Lesson B8.1 Photosynthesis

AQA spec link:

4.1.1 Photosynthesis is represented by the equations:

carbon dioxide + water → glucose + oxygen

Students should recognise the chemical symbols:

CO_2, H_2O, O_2, and $C_6H_{12}O_6$.

Students should be able to describe photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.

Aiming for Grade 4 LOs:

- Describe how plants get the materials they need for growth.
- State the word equation for photosynthesis.
- Describe why plants need light to carry out photosynthesis.

Aiming for Grade 6 LOs:

- Describe how the leaf is adapted for photosynthesis.
- Write the balanced symbol equation for photosynthesis.
- Describe an experiment to prove that plants carry out photosynthesis when exposed to light.

Aiming for Grade 8 LOs:

- Explain how adaptations of the leaf make photosynthesis efficient.
- Explain why photosynthesis is an endothermic reaction.
- Explain why chlorophyll is needed for photosynthesis.

Lesson B8.2 The rate of photosynthesis

AQA spec link:

4.1.2 Students should be able to explain the effects of temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll on the rate of photosynthesis.

Students should be able to:
- measure and calculate rates of photosynthesis
- extract and interpret graphs of photosynthesis rate involving one limiting factor
- plot and draw appropriate graphs selecting appropriate scale for axes
- translate information between graphical and numeric form.

These factors interact and any one of them may be the factor that limits photosynthesis. Students should be able to explain graphs of photosynthesis rate involving two or three factors and decide which the limiting factor is.

Students should understand and use inverse proportion – the inverse square law and light intensity in the context of photosynthesis.

Aiming for Grade 4 LOs:

- List the factors that affect the rate of photosynthesis (temperature, carbon dioxide concentration, light intensity, amount of chlorophyll).
- State simply the relationship between these factors and the rate of photosynthesis.
- Plot a line graph and write a simple conclusion.

Aiming for Grade 6 LOs:

- Describe why low temperature, shortage of carbon dioxide, shortage of light and shortage of chlorophyll limit the rate of photosynthesis.
- Suggest which factor limits the rate of photosynthesis in a given situation.
- Interpret and explain graphs of photosynthesis rate involving one limiting factor.

Aiming for Grade 8 LOs:

- Apply knowledge of enzymes to explain why a high temperature affects the rate of photosynthesis.
- Predict how the rate of photosynthesis will be affected with more than one limiting factor.
- Understand and use the inverse square law and light intensity in the context of photosynthesis.

Bell task

<u>Bags in box</u>. Attempt these questions – back of books or rough paper. I will take in your score!

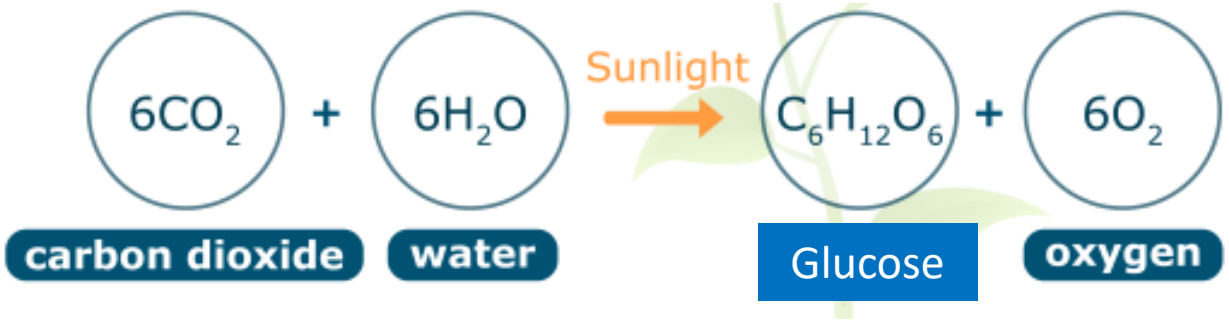
What is the word equation for photosynthesis?

Where does each reactant enter the plant?

How is the sunlight absorbed?

Where does the reaction occur?

What is the waste product?



Water – through roots
Carbon dioxide – through leaves

By chlorophyll (green pigment) in the chloroplasts

In the chloroplasts, mesophyll cells in the leaves.

Oxygen

Photosynthesis

Objectives:

Explain how different factors limit the rate of photosynthesis.

Investigate how plants use glucose.

Success criteria:

- I can recall the products and reactants of photosynthesis and how they are transported.
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Key words: diffusion; mesophyll; endothermic; compensation; cellulose; starch; amino acid.

Transport structures in plants

- Function?
- Structure -Alive or dead? Transport up or down?

