



# GCSE Biology Topic 4.4.1: Photosynthesis

This is the first part of the shortest topic in GCSE Biology – Bioenergetics. It mainly focuses on one of the most important process in the whole of Biology – Photosynthesis, as you (might) have missed from the title above.

## Photosynthesis Equations

Word equation for photosynthesis:

**Carbon dioxide + water  $\xrightarrow{\text{light}}$  Oxygen + glucose**

Symbol equation for photosynthesis.

**$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$**

The Formula for calculating light intensity:

**Light Intensity (=)(proportional to)  $1/\text{distance}^2$**

### Cover up the *blue* boxes

Cover up the boxes above using a paper or bookmark in blue and try to recall it either out loud or in your head. Try it out: *it's way better than just reading.*

### How to Revise

Cover up the boxes in blue below and try to recall it either out loud or in your head. Factual Recall is important for specific definition questions.

## Biology Topic 4.4.1 (Photosynthesis) Fact Recall Table

|   |  |
|---|--|
| What is the word equation for photosynthesis?                         | Carbon dioxide + water $\xrightarrow{\text{light}}$ glucose + oxygen   |
| What is the symbol equation for photosynthesis?                       | $6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$  |
| What type of reaction is photosynthesis?                              | Photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.                                    |
| Where does photosynthesis take place?                                 | It takes place in chloroplasts in green plant cells - they contain pigments like chlorophyll that absorb light.  |
| What are the limiting factors that affect the rate of photosynthesis? | Intensity of light, concentration of $\text{CO}_2$ , temperature, chlorophyll  |
| How does a plant disease affect the rate of photosynthesis?           | The amount off chlorophyll in a plant can be affected by disease or environmental stress, such as a lack of nutrients. These factors can cause chloroplasts to |



|  |  |
|--|--|
|  | become damaged or to not make enough chlorophyll. This means the rate of photosynthesis is reduced because they can't absorb as much light.  |
| Describe the graph for light-intensity versus rate of photosynthesis | As the light level is raised, the rate of photosynthesis increases steadily - but only up to a certain point. Beyond that, it won't make any difference - as light intensity increases, the rate will no longer increase. This is because CO <sub>2</sub> level which is now the limiting factor, not light. |
| Describe the graph for light-intensity versus rate of photosynthesis | As with light intensity, the amount of CO <sub>2</sub> will only increase the rate of photosynthesis up to a point. After this the graph flattens out - as the amount of CO <sub>2</sub> increases, the rate no longer increases. This shows that CO <sub>2</sub> is no longer the limiting factor.          |
| Describe the graph for temperature versus rate of photosynthesis     | If the temperature of the plant gets too low, the enzymes needed for photosynthesis work more slowly at low temperatures. If it is too hot, the enzymes it needs for photosynthesis and its other reactions will be damaged.   |
| How do we calculate light intensity?                                 | Light intensity = $1/\text{distance squared}$  |
| Why do we study the limiting factors for photosynthesis?             | Limiting factors are important in the economics of enhancing the conditions in greenhouses to gain the maximum rate of photosynthesis while still maintaining profit.  |
| How is temperature controlled in greenhouses?                        | Greenhouses help to trap the Sun's heat, and make sure that the temperature doesn't become limiting. A heater or shades and ventilation are also used when it gets too cold or hot.  |
| How is light controlled in greenhouses?                              | Commercial farmers supply artificial light after the Sun goes down to give their plants more quality photosynthesis time.  |
| How is carbon dioxide controlled in greenhouses?                     | By using a paraffin heater to heat the greenhouse. As the paraffin burns, it makes carbon dioxide as a by-product.   |
| How do plants use glucose? (5 ways)                                  | Used for respiration   |
|  | Converted into insoluble starch for storage  |
|  | Used to produce fat or oil for storage   |
|  | Used to produce cellulose, which strengthens the cell wall   |
|  | Used to produce amino acids for protein synthesis  |