

Inheritance

Threshold Concept

Organisms pass on their DNA in order to survive.

DNA



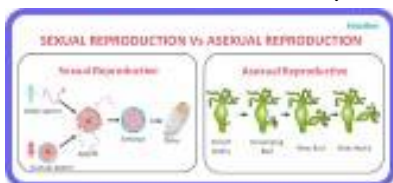
DNA is found in the nucleus of cells and contains all the genetic material to make the organism



Keywords

- Cell**..... The smallest unit that can live on its own and makes up all living organisms
- Nucleus** The organelle inside cells that contains the cells genetic material
- DNA**..... The molecule inside cells that contains all the genetic information responsible for the development and function of an organism
- Chromosomes**..... A structure made up of proteins and DNA organised into genes inside the nucleus of a cell
- Gene** Genes carry information that determine what characteristics are inherited from an organism's parents
- Reproduction**..... The production of offspring

Sexual and asexual reproduction

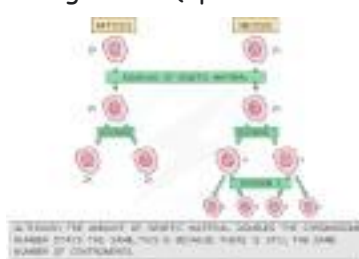


There are two main forms of reproduction: sexual and asexual reproduction. In sexual reproduction, an organism combines the genetic information from each of its parents and is genetically unique. In asexual reproduction, one parent copies itself to form a genetically identical offspring



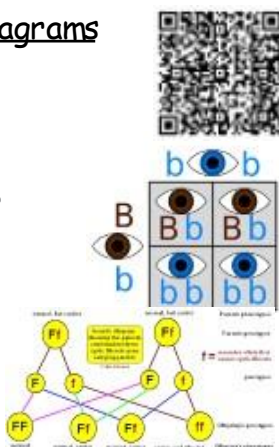
Mitosis / Meiosis

Mitosis is a form of cell division which produces two identical, diploid body cells. Meiosis is a form of cell division which produces four non-identical, haploid sex cells or gametes (sperm and ova in humans)

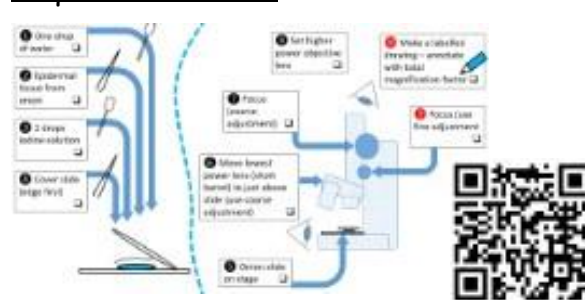


Genetic cross diagrams

Genetic crossing describes breeding two selected individuals so their offspring can be studied to understand how a particular trait is inherited down the generations.



Required Practical



Equations for this topic

Image size = actual size x magnification

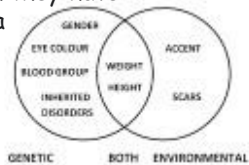
Variation

Threshold Concept

All living things need to change to live.

Variation

Individuals in a population are usually similar to each other, but not identical. Some of the variation within a species is genetic, some is environmental - the conditions in which they have developed and some is a combination of both



Keywords

Variation..... any difference between the individuals in a species or groups of organisms of any species

Evolution the change in the characteristics of a species over several generations and relies on the process of natural selection

Adaptation..... the adjustment of organisms to their environment in order to improve their chances at survival in that environment

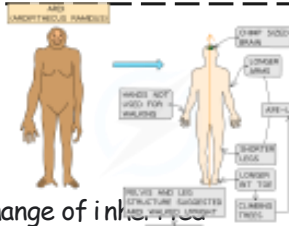
Natural Selection the process through which populations of living organisms adapt and change

Natural Selection

In any environment, the individuals that have the best adaptive features are the ones most likely to survive and reproduce



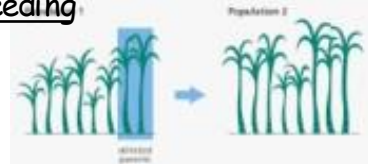
Evolution



Evolution is the change of inherited characteristics within a population over time through natural selection, which may result in the formation of a new species. Five main processes that lead to evolution:

- mutation
- non-random mating
- gene flow
- finite population size (genetic drift)
- natural selection.

