Respiration

Keyword	Definition
Respiration	Process in living things which oxygen is used to release the energy from food. Glucose + Oxygen → Carbon Dioxide + Water (+energy)
Aerobic Respiration	Respiration that requires oxygen.
Anaerobic Respiration	Respiration without oxygen.
Lactic Acid	A chemical produced during anaerobic respiration
Mitochondria	Structures in the cytoplasm of all cells where aerobic respiration takes place.
Oxygen Debt	The amount of extra oxygen required by the body for recovery after vigorous exercise.
Alveoli	Tiny air sacs in the lungs, where gas is exchanged during breathing.
Bronchi	Branches off the trachea that distribute air to both lungs.
Bronchioles	Branches of the bronchi, that distribute the inhaled air throughout all of the lungs.
Diaphragm	Expands and moves down so lungs have room to fill with air – inhalation. Contracts and moves upwards to force air out of the lungs (exhalation).
Lung	Soft organ that inflates to draw in oxygenated air and deflates to expel air.
Trachea	Windpipe, air passes between mouth and lungs.

Aerobic Respiration

Respiration is a series of reactions that takes place in the cells of animals and plants.
Energy is released in the reaction. The mitochondria, found in the cell cytoplasm, is where respiration happens.

Glucose + Oxygen → Carbon Dioxide + Water (+energy)

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

'Energy' is in brackets because it is not a substance. This type of respiration, where oxygen is used, is known as aerobic respiration. Oxygen (from breathing) is carried from the lungs to all the cells of the body in the blood. The waste products (carbon dioxide and water) are taken away from the cells by the blood and breathed out from the lungs.

Anaerobic Respiration

Although anaerobic respiration does release some energy, it does not release as much as aerobic respiration does.

Glucose → Lactic Acid (+energy)

The lactic acid produced during anaerobic respiration builds up in muscles. This can be felt as an aching in muscles during or after exercise.

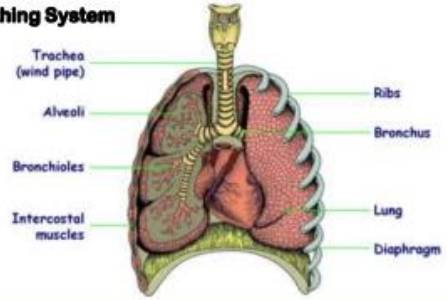
Anaerobic Respiration in Microbes

Anaerobic respiration happens in microorganisms such as bacteria because they need to release energy from glucose. Yeast (unicellular fungi), carry out a process called fermentation.

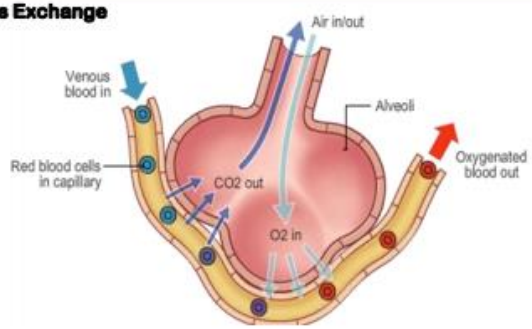
Glucose → Ethanol + Carbon Dioxide

The ethanol (alcohol) is useful for brewers, and carbon dioxide is useful to bakers because it helps their bread rise.

The Breathing System



Gas Exchange



The alveoli are adapted to make gas exchange in the lungs happen easily and efficiently.

- Alveoli give the lungs a large surface area.
- Alveoli have think cells walls (just one cell thick)
- Alveoli are surrounded by lots of blood capillaries.

The gases move by diffusion from where they have a high concentration to a lower concentration.

Oxygen diffuses from the air in the alveoli into the blood.
Carbon dioxide diffuses from the blood into the air in the alveoli.

Asthma and Respiration

Air passage for people who are asthmatic become reduced.

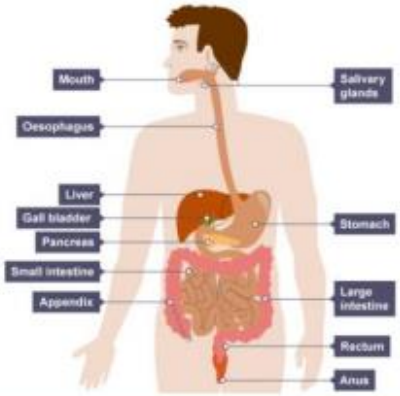
This is why they often struggle during exercise as there is reduced volume of oxygen getting into the blood stream, so rate of respiration is reduced.