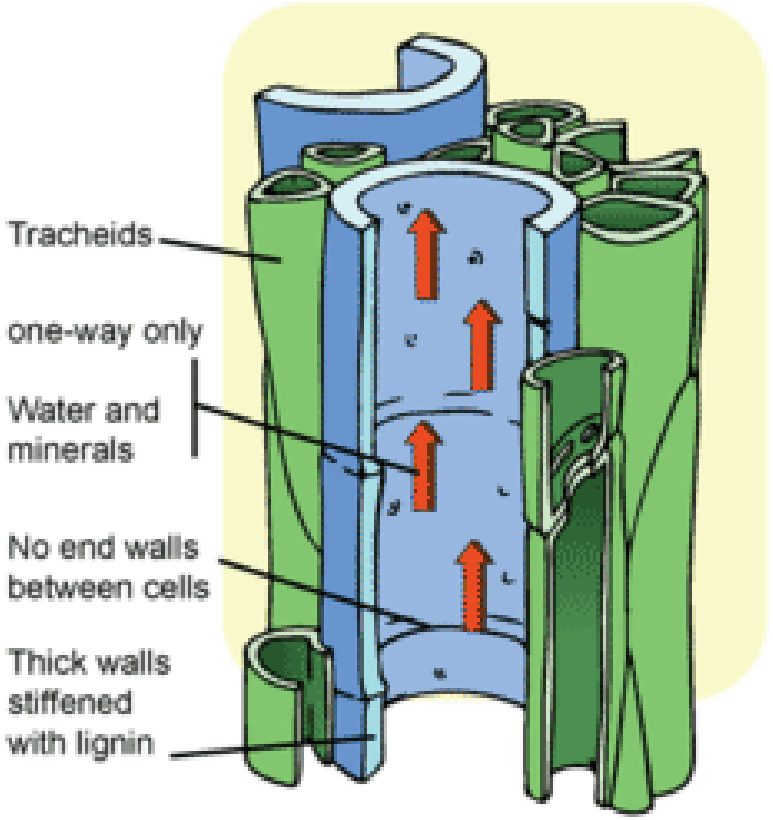
Xylem:

upward transport of water and mineral ions to replace water vapour lost through the leaves (transpiration).

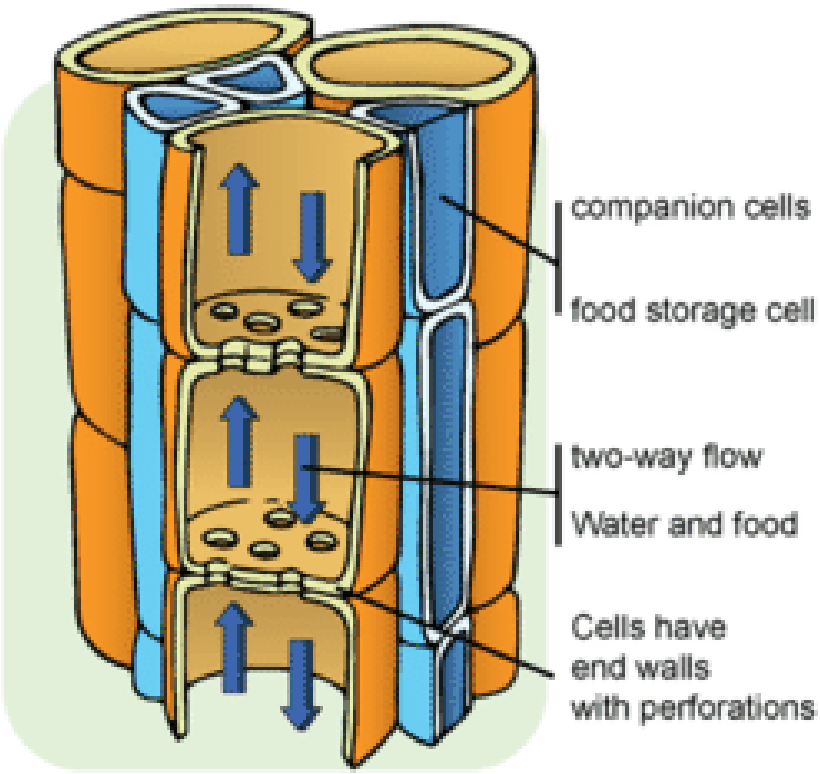
Formed from dead tissue that is strengthened with lignin.

Phloem:

transport sugars up and down (translocation) the plant.
Formed from living tissue



Xylem vessel



Phloem vessel

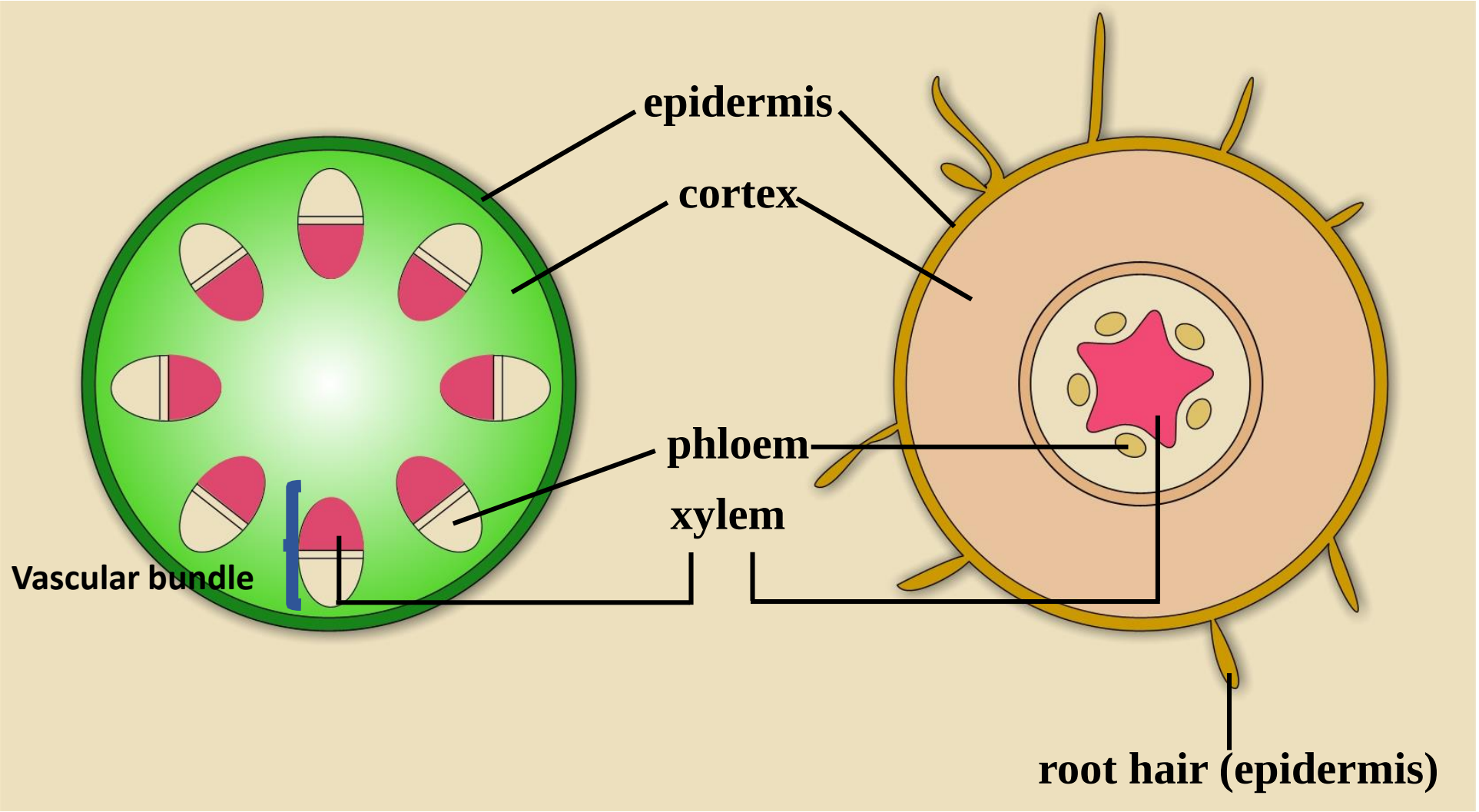
Xylem and phloem are our found together in **vascular bundles**

Challenge – what factors could affect the rate of transpiration? (water vapour loss through stomata)

