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Biology | 9B Plant Growth

KNOWLEDGE MAP

9Ba Reactions in Plants

Photosynthesis:
carbon dioxide + water → glucose + oxygen
reactants products

Chlorophyll inside **chloroplasts** in plant cells trap **light energy** for photosynthesis.

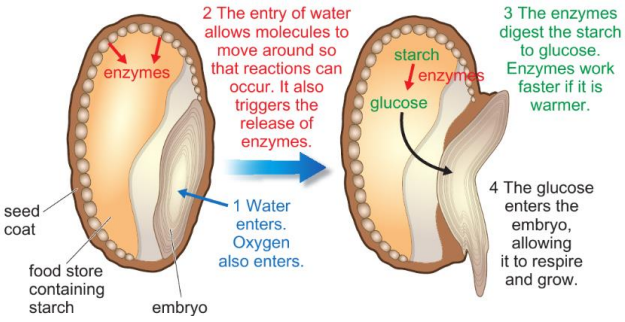
Limiting factors are variables that slow down the rate of a reaction.

Limiting factors of photosynthesis are **light, carbon dioxide** and **temperature.**

Aerobic respiration:
glucose + oxygen → carbon dioxide + water
reactants products

Phloem vessels carry the **glucose** made by photosynthesis as a **sugar solution** to all parts of the plant.

Waterlogged soil lacks oxygen and can cause roots to die.



9Bb Plant Adaptations

Roots are branched and spread out.

Root hair cells have a large surface area.

Xylem vessels are hollow tubes for carrying **water** and dissolved **mineral ions**.

Water is needed for photosynthesis, keeping leaves cool and stopping the plant from wilting.

Stomata are opened and closed by **guard cells.**

Stomata allow **gaseous exchange**. They open when it is light so that carbon dioxide can enter the leaf by **diffusion.**

Leaves are thin so there is a shorter distance for diffusion.

Leaves are broad and have a large surface area.

The **waxy cuticle** reduces water loss from the leaf.

Palisade cells contain many chloroplasts.

9Bc Plant Products

Lipids (fats and oils) are found in the leaf cuticle, cell membranes and as an energy store in seeds and some fruits.

Glucose is stored as **starch** or made into other **carbohydrates** such as **cellulose**.

Iodine solution turns blue-black in the presence of starch.

Proteins are made of **amino acids.** Plants need nitrates to make amino acids.

Enzymes are proteins.

Seeds store proteins.

For a seed to **germinate, water** and **oxygen** must enter.

9Bd Growing Crops

Fertilisers contain mineral salts e.g. potassium, phosphate, nitrates.

Pesticides kill pests. **Insecticides** kill insect pests. **Fungicides** kill fungi that cause plant diseases. **Herbicides** kill weeds.

Selective herbicides kill weeds but not crop plants.

A **variety** is a group of plants that have been bred to have certain characteristics.

Cross-breeding is breeding different varieties to produce offspring with characteristics of both breeds.

Selective breeding is when only plants with certain characteristics are used to breed.

9Be Farming Problems

Fertilisers can wash into rivers and lakes causing algae to grow quickly.

Decomposers break down the dead algae and plants, using up oxygen.

Insecticides can kill useful insects.

Some insecticides are **persistent** and build up in food chains.

Selective weedkillers can kill broad leaved plants in hedges.

Deforestation and **burning fossil fuels** increases the amount of carbon dioxide in the atmosphere, causing increased **global warming.**

Planting a single crop variety reduces **biodiversity.**

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Chemistry | 9F Reactivity

KNOWLEDGE MAP

9Fa Types of Explosion

Explosions can be caused by **physical changes** or **chemical reactions**.

In explosions there is a sudden **increase in volume** and a huge **transfer of energy**.

In **physical changes** there are no new substances made.

In **chemical reactions** there are new substances formed.

Atoms of the **reactants** are rearranged to form new **products**.

Pressure in gases is caused by the particles hitting the walls of the container.

Gas pressure can be increased by **increasing** the **number** of gas particles, **decreasing** the **size** of the container, **increasing** the **temperature**.

9Fc Energy and Reactions

Oxidising agents release oxygen for chemical reactions.

Increasing the **surface area** increases the reaction speed.

Exothermic reactions transfer energy from the reactants to the surroundings.

Endothermic reactions transfer energy from the surroundings to the reactants.

Many exothermic reactions need an initial **input of energy** to break some of the bonds of the reactants.

9Fb Reactivity

Metal	Reaction with oxygen in air	Reaction with cold water	Reaction with dilute acid
potassium	🔥	🔥	explosive
sodium	🔥	✓✓✓	explosive
lithium	🔥	✓✓	✓✓✓
calcium	🔥	✓✓	✓✓✓
magnesium	🔥	✓	✓✓
aluminium	✓✓✓	•••	✓✓
zinc	✓✓	•••	✓✓
iron	✓✓	•••	✓
tin	✓	•••	✓
lead	✓	•••	✓
copper	✓	✗	✗
mercury	•••	✗	✗
silver	•••	✗	✗
gold	✗	✗	✗
platinum	✗	✗	✗

Increasing reactivity

Key

explosive	can catch fire	✓✓✓ reacts very quickly
✓✓ reacts quickly	✓ reacts	••• slow or partial reaction
✗ no reaction		

metal + water → metal hydroxide + hydrogen

metal + acid → salt + hydrogen

Hydrochloric acid forms chloride salt.
Sulfuric acid forms sulfate salts.
Nitric acid forms nitrate salts.

metal + oxygen → metal oxide.
This is an **oxidation** reaction.

