Your notes

GCSE Biology: revision notes

Photosynthesis

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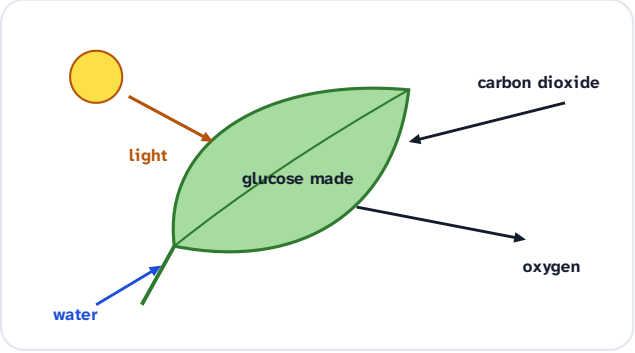
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Start here: how plants make their food

- Plants do not eat: they make their own food, glucose, using light energy from the Sun.
- They take in carbon dioxide from the air and water from the soil, and give out oxygen: carbon dioxide + water → glucose + oxygen.
- It happens in chloroplasts, which contain **chlorophyll**, the green substance that absorbs light. It is **endothermic**: energy is taken in, from light.

The photosynthesis reaction

- **Photosynthesis** happens in chloroplasts. **Chlorophyll** absorbs light energy, which is used to make glucose.
- Word equation: carbon dioxide + water → glucose + oxygen (light is needed).
- Symbol equation: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$.
- **Photosynthesis** is **endothermic**: energy is transferred from the environment (as light) to the chloroplasts.



Limiting factors

- The rate of **photosynthesis** is affected by temperature, **light intensity**, carbon dioxide concentration and the amount of **chlorophyll**.
- A **limiting factor** is the factor in shortest supply, which stops the rate increasing.
- Raising **light intensity** or CO_2 concentration increases the rate until another factor becomes limiting, so the graph levels off.
- Temperature increases the rate up to an optimum; above it, the enzymes involved are denatured and the rate falls.
- (Higher) **Light intensity** is inversely proportional to the square of the distance from the light source: **light intensity** $\propto 1 \div \text{distance}^2$.

Greenhouses

- Farmers use greenhouses to control conditions: heaters for temperature, lamps for light, and paraffin heaters or gas to raise CO_2.
- (Higher) Growers must balance the cost of extra heat, light or CO_2 against the value of the extra crop, so rates are not always kept at the maximum.

Uses of glucose

- Some glucose is used in respiration to release energy.
- Glucose is converted into insoluble **starch** for storage, and into fats or oils for storage (especially in seeds).
- Glucose is used to make **cellulose**, which strengthens cell walls.
- Glucose is combined with **nitrate ions** from the soil to make amino acids, which are used to make proteins.

Required practical: light intensity and photosynthesis

- Put a piece of pondweed in a boiling tube of water with sodium hydrogencarbonate (to supply CO_2).
- Place a lamp at a measured distance and count the bubbles of oxygen (or collect the gas in a gas syringe) in a set time.
- Repeat at different distances. Keep temperature and CO_2 constant; a beaker of water between lamp and tube can absorb heat.
- As the lamp moves closer, **light intensity** increases and more oxygen is produced, until another factor becomes limiting.

Exam tip

- Learn the word and symbol equations. A **limiting factor** is whatever is in short supply: on a graph, it's where the line levels off that something else has started to limit the rate.
- In the practical, count bubbles or measure gas at different distances from the lamp, and keep everything else the same.

Your notes

Common mistakes

- Saying plants only respire at night. They respire all the time.
- Saying **photosynthesis** 'makes energy'. It stores energy from light in glucose.

Worked examples

(Higher) A lamp is moved from 10 cm to 20 cm away from a plant. What happens to the light intensity?

Light intensity follows the inverse square law: intensity $\propto 1 \div \text{distance}^2$. **intensity $\propto 1 \div d^2$**

The distance doubles, so the intensity is divided by 2^2, which is 4. **$1 \div 2^2 = 1/4$**

Answer: The light intensity falls to a quarter of what it was

Key terms

Photosynthesis	The process in which plants use light energy to make glucose from carbon dioxide and water.
Chlorophyll	The green pigment in chloroplasts that absorbs light.
Endothermic	A reaction that takes in energy from the surroundings.
Limiting factor	The factor in shortest supply that stops the rate of a process from increasing.
Light intensity	How bright the light is; it falls as distance from the source increases.
Inverse square law	Light intensity is proportional to $1 \div \text{distance}^2$.
Starch	An insoluble carbohydrate that plants use to store glucose.
Cellulose	A carbohydrate made from glucose that strengthens plant cell walls.
Nitrate ions	Mineral ions absorbed from soil and used to make amino acids and proteins.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What are the products of photosynthesis?
2. Where in a plant cell does photosynthesis happen?
3. Why is photosynthesis described as endothermic?
4. What is a limiting factor?
5. Why does the rate of photosynthesis fall at very high temperatures?

Your notes

6. A lamp is moved from 10 cm to 20 cm from a plant. What happens to the light intensity? (Higher)
7. What is glucose combined with to make amino acids?
8. Why do plants store glucose as starch?

Answers

1. Glucose and oxygen
2. Chloroplasts
3. Energy is taken in from the environment as light
4. The factor in shortest supply that stops the rate increasing
5. The enzymes are denatured
6. It falls to a quarter
7. Nitrate ions
8. Starch is insoluble

What to do next

Practise 15 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

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