Bioenergetics

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Topic-Bioenergetics

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- metabolism

Photosynthesis

Photosynthesis

In a green plant,it produces **glucose** by the process of **photosynthesis**.

- In this process, it combines **carbon dioxide with water** to form **glucose and oxygen**

Photosynthesis requires energy in the form of **light** to drive the chemical reaction. This light energy required is absorbed by a green pigment called **chlorophyll** in the leaves.

Word equation

Carbon dioxide+water+(light energy)→Glucose+Oxygen

It is the reverse of respiration

Factors affecting Photosynthesis

The rate of photosynthesis can be affected by the:

- **Light intensity**
- **Concentration of carbon dioxide**
- **Temperature**
- **Amount of chlorophyll in a leaf**

These 3 factors have a **combined effect on the rate of photosynthesis** therefore if one is restricted, the rate of photosynthesis will be below the maximum possible rate.

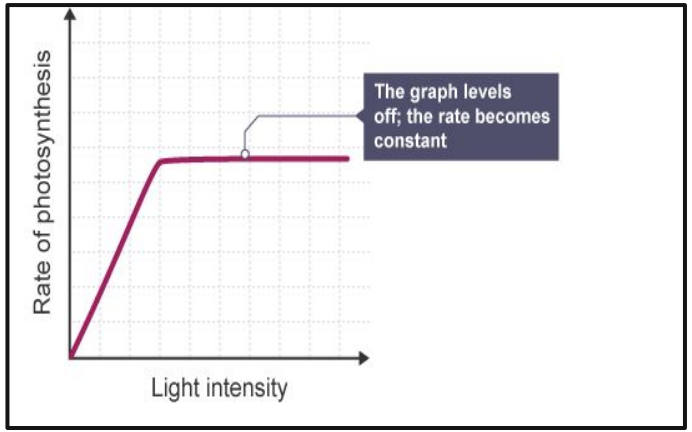
The restricted one is also known as the **limiting factor**

Light intensity

Without enough light, a plant cannot photosynthesise very quickly.

- Increasing the light intensity increases the rate of photosynthesis until some other becomes a **limiting factor.**

This is the graph for the light intensity to rate of photosynthesis:

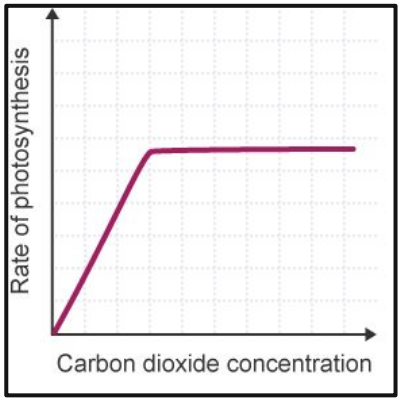


Carbon Dioxide

Carbon dioxide with water is one of the reactants in photosynthesis

- Increasing the concentration of carbon dioxide, increases the rate of photosynthesis until some other becomes a **limiting factor.**

This is the graph for the concentration of carbon dioxide to rate of photosynthesis:

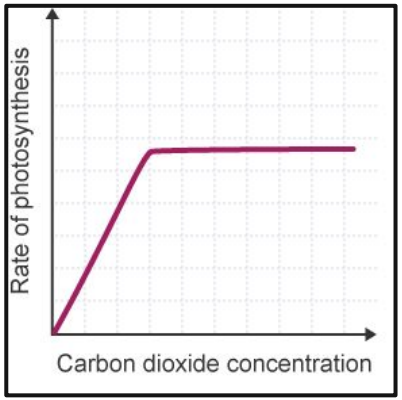


Temperature

With temperature, if the temperature is **too high**, the enzymes needed for photosynthesis become **denatured** however if the temperature is **too low**, the rate of photosynthesis will be **slower**.

- If the temperature is just right, it increases the rate of photosynthesis until some other becomes a **limiting factor.**

This is the graph for the concentration of carbon dioxide to rate of photosynthesis:



Greenhouses and artificial farming

- Hydroponic growing systems-growing plants without soil
- Propane burners-burning hydrocarbons for carbon dioxide
- Artificial lighting-always light 24 hours a day
- Thermostatically controlled vent- so temperature can be always at optimum temperature
- Irrigation system-supplies just the right amount of water

Respiration

Respiration

Respiration is **NOT** breathing

- **Respiration is the process of transforming energy from glucose.**
- This happens in **EVERY** cell.

Why we need respiration?

All living organisms need energy to live.

- Some processes which need energy are:
  - Cell division.
  - Maintain constant conditions in cells.
  - Active transport.
  - Transmission.
  - Driving chemical reactions needed to keep organisms alive.
  - Movement-energy is released to contract muscles whilst plants need it to transport things around our system.

Respiration

Respiration is **only 40% efficient**.

As mammals respire, **heat is released** which keeps mammals warm and helps keep a **constant internal temperature**.

There are 2 types of respiration

- Anaerobic respiration
- Aerobic respiration

Respiration is
EXOTHERMIC

Anaerobic respiration

We anaerobically respire when your body can't supply **enough oxygen** to your body during vigorous exercise.

When we need it

- Vigorous exercise

Word Equation

Glucose+enzymes→Carbon dioxide + lactic acid

However anaerobic respiration is **less** efficient in producing energy than aerobic respiration.

Anaerobic Respiration In Yeast

Yeast and a few plants can respire however the products are different than the products made when humans anaerobically respire:

Word Equation

Glucose → Ethanol + Carbon Dioxide

Ethanol is also known as alcohol

Anaerobic respiration in yeast is called **fermentation**

Used in the making of bread and wine

Aerobic Respiration

Respiration using oxygen is called **aerobic respiration**.

Word Equation

Glucose+oxygen→Carbon dioxide+water

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2$

Where does it happen

- Aerobic respiration mainly takes place in the **mitochondria** but can also happen in the cytoplasm.

- Aerobic respiration produces lots more energy than anaerobic and is the most common type of respiration

Response to exercise

Muscles need energy to contract. Whilst exercising the additional energy as:

- The **breathing rate and the volume of each breath increases** to bring more oxygen into the body
- The **heart rate increases** to supply more oxygen to the muscles

If there is an insufficient amount of oxygen,muscles begin to respire anaerobically meaning lactic acid is produced. This also means that muscles contract less efficiency

During long periods of vigorous exercise:

- **Lactic acid builds up**
- **Glycogen reserves** in muscles **become low** as more glucose is being used.

Oxygen Debt

When a period of exercise is over, lactic acid has to be removed from the body as it is **toxic**.

Lactic acid is taken to the liver by blood and either:

- ★ **Oxidised to Carbon Dioxide and water**

OR

- ★ **Converted to glucose, then glycogen so the glycogen levels in the liver and muscles can be restored**

Definition

The exact amount of energy needed to break down the lactic acid(or else it can harm your body)

Metabolism

Metabolism is the term used for **all the chemical reactions that go on inside our body**.

- This reaction builds up and breaks down molecules and is controlled by enzymes.

- In animals here's a summary of the reactions that break down compounds: