it is in equilibrium does not mean that it favours reactants and products equally, it just means the concentrations of each stay constant (the reaction is still going).

How can we control reversible reactions? (Higher Tier only)

Temperature

When the Temperature of a closed system is **increased**, the equilibrium will shift in the **Endothermic** direction, therefore moving to **lower** the temperature and minimise the change.

When the Temperature of a closed system is **decreased**, the equilibrium will shift in the **Exothermic** direction, therefore moving to **lower** the temperature and minimise the change

When answering questions about temperature sometimes it is easier to think about the sides as being **HOT** (exothermic) or **COLD** (endothermic)

Le Chateliers principles put simply means you need to do the opposite to minimise the change. So if you want to shift equilibrium to the Exothermic (hot) side, cool it down by lowering the temperature. If you want to shift equilibrium to the Endothermic (cold) side, heat it up by raising the temperature.

Pressure

When the Pressure of a closed system is **increased**, the equilibrium will shift towards the side **with less moles of gas**, therefore moving to **lower** the pressure and minimise the change.

When the Pressure of a closed system is **decreased**, the equilibrium will shift towards the side **with more moles of gas**, therefore moving to **increase** the pressure and minimise the change.

When talking about **pressure**, we only care about the **moles of GAS**

Key knowledge question	Answer
What is the rate of a reaction?	The speed in which a chemical reaction takes place
How can the rate of reaction be calculated from a volume of gas produced?	rate = volume of gas produced/ time
If the initial rate of a reaction is being calculated, where would a tangent be drawn?	time = 0
What are the 4 factors that affect the rate of reaction?	temperature, concentration/pressure, surface area, addition of a catalyst
What happens to the rate of the reaction if the temperature of the reaction is increased?	increases the rate of reaction
Why does increasing the surface area increase the rate of reaction?	(More exposed particles) increases the frequency of collisions
How does a catalyst increase the rate of reaction?	lowers the activation energy, so more particles have the energy greater than the activation energy
What is collision theory?	Particles need to collide in the correct orientation and with enough energy in order to react
What symbol is used to show a reaction is reversible?	\rightleftharpoons

B3 Infection and Response

Big questions: What causes disease?

- What are communicable diseases?
- Viral, Fungal and Bacterial diseases, what causes what?
- Viral, Fungal and Bacterial diseases, how are they spread?
- What is malaria?
- How do microbes make us ill?
- How does our immune system cure and protect us?
- What are vaccinations?
- Why won't antibiotics help if you have flu?
- How do antibiotics effect microbial growth?
- What do painkillers do?
- Where do we get drugs from and how are they developed?
- What causes plant diseases?

Key vocabulary

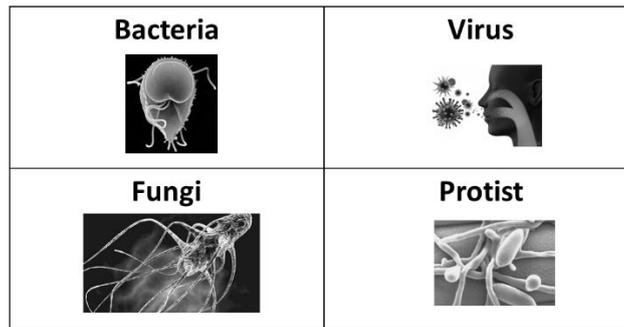
Antibiotic	Substances that slow down or stop the growth of bacteria.
Antibody	A protein produced by white blood cells in the response to the presence of an antigen.
Antigen	A molecule on the surface of a cell. A foreign antigen will trigger an immune response.
Bacteria	A microorganism (prokaryote) some of which cause diseases e.g. salmonella.
Bacterial resistance	Bacteria that have mutations in their DNA which mean an antibiotic no longer effects them is said to be resistant e.g. MRSA.
Communicable disease	A disease that can spread between individuals.
Double Blind Trial	The volunteers do not know which group they are in, and neither do the researchers, until the end of the trial.
Fungi	A microorganism, some of which cause disease e.g., Ring worm.
Gonorrhoea	A sexually transmitted bacterial disease.
HIV	A virus that attacks the immune system cells so that eventually it cannot cope with other infections or cancers. It causes AIDS.
Measles	A viral disease that causes a red skin rash and a fever.
Malaria	A disease caused by a protist and spread by mosquito, which causes repeating episodes of fever.
Pathogen	A disease causing microorganism.
Painkiller	Painkillers are chemicals that relieve the symptoms but do not kill the pathogens. Common examples include paracetamol and aspirin, and they can relieve a headache or a sore throat.
Phagocytosis	The process by which white blood cells engulf foreign cell and digest them.
Protist	A microscopic animal some of which cause disease e.g. malaria.