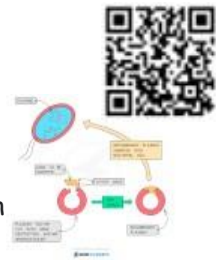
Selective Breeding



Selective breeding or artificial selection is when humans breed plants and animals for particular genetic characteristics. Humans have bred food crops from wild plants and domesticated animals for thousands of years

Genetic Engineering

Genetic engineering involves modifying the genome of an organism by introducing a gene from another organism to result in a desired characteristic



Fossils



A fossil is the preserved remains of a dead organism from millions of years ago.

Evidence for early forms of life comes from fossils. By studying fossils, scientists can learn how much (or how little) organisms have changed as life developed on Earth

Required Practical

Equations for this topic

Quantitative chemistry

Threshold Concept

To understand that total mass of reactants equals total mass of products

RFM

molybdenum	← element name
42	← atomic number number of protons (Z)
Mo	← atomic symbol
95.94	← atomic mass A (this is an average mass)

RAM is atomic mass of an element

RFM is the combination of all elements Ar in a compound or Molecule

Work example

Helium (He) Ar = 4

Carbon dioxide = CO₂

Carbon (C) = 12 Oxygen (O) = 16

Mr of CO₂ = 12 + (16 x 2) = 44

4 He helium	12 C carbon
16 O oxygen	



Keywords

Conservation - the mass of the reactants must equal the mass of the products in a chemical reaction

Formula mass - the combined mass numbers of an element or compound

Concentration - the amount of substance dissolved in a solution

Equation - symbol representation of a chemical reaction

Loss - the process of losing something

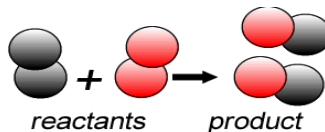
Gain - the process of gaining something

Balancing Equations

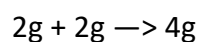
As the same number of elements are at the start and the end of reactions. The Equation needs to be balanced.



Conservation of Mass



The reactants mass must always equal the mass of the products

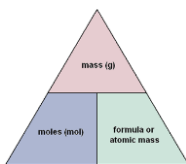


We can not destroy atoms.



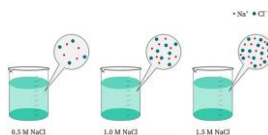
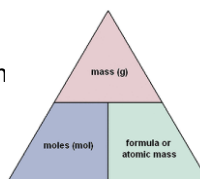
Moles

Chemical amounts are measured in moles. One mole of a substance contains 6.02×10^{23} particles (Avagadro's number)



Concentration

Concentration is the amount of substance in a certain volume of solution (g/dm³)



Percentage by mass

The amount of an element in a compound is called its percentage composition. It can be calculated using the mass of the given element in the compound and the RFM of the Compound.

$$\text{Mass \%} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100\%$$



Limiting reactions

The reactant that gets used up first in a reaction is called the limiting reactant. This reactant is not in EXCESS



Reacting masses

The mass of a product or reactant can be determined from having a balanced symbol equation. Once balanced, the equation tells you how many moles of each substance react with each other : $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ (Balanced)

This equation states that: 1 : Mg 2 : HCl to form 1 : MgCl₂ 1 : H₂

Using the formula and moles you can use this information to work out how much product you will make

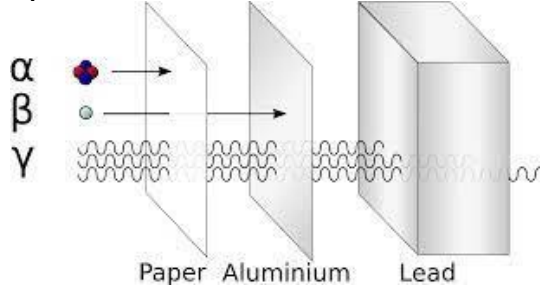


Atomic Structure

Threshold Concept

Identify that there are three types of radiation

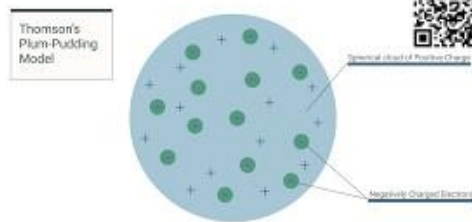
Alpha, Beta and Gamma



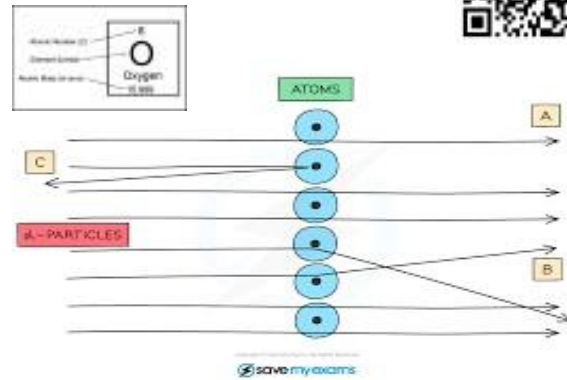
Keywords

Atom - the smallest particle of a chemical element that can exist
 Proton - positively charged particle
 Neutron - Particle with no charge
 Electron - Negatively charged particle
 Wave - Energy transfer method

Plum Pudding Model

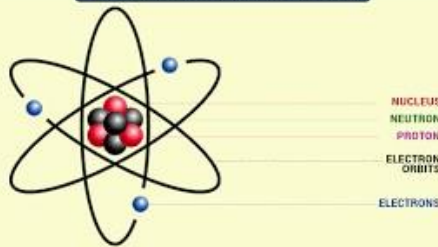


Rutherford's Scattering Experiment

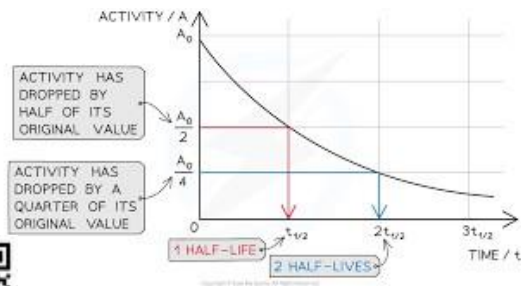


Nuclear Model

Rutherford's Model Of Atoms



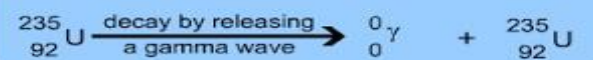
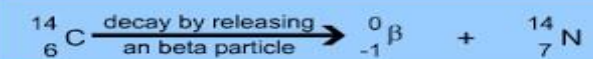
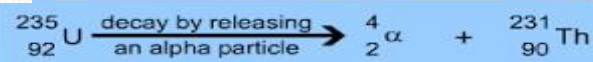
Half Life



Uses and Dangers of Radiation

	Irradiation	Contamination
Description	Object is exposed to radiation, but does not become radioactive	Object becomes radioactive and emits radiation
Source	Danger is from radiation emitted outside the object	Danger from radiation emitted within the object
Prevention	Prevented by using shielding, such as lead clothing	Prevented by safe handling of sources and air tight safety clothing
Causes	Caused by the presence of radioactive sources outside the body	Caused by inhalation or ingestion of radioactive sources

Equations for this topic



Particle Models of Matter

Threshold Concept

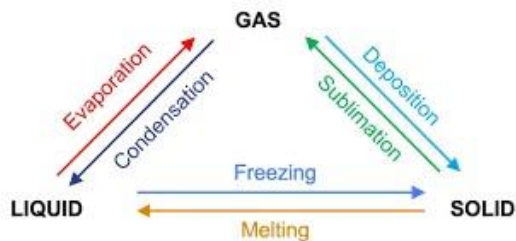
Changes of state are caused by energy changes

States of matter

Solid Liquid Gas



Changes of state



Links to information on the whole topic, consisting of slides, videos, and quizzes

Equations for this topic

$$P = F/A \text{ Pressure} = \text{Force} / \text{Area}$$

$$P = m/V \text{ Density} = \text{mass} / \text{volume}$$

$$\Delta E = m \times c \times \Delta\theta \text{ Change in Energy} = \text{mass} \times \text{specific heat capacity} \times \text{change in temperature}$$

$$\Delta E = m \times L \text{ Change in Energy} = \text{mass} \times \text{Specific Latent Heat}$$

$$P = \rho \times g \times h \text{ Pressure in a liquid column} = \text{density} \times \text{gravity} \times \text{height (TRIPLE ONLY)}$$

$$\text{For gases: } p \times v = \text{constant} \text{ For Gases: pressure} \times \text{volume} = \text{constant} \text{ (TRIPLE ONLY)}$$

Keywords

States of matter - solid, liquid or gas.

Particles - the smallest part that a substance can be broken down into.

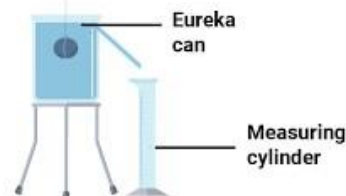
Energy - a property of a substance that is stored or transferred in order for things to be done.

Density - how compact a substance is.

Pressure - continuous force acted on or against an object.

Required Practical

Density



Specific Heat Capacity

