

Respiration, stored as insoluble starch, fats or oils for storage, cellulose for cell walls, combine with nitrates from the soil to form amino acids for protein synthesis

Plants use the glucose produced in photosynthesis in a variety of ways

Photosynthetic reaction

The plant manufactures glucose from carbon dioxide and water using energy transferred from the environment to the chloroplasts by light

Photosynthesis

Plants make use of light energy from the environment (ENDOTHERMIC) to make food (glucose)

Carbon dioxide + Water $\xrightarrow{\text{light}}$ Oxygen + Glucose

$\text{CO}_2 + \text{H}_2\text{O} \xrightarrow{\text{light}} \text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6$

The rate of photosynthesis is affected by temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll

Factors affecting the rate of photosynthesis	Factor	How the rate is affected	Limiting factors (why the rate stops going up)
	Temperature	As the temperature of the environment the plant is in increases rate of photosynthesis increases (up to a point) as there is more energy for the chemical reaction.	Photosynthesis is an enzyme controlled reaction. If the temperature increases too much, then the enzymes become denatured and the rate of reaction will decrease and stop
	Light intensity	Light intensity increases as the distance between the plant and the light sources increases. As light intensity increases so does the rate of photosynthesis (up to a point) as more energy is available for the chemical reaction.	At point X another factor is limiting the rate of photosynthesis. This could be carbon dioxide concentration, temperature or the amount of chlorophyll
	Carbon dioxide concentration	Carbon dioxide is needed for plants to make glucose. The rate of photosynthesis will increase when a plant is given higher concentrations of carbon dioxide (up to a point).	At point X another factor is limiting the rate of photosynthesis. This could be light intensity, temperature or the amount of chlorophyll
	Amount of chlorophyll	Chlorophyll is a photosynthetic pigment that absorbs light and allows the reaction between water and carbon dioxide to occur (photosynthesis)	Another factor could limit the rate of photosynthesis. This could be light intensity, temperature or the carbon dioxide concentration

Control conditions in greenhouses to reduce limiting factors can improve crop yields

Heating

Used to provide optimum temperatures for maximum plant growth.

Artificial lighting

Enhances the natural sunlight especially overnight and on cloudy days.

Extra carbon dioxide

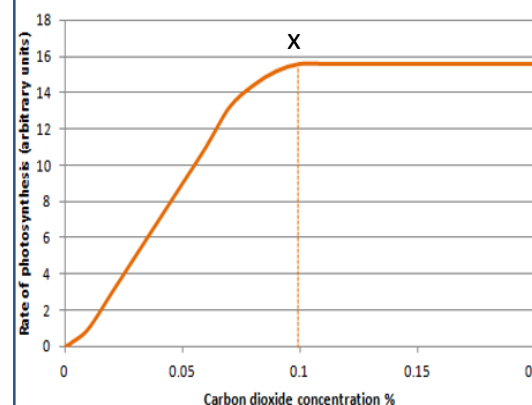
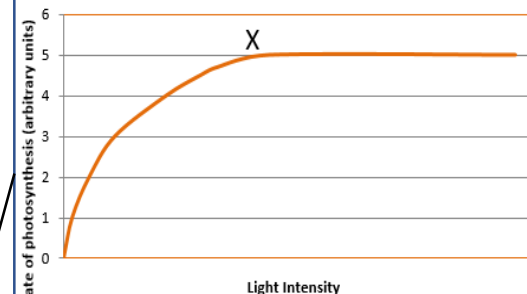
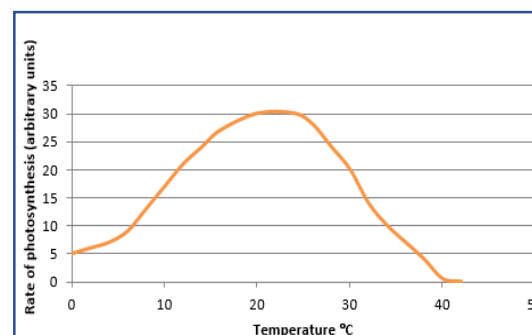
Gas can be pumped into the air inside the greenhouse.

Growers must balance the economics of additional costs of controlling the conditions to maximise photosynthesis with making a profit.



AQA GCSE BIOENERGETICS part 1

Rate of photosynthesis



Rate of photosynthesis HT Only

Graph lines C and D: If temperature is increased by 10°C then a slight increase in rate of photosynthesis occurs.

Explain graphs of two or three factors and decide which is the limiting factor

Graph lines A and D: If carbon dioxide concentration and temperature are increased the rate of photosynthesis increases significantly up to a point.

Graph Lines A and B: If carbon dioxide concentration is increased from 0.01% to 0.1% then a large increase in rate occurs up to a point.

Light intensity obeys the inverse square law. This means that if you double the distance between the plant and the light source you quarter the light intensity

Graph line A: Rate could be limited by temperature and/or amount of chlorophyll. Plant tissue can be damaged when carbon dioxide concentrations exceed 0.1%