What are communicable diseases?

Communicable diseases are infectious diseases caused by pathogens.
A pathogen is a microbe that causes disease.

There are 4 types of pathogen:

1. Bacteria - Small single celled organisms with no membrane bound organelles
2. Viruses - Very tiny and simple, just a protein coat and string of genetic material
3. Fungi – Fungi (singular: fungus) are a kingdom of usually multicellular eukaryotic organisms that are heterotrophs (cannot make their own food)
4. Protists - Eukaryotes that are not plant, animal or fungus. They have a nucleus and membrane bound organelles. Some are multicellular but most are unicellular



Viral, Fungal and Bacterial diseases, what causes what?

Pathogen	Example in animals	Example in plants
Viruses	Measles and HIV (potentially leading to AIDS)	Tobacco mosaic virus
Bacteria	Salmonella and Gonorrhoea	
Fungi	Athlete's foot	Rose black spot
Protists	Malaria	

Viral, Fungal and Bacterial diseases, how are they spread?

Transmission – how disease are spread.

Transmission can occur in a number of important ways.

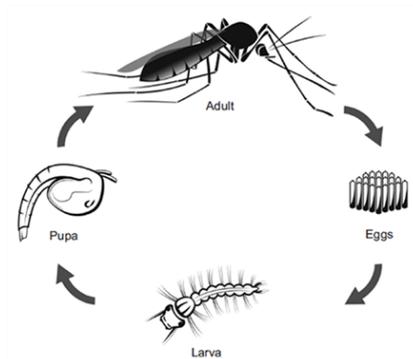
Type	Examples
Direct contact	This can be either sexual contact (during intercourse) or non-sexual contact, (like shaking hands).
Water	Dirty water can transmit many diseases, such as the cholera bacterium.
Air	When a person who is infected by the common cold sneezes, they can spray thousands of tiny droplets containing virus particles to infect others.
Unhygienic food preparation	Undercooked or reheated food can cause bacterial diseases like E. coli which is a cause of food poisoning.
Vector	Any organism that can spread a disease is called a vector. Many farmers think tuberculosis in their cattle can be spread by badgers.

How to prevent the spread of diseases

Method	Example	How it works
Sterilising water	Cholera	Chemicals or UV light kill pathogens in unclean water.
Suitable hygiene – food	Salmonella	Cooking foods thoroughly and preparing them in hygienic conditions kills pathogens.
Suitable hygiene – personal	Athlete's foot	Washing surfaces with disinfectants kills pathogens. Treating existing cases of infection kills pathogens.
Vaccination	Measles	Vaccinations introduce a small or weakened version of a pathogen into your body, and the immune system learns how to defend itself.
Barrier contraception	HIV/AIDs	Using barrier contraception, like condoms, stops the transfer of bodily fluids and sexually transmitted diseases

What is malaria?

- Malaria is a protist disease
- Malaria is a disease caused by a microorganism carried by mosquitoes
- Part of the protist's life cycle takes place inside the mosquito
- The microorganism is transferred to humans when adult female mosquitoes feed on human blood
- Mosquitos are vectors
- Causes fever (can cause death)
- Prevention: stop the mosquitos breeding and use mosquito nets



How do microbes make us ill?

- Infectious (communicable) diseases are caused by microbes called pathogens
- These may reproduce rapidly inside the body and may produce toxins that make us feel ill
- Viruses damage cells in which they reproduce

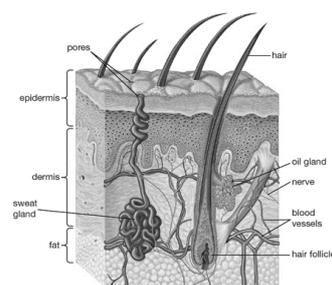
How does our immune system cure and protect us?

Non-specific human defence systems against disease

The first line of defence against infection stops the pathogens from entering your body. These first lines are general defences, and are not specific to fight against certain types of pathogen. They are called non-specific, and they can be physical or chemical barriers.

The skin

The skin covers almost all parts of your body to prevent infection from pathogens. If it is cut or grazed it immediately begins to heal itself, often by forming a scab, which prevents infection as the skin acts as a physical barrier.



The immune system of the body is highly complex, with white blood cells being the main component

Once a pathogen has entered the body the role of the immune system is to prevent the infectious organism from reproducing and to destroy it

White blood cells help to defend against pathogens by:

Phagocytosis

Phagocytes are white blood cells that engulf and digest pathogens.

The phagocyte surrounds the pathogen and releases enzymes to digest and break it down to destroy it.

Production of antibodies

Lymphocytes (a type of white blood cell) produce antibodies.

Antibodies are Y-shaped proteins. The aim of antibody production is to produce the antibody that is specific (complementary) to the antigens on the surface of the pathogen.

Production of antitoxins

Some pathogens (usually bacteria) can produce substances which act as toxins which make you feel unwell

Lymphocytes can produce antibodies against these substances – in this case, they are called antitoxins

The antitoxins neutralise the effects of the toxin.

What are vaccinations?

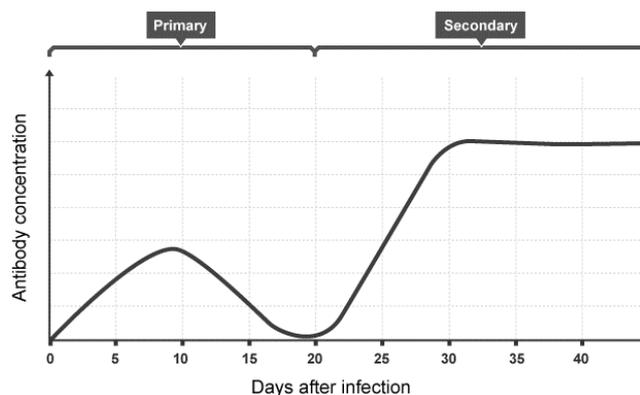
A vaccine contains a small amount of dead or inactive (attenuated) pathogens.

- These are introduced into the body, often by injection, orally or nasal spray.
- These cause the white blood cells to produce antibodies.
- Immunity allows white blood cells to quickly produce specific antibodies, preventing the disease developing.

Infections and vaccinations produce primary and secondary responses-

Primary - the antibodies slowly increase, peak at around ten days and then gradually decrease.

Secondary - exposure to the same pathogen causes the white blood cells to respond quickly, producing lots of the relevant antibodies, which prevents infection.



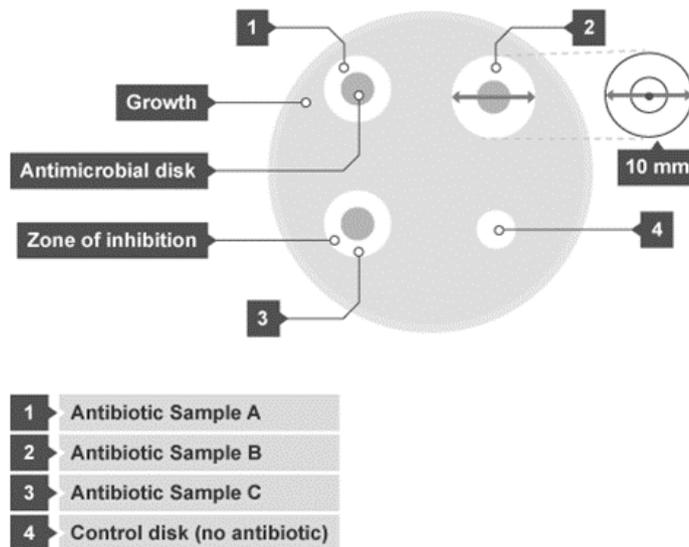
Why won't antibiotics help if you have flu?

Antibiotic – Antibiotics are medications that destroy or slow down the growth of bacteria.

Antibiotics do not work on viruses.

So there is no point taking antibiotics for a cold or flu – as these are caused by a virus.

How do antibiotics effect microbial growth?



BBC Bitesize

What do painkillers do?

- Painkillers are drugs that relive pain
- E.g. throat sweets, painkillers (aspirin, ibuprofen, paracetamol)
- Painkillers relieve symptoms but do not kill pathogens, they stop you feeling the pain
- Paracetamol, aspirin and morphine block nerve impulses from the painful part of the body, or block nerve impulses travelling to the part of the brain responsible for perceiving pain

In larger doses they can be harmful or even fatal.

Some painkillers are addictive.

Where do we get drugs from and how are they developed?

Plants: plants are also attacked by pathogens and have evolved chemicals to defend themselves against pests and pathogens. We can adapt some of these to make new drugs.

- Aspirin was developed from a chemical found in the bark of willow trees. It is used to lower pain and reduce inflammation.
- Digitalis is used to treat heart conditions. It was developed from a chemical found in poisonous foxgloves.

Microorganisms: As with plants, microorganisms have chemical defences which we can copy.

- Penicillin was our first antibiotic, discovered by Alexander Fleming. He was throwing away old bacteria petri dishes when he noticed one had mould on it. The area around the mould was free of bacteria. He discovered that the mould (*Penicillium notatum*) produced a substance which kills bacteria.

How does a new drug get tested?

Producing new drugs is a lengthy and very expensive process. Drug development goes through the following stages:

- Discovery
- Pre-clinical Testing
- Clinical Trials

To work out how well a drug works, patients are put random groups. One group is given the real drug, the other group a placebo which looks like the real drug but doesn't do anything.

Where possible, clinical trials are blind to allow for the placebo effect (when a patient expects to feel better, they often believe that they do, even if nothing physical has changed.)

Double-blind means that neither the patient nor the doctor knows whether they are getting the placebo or the real drug.

This is because even doctors are affected by the placebo effect, and can be subconsciously influenced by their knowledge when reporting the results.

What causes plant diseases?

Tobacco mosaic virus (TMV)

This is a disease caused by a virus, it can infect tobacco and crops like potatoes, peppers and tomatoes.

It spreads through contact or through animals spreading it from one plant to another.

It reduces the leaf's ability to photosynthesise and so reduces the size of the crop.

Rose black-spot

Rose black spot fungus is a fungus that causes black spots on leaves, it infects roses.

Again this reduces the plants ability to photosynthesise, so plants do not grow as well.



Science Homework 2

Complete the section of the homework workbook identified on the front and learn the key knowledge questions and answers for all of the areas covered in this knowledge organiser ready for the end of term test.

Wider Reading:



Antibiotic resistance
31 July 2020

Key facts

- Antibiotic resistance is one of the biggest threats to global health, food security, and development today.
- Antibiotic resistance can affect anyone, of any age, in any country.
- Antibiotic resistance occurs naturally, but misuse of antibiotics in humans and animals is accelerating the process.
- A growing number of infections – such as pneumonia, tuberculosis, gonorrhoea, and salmonellosis – are becoming harder to treat as the antibiotics used to treat them become less effective.
- Antibiotic resistance leads to longer hospital stays, higher medical costs and increased mortality.

Introduction

Antibiotics are medicines used to prevent and treat bacterial infections. Antibiotic resistance occurs when bacteria change in response to the use of these medicines.

Bacteria, not humans or animals, become antibiotic-resistant. These bacteria may infect humans and animals, and the infections they cause are harder to treat than those caused by non-resistant bacteria.

Antibiotic resistance leads to higher medical costs, prolonged hospital stays, and increased mortality.

The world urgently needs to change the way it prescribes and uses antibiotics. Even if new medicines are developed, without behaviour change, antibiotic resistance will remain a major threat. Behaviour changes must also include actions to reduce the spread of infections through vaccination, hand washing, practising safer sex, and good food hygiene.

Read the rest of the article here: <https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance>

Key knowledge question	Answer
Name 3 ways a vaccine can be introduced to the body.	Injection, orally or nasal spray.
Name 3 ways that pathogens are spread.	Food, water, airborne droplets, vectors, direct and indirect contact.
Name 4 types of drugs.	Depressants, pain killers, stimulants and hallucinogens.
Name the 3 things that white blood cells do to invading microbes.	Engulf, produce antibodies, produce antitoxins.
Name the 4 types of pathogen.	Virus, fungi, bacteria, protist (allow protozoa).
What are toxins?	Harmful substances produced by a pathogen.
What is a pathogen?	An organism which causes diseases.
What is a placebo?	A substance that has no therapeutic effect, used as a control in testing new drugs
What is herd immunity?	Majority of the population is vaccinated, reduce the chances of people coming into contact with the pathogen.
What is a double blind trial?	Neither the patient nor the doctor know whether they have been given a placebo.

P4 Atomic Structure

Big questions:

- What are atoms made of?
- How was the structure of the atom discovered?
- What is nuclear radiation?
- What are the properties of the nuclear radiations?
- How do we write decay equations?
- How long do sources stay radioactive?
- What is the difference between irradiation and contamination?

Key vocabulary

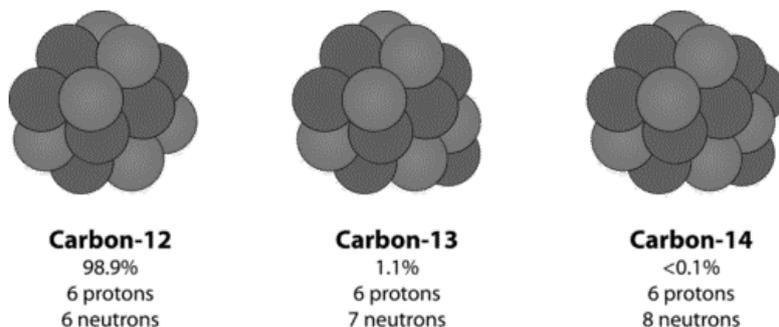
Alpha particle	A helium nucleus (two protons, two neutrons) emitted from some unstable nuclei during radioactive decay.
Alpha scattering experiment	An experiment carried out by Rutherford and others that showed that the atom has a nucleus.
Atomic structure	The atoms of an element are made of smaller, sub-atomic, particles. The number and arrangement of these particles is the atomic structure of the element.
Background radiation	Ionising radiation emitted by natural and man-made sources that is at a constant low level all over the Earth.
Beta particle	A fast moving electron emitted from the nucleus of some unstable nuclei during radioactive decay. Created by the decay of a neutron into a proton and electron.
Decay equation	A symbol equation representing the decay of a nucleus. Show the changes happening in the nucleus of radioactive isotopes.
Gamma ray	A photon (particle) of high energy electromagnetic radiation emitted from some unstable nuclei during radioactive decay.
Half Life	The time taken for one half of all remaining undecayed nuclei to decay. A measure of how long a sample will stay radioactive.
Ionising Radiation	Potentially harmful radiation emitted from the nucleus of an unstable isotope that can cause ionisation of other atoms.
Irradiation and contamination	Potentially harmful exposure to radiation either by radiation passing through (irradiation) or being in contact with radioactive material (contamination)
Isotope	Version of the same element with the same number of protons but different number of neutrons.
Radioactive decay	When an unstable isotope of an element undergoes a change in its nucleus and emits ionising radiation.

- **What are atoms made of?**

Atoms consist of a nucleus of protons and neutrons surrounded by electrons.

Isotopes of an element have the same number of **protons** and different number of **neutrons**. They have the same **Atomic number** and different **Mass number**.

Eg. Isotopes of carbon.



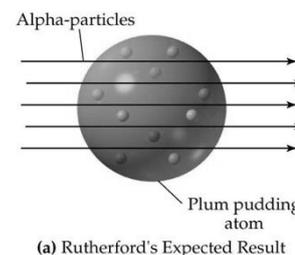
- **How was the structure of the atom discovered?**

Rutherford's alpha scattering experiment led to the modern model of the atom.