Digestion

Keyword	Definition
Digestion	The breakdown of large insoluble food molecules into smaller soluble ones.
Digestive System	Organ system involved in breaking food down so that it can be absorbed into the bloodstream.
Absorbed	When a substance is taken in by something or moved across a barrier such as a cell membrane.
Amylase	An enzyme that can break down starch into simple sugars.
Lipase	Enzyme that breaks down lipids (fats & oils).
Carbohydrase	Enzyme that breaks down carbohydrates.
Protease	Enzyme that breaks down proteins.
Enzyme	A protein which catalyses or speeds up a chemical reaction.
Surface Area	The area of the surface of an organism or membrane.
Villi	Finger-like projections in the small intestine that provide a large surface area for the absorption of food.
Capillary	Tiny blood vessels with walls one-cell thick where exchange of materials occurs.
Bile	Substance produced in the liver. It emulsifies fats to prepare them for digestion.
Pancreas	Produces biological catalysts called enzymes which speeds up the digestive reactions.
Excretion	Process by which waste products from chemical reactions in an organism are removed.

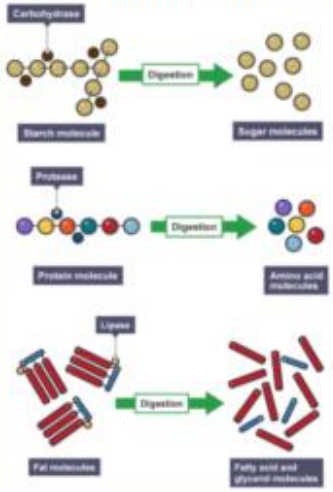
Further Reading:
https://www.bbc.com/bitesize/guides/z9pv34j/revision/1
https://www.bbc.com/bitesize/guides/zwqycdm/revision/1

The food we eat has to be broken down into other substances that our bodies can use. This is called digestion. Without this process, we could not absorb the food unto our bodies and use it.



Organ	Function
Oesophagus	Also known as the gullet. Connects the mouth to the stomach. Food is pushed down using contractions of muscles.
Liver	Production of bile.
Stomach	Churns and mixes the food with hydrochloric acid and enzymes.
Pancreas	Produces biological catalysts called enzymes which speeds up the digestive reactions.
Small Intestine	Absorption of digested food into the bloodstream, production of enzymes to aid digestion.
Large Intestine	Absorption of excess water.
Rectum	Storage of faeces (undigested material) before excretion.
Anus	Where faeces are excreted (removed from the body).

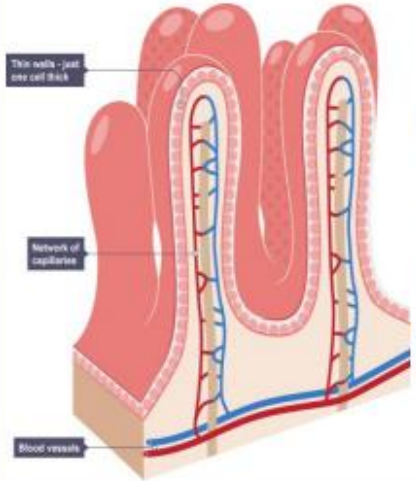
Enzymes are not living things. They are special proteins that can break large molecules into smaller molecules.



Minerals, vitamins and water are already small enough to be absorbed by the body without being broken down, so they're not digested.

Digestive enzymes cannot break down dietary fibre, which is why the body cannot absorb it.