Transport in plants

Stem

Root



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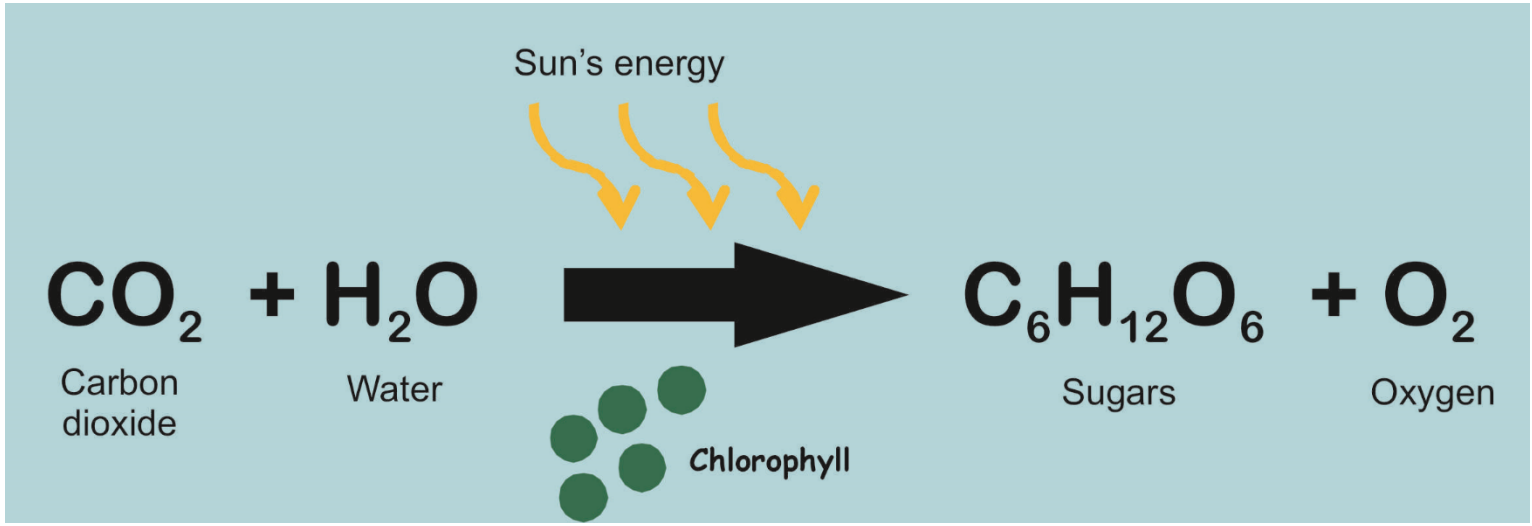
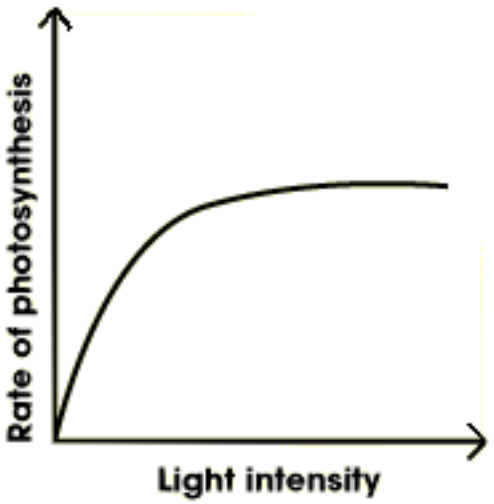
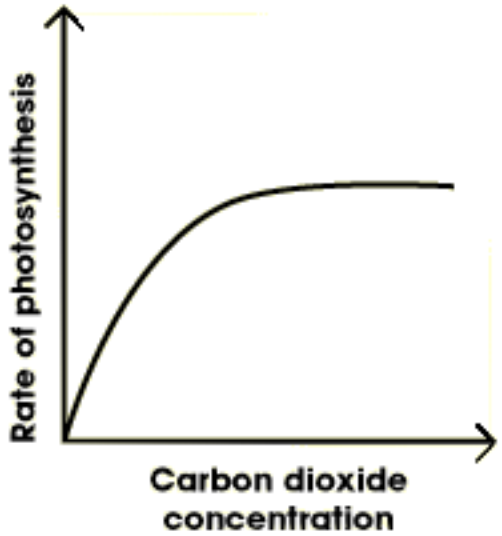
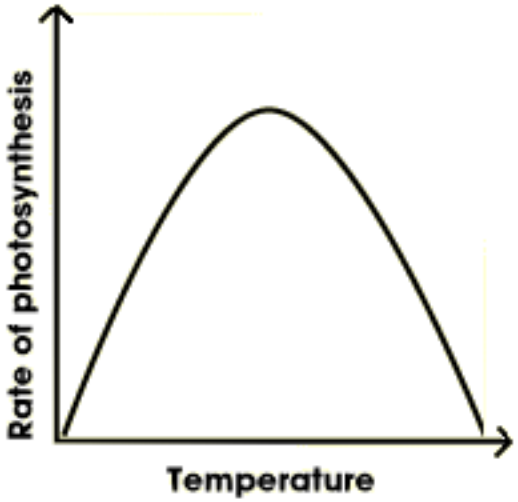
What factors could limit the rate of photosynthesis?

The amount of chlorophyll also affects the rate - TMV









Can you explain the shape of these graphs?

Three factors can limit the speed of photosynthesis - light intensity, carbon dioxide concentration and temperature.