Thompson's plum pudding:

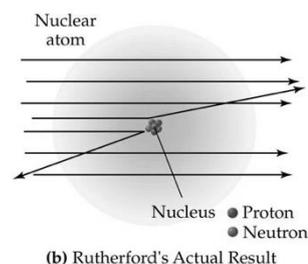
- Electrons scattered throughout.
- Positive charge spread everywhere.

Expect alpha particles to pass through mostly undeflected.



Rutherford's results:

- Many alpha particles pass through – must be lots of empty space.
- Some deflected through big angles – positive charge is in one place.



Rutherford concludes: nucleus in the centre, electrons on outside.

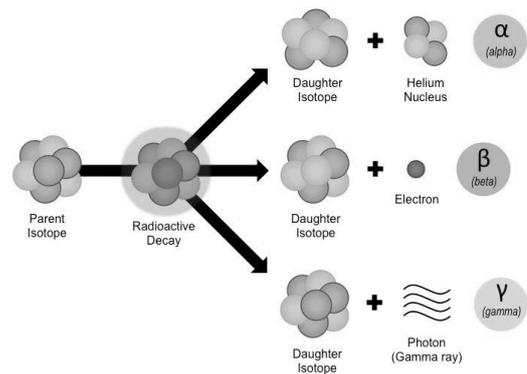
- **What is nuclear radiation?**

In **alpha decay** a nucleus loses two protons and two neutrons.

- Mass number down by 4
- Atomic number down by 2

In **beta decay** a neutron becomes a proton and an electron. The electron is emitted. It is the beta particle.

- Mass number stays the same
- Atomic number goes up by 1

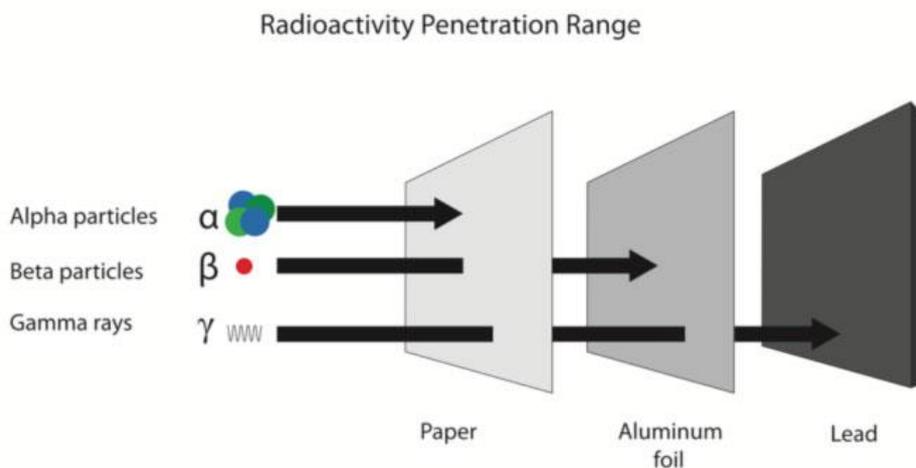


In **gamma decay** a photon of high energy electromagnetic radiation is emitted. The nucleus is unchanged.

- **What are the properties of the nuclear radiations?**

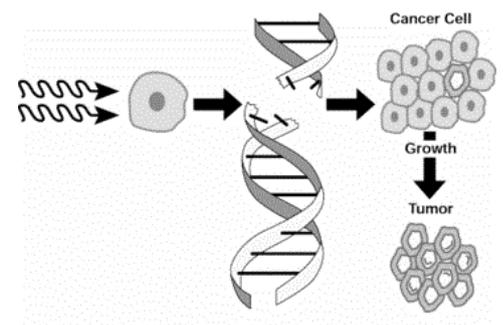
The penetrating power is a measure of how difficult it is to stop a radiation.

Alpha radiation has a low penetrating power. Beta is greater and gamma radiation is the most penetrating.

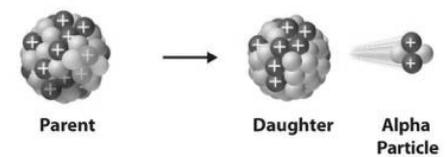
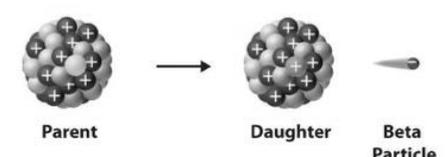


Nuclear radiations (alpha, beta, gamma) can cause **ionisation** (knock electrons out of other atoms).

This can damage human DNA and lead to cell damage or mutation that can lead to cancer.



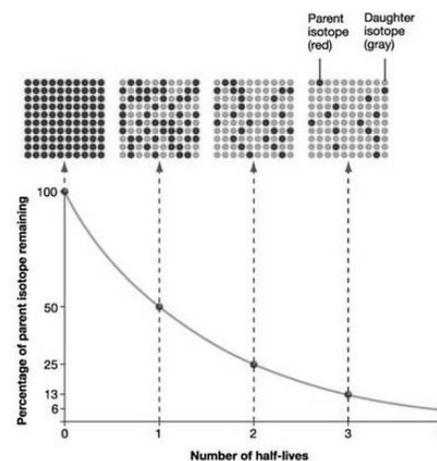
• How do we write decay equations?

Decay Type	Radiation Emitted	Generic Equation	Model
Alpha decay	${}^4_2\alpha$	${}^A_ZX \longrightarrow {}^{A-4}_{Z-2}X' + {}^4_2\alpha$	 <p>Parent → Daughter + Alpha Particle</p>
Beta decay	${}^0_{-1}\beta$	${}^A_ZX \longrightarrow {}^A_{Z+1}X' + {}^0_{-1}\beta$	 <p>Parent → Daughter + Beta Particle</p>
Gamma emission	${}^0_0\gamma$	${}^A_ZX^* \xrightarrow{\text{Relaxation}} {}^A_ZX' + {}^0_0\gamma$	 <p>Parent (excited nuclear state) → Daughter + Gamma ray</p>

• How long do sources stay radioactive?

Half life is: the time taken for the number of un-decayed atoms to fall by half. Equal to time for radioactive count to fall by half.

- Doesn't matter where you start counting – half life always the same.
- Half life for different isotopes very different.
- Half life useful for aging fossils and rocks – eg. carbon dating



• What is the difference between irradiation and contamination?

Contamination – you have a radioactive source material on you or in you.

Irradiation - ionising radiation strikes you or passes through you.



Science Homework 3

Complete the final section of the homework workbook identified on the front and learn the key knowledge questions and answers for all of the areas covered in this knowledge organiser ready for the end of term test.

Key knowledge question	Answer
Which model of the atom consists of a sphere of positive charge with electrons embedded inside?	Sphere (ball) of positive charge, (negative) electrons scattered throughout
Give two features of the Plum Pudding model of the atom	Positive charge concentrated in the centre (nucleus), (negative) electrons around the outside
Give two features of the Rutherford nuclear model of the atom	Orbitting the nucleus (in energy levels/shells)
Where are electrons found in the nuclear model of the atom?	${}^4_2\text{He}$ or a helium nucleus or 2 protons and 2 neutrons
Describe an alpha particle	${}^0_{-1}\text{e}$ or a fast moving/high energy electron
Describe a beta particle	${}^0_0\gamma$ or a high energy/frequency electromagnetic wave
Describe gamma	alpha, beta, gamma and neutron decay
State 3 type of nuclear radiation	the time taken for the activity to halve
Define half-life	contamination
What term means getting radioactive source on your skin, clothes or an object?	irradiation
What term means being exposed to the radiation emitted from a radioactive source?	mass number decreases by 4, atomic number decreases by 2
How do the mass number and atomic number change when a nucleus emits an alpha particle?	mass number stays the same, atomic number increases by 1

Wider reading

How to get the most out of your knowledge organiser:

- To get the most use out of the knowledge organisers you should be learning sections and then self-testing.
- There are several different things you can do
 - Look, cover, write, check, correct
 - Read through the organisers
 - Mind maps
 - Key spellings
 - Make a glossary
 - Missing out key words
 - Questions/answers answers/questions
 - Flash cards
 - Revision clock learning
 - Mnemonics

Science Learning Tools and wider study:

The Oak Academy – Online Science lessons

BBC Bitesize science

You tube channels:

Fuse school

Ted talks

Free science lessons

Primrose Kitten

Shows on Netflix

Our planet

Tiny creatures

A life on our planet