Iron and steel **rust** when they are in contact with water and air. **Salt** speeds up rusting.

Rusting can be prevented by a **physical barrier** such as paint or oil, or **sacrificial protection** using a more reactive metal.

9Fd Displacement

In a **displacement reaction**, the more reactive metal takes the place of the less reactive metal.

The **thermite reaction** is an example of a displacement reaction:
aluminium + iron oxide → aluminum oxide + iron

9Fe Extracting Metals

Very unreactive metals such as gold are found in their **native state** in the Earth's crust.

More reactive metals are found as **compounds**.

An **ore** is a rock which contains enough of a metal or metal compound to be worth mining.

Reactive metals need to be **chemically extracted** from their ores.

Iron is extracted from iron oxide by heating it with carbon. The carbon acts as a reducing agent.

iron oxide + carbon → iron + carbon dioxide

Oxidation is the addition of oxygen. **Reduction** is the removal of oxygen.

Aluminium is extracted from aluminium oxide by **electrolysis**.

Electrolysis is a more **expensive** process as it requires a lot of electricity. It is only used for extraction of metals the are more reactive than carbon.

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Physics | 9I Forces and Motion

KNOWLEDGE MAP

9Ia Forces and Movement

Friction is the force between two objects that are touching.

Air resistance and **water resistance** are **drag forces**.

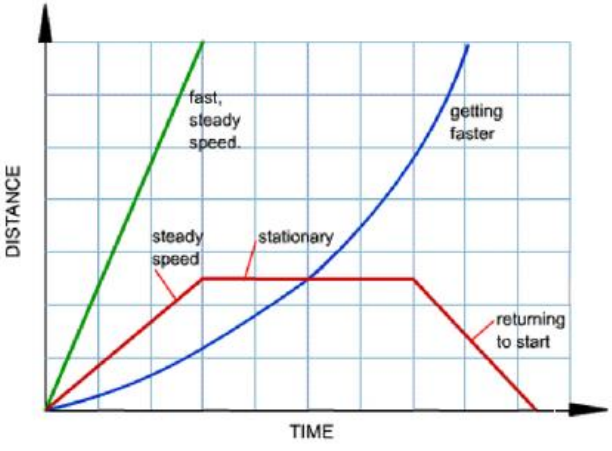
Drag forces slow down objects moving through fluids.

The size of the drag force **increases** as the **speed** of the object **increases**.

If the forces acting on a moving object are **balanced**, the object will move at a **constant speed**.

If the forces acting on an object are **unbalanced**, the difference between the two forces is the **resultant force**.

The **top speed** of a moving object depends on the maximum force that can move it forwards and the friction or drag acting to slow it down.



9Ib Energy for Movement

Kinetic energy is energy stored in moving objects.

Gravitational potential energy is energy stored in raised objects.

Elastic potential energy (or **strain energy**) is energy stored in elastic materials when they are **deformed** (change shape).

Internal (or **thermal**) **energy** is the energy stored in the movement of particles.

Wind, moving water or solar energy are **renewable resources.**

Fossil fuels are **non-renewable resources.**

The law of conservation of energy states that energy is never created or destroyed, only transferred.

Efficiency of energy transfer compares the useful energy transferred to the total energy transferred**.**

Wasted energy such as sound or heating is **dissipated** (spread out)

9Ic Speed

$$Speed = \frac{distance}{time}$$

Units of speed depend on the measurements you take.
mph (miles per hour)
km/h (kiliometres per hour)
m/s (metres per second)

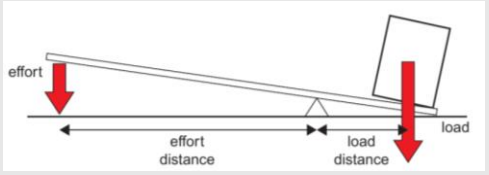
$$Mean\ (average\ speed) = \frac{total\ distance\ travelled}{total\ time\ taken}$$

Displacement is the distance, in a straight line, between and object and its starting point.

Relative speed is the speed of one object compared to another.

9Id Turning Forces

A **lever** is a long bar that turns around a **pivot** or **fulcrum**.



A lever acts as a **force multiplier** if the effort distance is greater than the load distance.

A lever acts as a **distance multiplier** when a large effort force moves a small distance and the load moves a greater distance.

The **turning effect** of a force is called a **moment**.

Moment of the force = force x distance from pivot
Nm N m

If the clockwise moment balanced the anticlockwise moment, the lever is in **equilibrium**.

9Ie More Machines

Levers are simple machines that help us use a smaller force to move an object.

Ramps are simple machines that help us to push an object up a slope.

Pulleys ae simple machines to help us move things.

$$work\ done\ (J) = force\ (N) \times distance\ moved\ (m)$$