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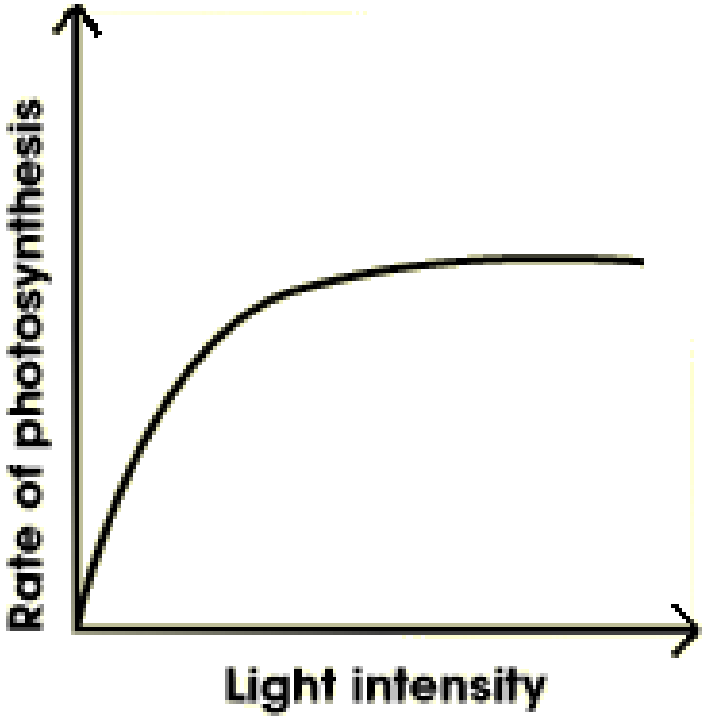
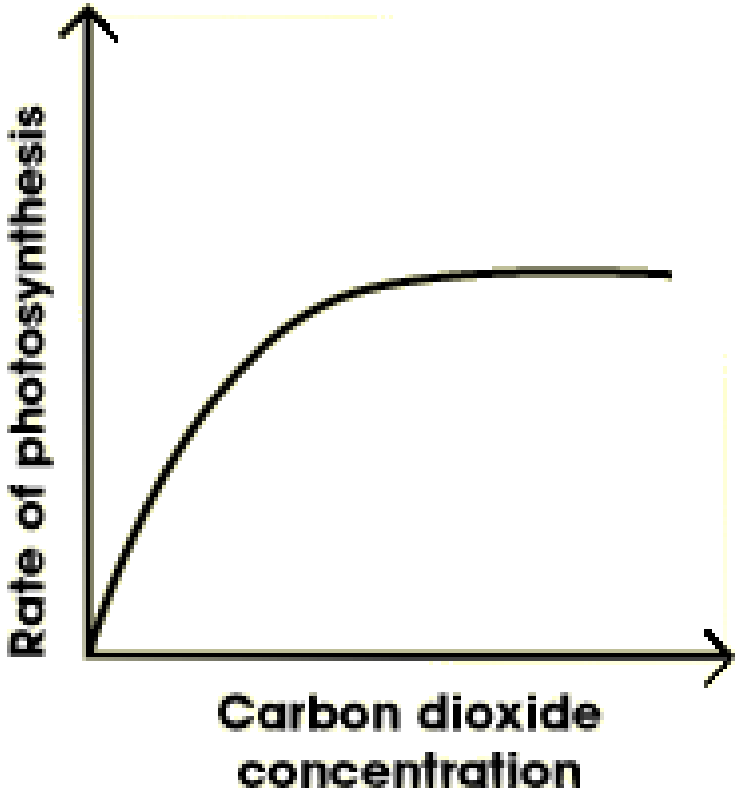


Without enough light, a plant cannot photosynthesise very quickly, even if there is plenty of water and carbon dioxide.

Increasing the light intensity will increase the rate of photosynthesis.
Until another factor becomes the limiting factor…

Three factors can limit the speed of photosynthesis - light intensity, carbon dioxide concentration and temperature.



Sometimes photosynthesis is limited by the concentration of carbon dioxide in the air.

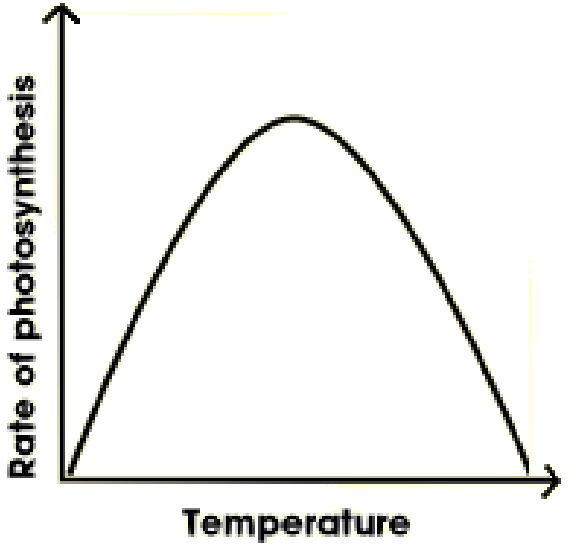
Even if there is plenty of light, a plant cannot photosynthesise if there is insufficient carbon dioxide.

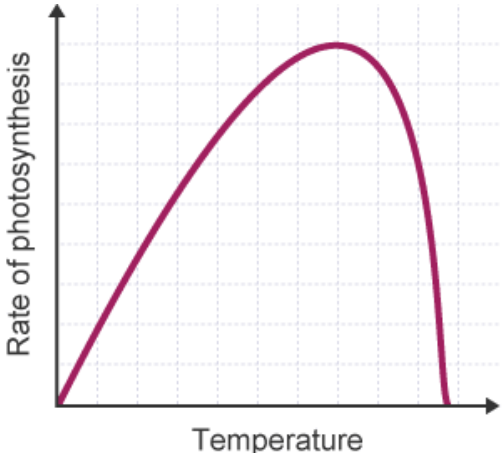
Three factors can limit the speed of photosynthesis - light intensity, carbon dioxide concentration and temperature.

Photosynthesis involves enzymes, hence there is an optimum temperature.

Low temps – slow rate due to limited collisions between enzyme and substrate.

High temps- enzymes are denatured.



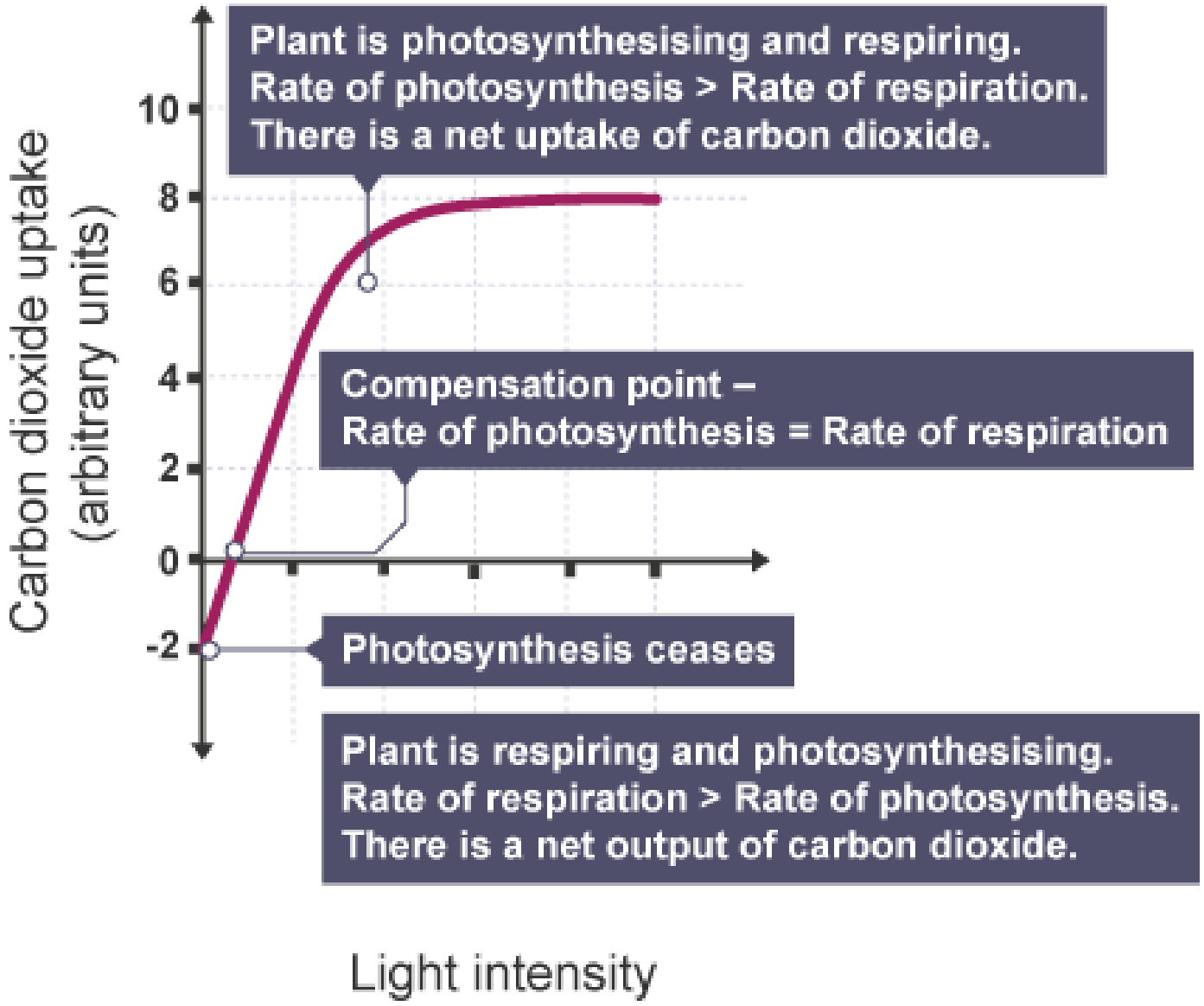


Compensation points

If oxygen production or carbon dioxide uptake is used as a measure of photosynthetic rate, the graphs are slightly different.

The line does not go through the origin. This is because oxygen production and carbon dioxide uptake are affected by **respiration** as well as photosynthesis.

The compensation point is the light intensity at which the rate of photosynthesis is equal to the rate of respiration.



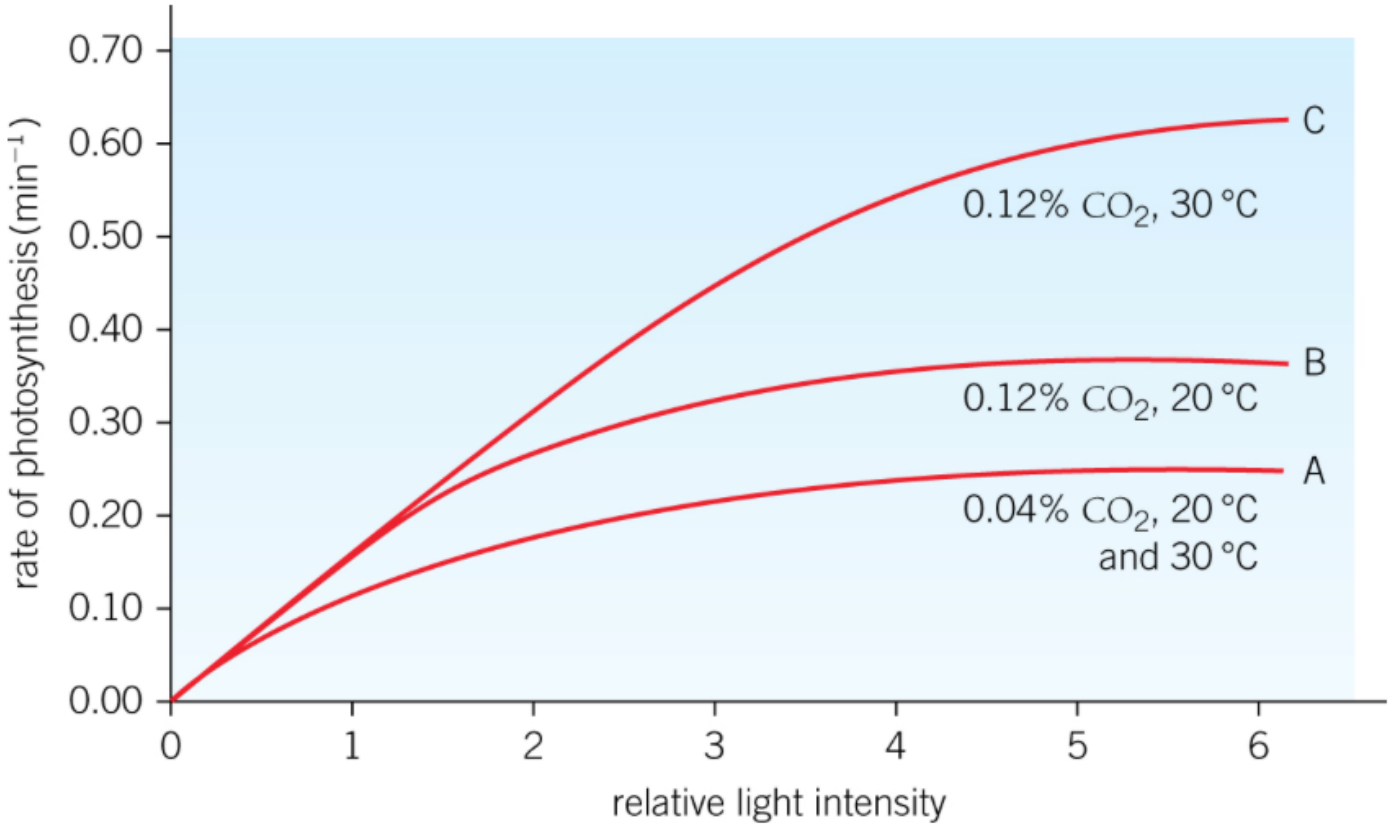
Rate limiting factors plenary

What is the rate limiting factor for B?

Temperature

What is the rate limiting factor for A?

Carbon dioxide



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Checkpoint assessment

Open book

Independent work

SILENT

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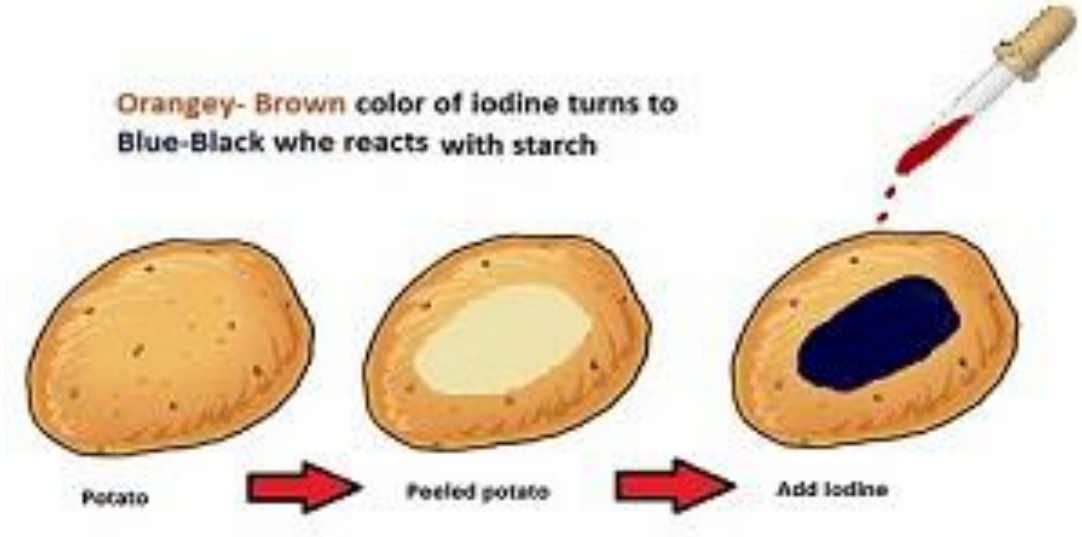
Uses of glucose



Divide your page into 6.

- State each way plants use glucose.
- Explain why they use glucose in this way.
- Challenge – explain why plants convert glucose to starch for storage.

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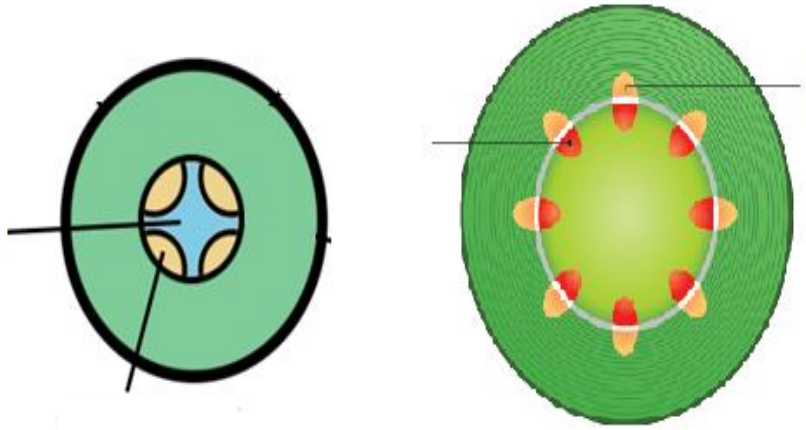
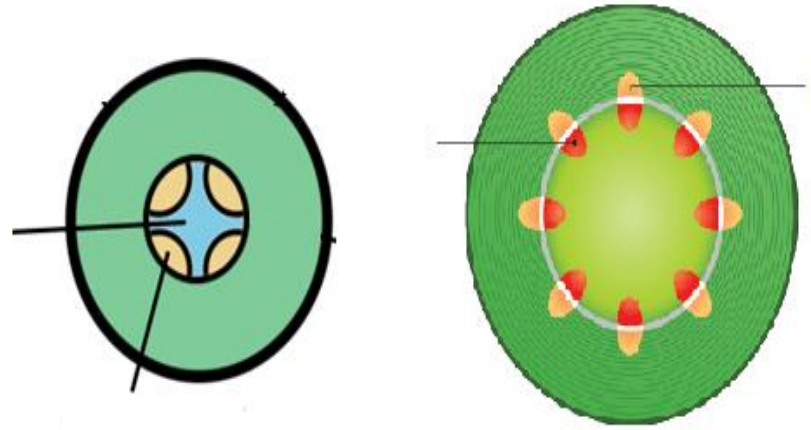


Root Stem



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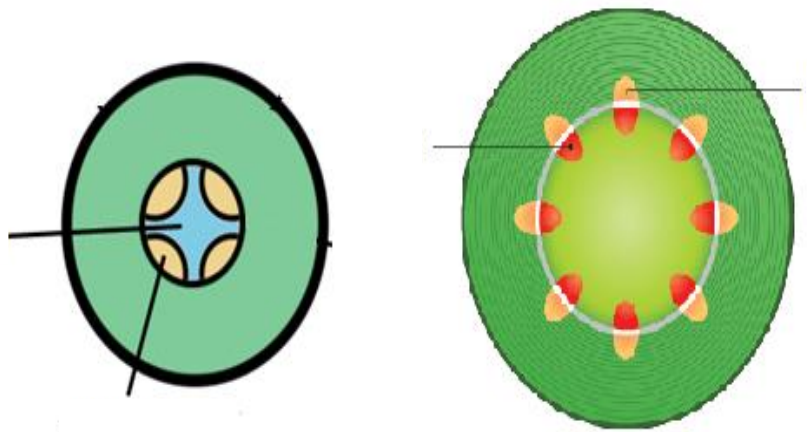

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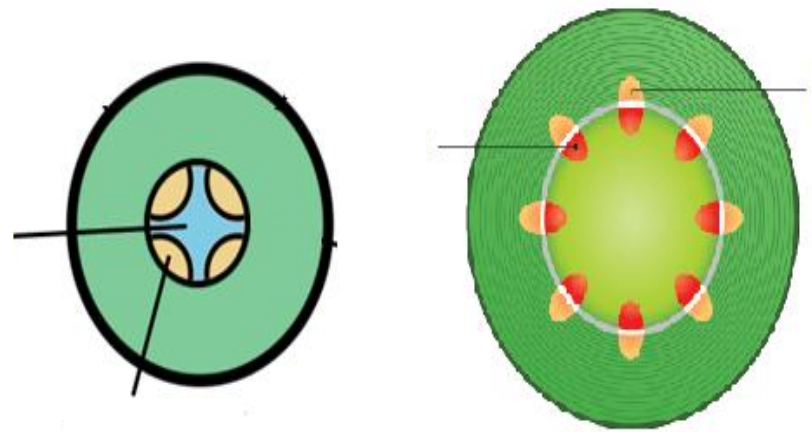

Root Stem