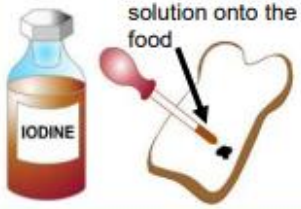
Adaptations of the Small Intestine

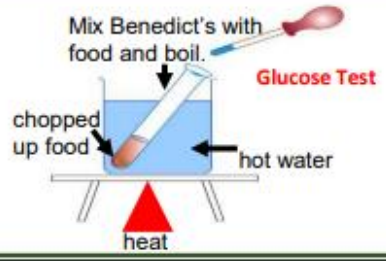


The small intestine is adapted for efficient absorption of digested food into the blood stream by:

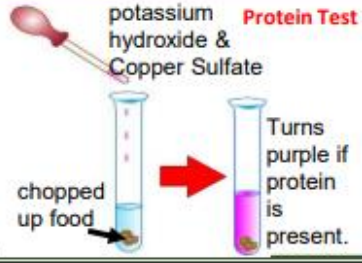
- Having a very large surface area.
- Surrounded by lots of blood capillaries.
- Thin walls (1 cell thick) for faster absorption.

Starch Test





Protein Test



Elements, Compounds, Mixtures

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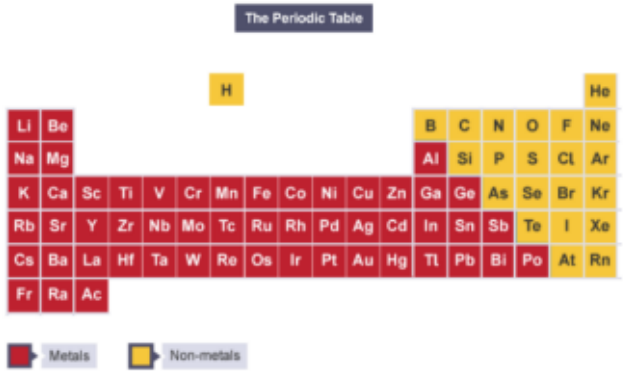
Keyword	Definition
Periodic Table	A table of all the known elements in order of their atomic number.
Group	Vertical columns on the periodic table
Period	Horizontal rows on the periodic table
Atom	The smallest piece of an element.
Element	A substance containing only one type of atom.
Compound	Two or more different elements which are chemically joined together.
Mixture	Two or more different elements or compounds which are not chemically joined together.
Chemical Reaction	A process in which one or more substances are changed into others, by their atoms being rearranged. Also known as irreversible reactions.
Physical Reaction	A process in which the physical properties are changed, but no new substances are made. Also known as reversible reactions.
Reactant	A substance that reacts together with another substance to form products during a chemical reaction.
Product	A substance formed in a chemical reaction.
Conservation of Mass	The total mass of the products in a chemical reaction will be the same as the total mass of the reactant.

Further Reading:

https://www.bbc.co.uk/bitesize/guides/zt2hpv4/revision/1

https://www.bbc.co.uk/bitesize/guides/z84wjxs/revision/1



Metals	Non-Metals
Shiny in colour, solids at room temperature (except mercury), high density, strong, malleable, good conductor of heat and electricity.	Dull in colour, can be solids, liquids or gases at room temperature, low density, brittle, poor conductors of heat and electricity.

Atoms, Elements, Compounds & Mixtures

This models an element. There is only one type of atom.

This models a compound. There are two different elements chemically combined together.

This models a mixture. There are two or more different elements which are not chemically combined.

Chemical & Physical Reaction

Chemical changes happen when chemical reactions occur. They involve the formation of new chemical elements or compounds.
E.g. Iron will react with oxygen to form Iron Oxide (rust).

Physical changes do not lead to new chemical substances forming. In a physical change, a substance simply changes physical state. E.g. A solid to a liquid.

Chemical Reactions & Equations

The changes in a chemical reaction can be modelled using equations. In general we write:

Reactants → Product

The reactants are shown the left of the arrow, and the products are shown on the right of the arrow. The arrow tells us a chemical reaction has taken place.

E.g.

Iron + Oxygen → Iron Oxide

The Iron and oxygen react together (reactants) to produce Iron Oxide (product).

Naming Compounds

Metal + Non-Metal (which contain two elements)

1. The metal always goes first.
2. The ending of the non-metal changes to 'ide'.

E.g.

Copper + Oxygen → Copper Oxide

Lithium + Fluorine → Lithium Fluoride

To name compounds which have a metal, non-metal and oxygen (three or more elements)

1. The metal always goes first.
2. The ending of the non-metal changes to 'ate'.

E.g.

Copper, Sulfur, Oxygen

Copper Sulfate

Conservation of Mass

No atoms are created or destroyed in a chemical reaction. Instead, they just joint together in a different way than they were before the reaction, and form products. This means that the total mass of the products in a chemical reaction will be the same as the total mass of the reactants.

Balancing Equations

A balanced equation gives more information about a chemical reaction because it gives the symbols and formulae of the substances involved.

$Cu + O_2 \rightarrow CuO$

The above equation is not balanced because there is one copper atom on both sides of the arrow, but two oxygen atoms on the left hand side, and only one on the right.
You need to adjust the number of units of some substances until you have equal numbers of atoms on both sides of the arrow. You cannot change the formulae of a substance (you can't change the small number).

$2Cu + O_2 \rightarrow 2CuO$

The Periodic Table

Keyword	Definition
Periodic Table	A tabular representation of all known elements in order based on atomic number.
Atomic Number	The number of protons in the nucleus of an atom. Also called the proton number.
Periods	A horizontal row in the periodic table.
Groups	A vertical column in the periodic table containing elements with similar chemical properties.
Element	A substance made of only one type of atom.
Compound	A Substance where two or more elements have chemically joined together.
Mixture	Two or more substances that are not joined together. The substances can be elements, compounds or both.
Reactive	The tendency of a substance to undergo a chemical reaction.

Further Reading:
https://www.bbc.com/bitesize/guides/z3vwxnb/revision/5
https://www.bbc.com/bitesize/guides/z84wjxs/revision/1

The periodic table is arranged in rows called periods and columns called groups. Groups contain elements with similar chemical properties.

Group 1 – Alkali Metals

Group 1 metals are very soft metals which can be cut with a knife. They have very low melting and boiling points and are very reactive compared to other metals. The elements become more reactive as you go down group 1.

When the group 1 metals react in water they produce a metal hydroxide and hydrogen gas.
E.g.
Lithium + Water → Lithium Hydroxide + Hydrogen

Group 2 – Alkali Earth Metals

Group 2 metals are reactive, but less reactive than group 1 elements.
Group 2 metals react with acids to produce a salt and hydrogen. The name of the salt depends on the acid used.
Hydrochloric Acid – Chloride
Sulfuric Acid – Sulfate
Nitric Acid - Nitrate
E.g.
Magnesium + Hydrochloric Acid → Magnesium Chloride + Hydrogen
Magnesium + Sulfuric Acid → Magnesium Sulfate + Hydrogen
Magnesium + Nitric Acid → Magnesium Nitrate + Hydrogen

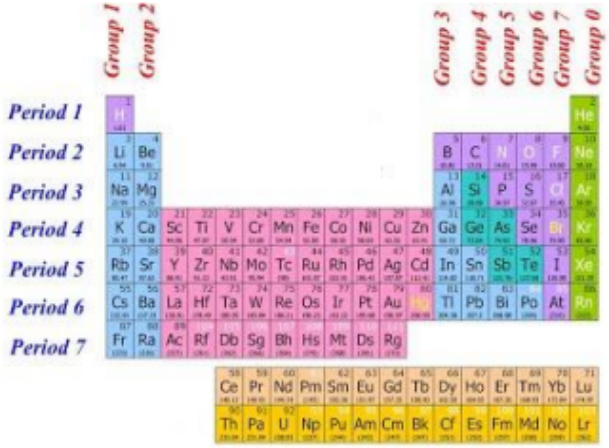
Group 2 metals become more reactive when you go down group 2.

Group 7 – The Halogens

Group 7 elements become less reactive when you move down the group. This can be shown as a displacement reaction.

Group 0 – The Noble Gases

Group 0 elements are not reactive. This is because the atoms have full outer shells.



Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Lithium - Li Sodium - Na Potassium - K	Beryllium – Be Magnesium – Mg Calcium - Ca	Boron – B Aluminium – Al Gallium – Ga	Carbon – C Silicon – Si Germanium – Ge	Nitrogen – N Phosphorus – P Arsenic – As	Oxygen – O Sulfur – S Selenium - S	Fluorine – F Chlorine – Cl Bromine - Br	Helium – He Neon – Ne Argon - Ar