# Biology 4: Bioenergetics

## Section 1: Photosynthesis Equation

1 Carbon dioxide + water $\xrightarrow{\text{light}}$ glucose + oxygen

2 $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

## Section 2: Key terms

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| 3 Chloroplast | The plant **organelle** where **photosynthesis** takes place. |
| 4 Chlorophyll | The **green pigment** that **absorbs energy from light**. |
| 5 Endothermic | Photosynthesis **takes energy** in (in the form of **light**). It is an endothermic reaction. |
| 6 Diffusion | **The spreading out of particles by random motion from where they are in high concentration to a low concentration. Occurs in gases and liquids.** |

## Section 3: Uses of Glucose

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| 7 Used in **respiration** to provide **energy**. |
| 8 Converted into **starch** for **storage**. |
| 9 Converted into **fats** and **oils** for **storage**. |
| 10 Produce **cellulose** to **strengthen** the **cell wall**. |
| 11 Produce **amino acids** to **make proteins** (also needs nitrate ions from the soil) |

## Section 4: Limiting Factors

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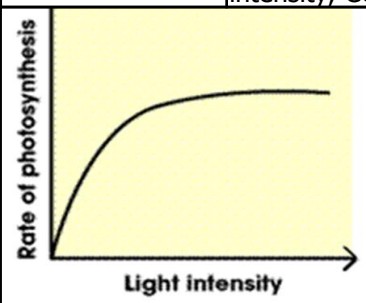
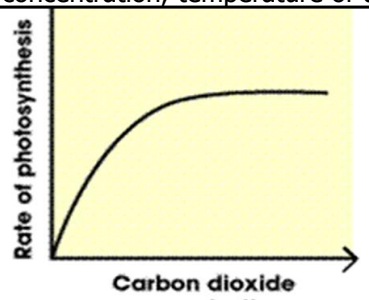
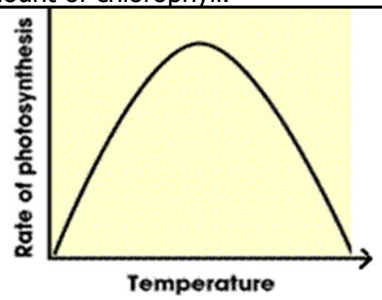
| 12 Limiting Factor | The factor that stops the rate of photosynthesis from increasing; could be light intensity, $CO_2$ concentration, temperature or amount of chlorophyll. |




**13 Light Intensity**
Initially light is the limiting factor. When the graph plateaus something else (e.g. $CO_2$ concentration, temperature) is limiting the rate.

**14 $CO_2$ concentration**
Initially $CO_2$ concentration is the limiting factor. When the graph plateaus something else (e.g. light intensity, temperature) is limiting the rate.

**15 Temperature**
As temperature increases, the rate of photosynthesis increases. Above the optimum there is a decrease in photosynthesis. Enzymes needed for photosynthesis become denatured.

## Section 5: Respiration

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| 16 Energy | Energy in organisms is needed for **chemical reactions to build larger molecules**, **movement** and **keeping warm**. |
| 17 Aerobic Respiration | Aerobic respiration **provides energy**. It requires **oxygen**. It is an **exothermic** reaction (produces heat). In **mitochondria**.<br><br>**Glucose + oxygen → carbon dioxide + water**<br>**$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$** |
| 18 Anaerobic Respiration (muscles) | **No oxygen** needed. Provides **less energy** than aerobic respiration as glucose **not fully oxidised**. Occurs during **intensive exercise**. In **cytoplasm**.<br>**Glucose → lactic acid** |
| 19 Lactic Acid | Produced in **anaerobic respiration in muscles**. **Build up** of lactic acid **causes fatigue**. Lactic acid must be **taken to the liver by the blood so** that it can be **oxidised back to glucose**. |
| 20 Oxygen Debt | The **amount of extra oxygen** the body needs **after exercise** to **react with the lactic acid** and remove it. |
| 21 Anaerobic Respiration (plant and yeast cells) | **No oxygen** needed. In yeast cells it is called **fermentation** – economically important for manufacture of **bread** and **alcoholic drinks**. In **cytoplasm**.<br>**Glucose → ethanol + carbon dioxide** |

## Section 5: Response to Exercise

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| 22 Increase in breathing rate | Increases rate at which **oxygen** is taken into the lungs. |
| 23 Increase in heart rate | Oxygenated blood is pumped around the body at a faster rate. Carbon dioxide is removed at a faster rate. |
| 24 Increase in breath volume | A **greater volume** of oxygen is taken in with each breath. |

## Section 6a: Metabolism

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| 25 Metabolism | The **sum of all the reactions** in a **cell** or **body**. Some of these reactions **require the energy released from respiration**. |

## Section 6b: Metabolic Reactions

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| 26 Conversion of glucose to starch, cellulose or glycogen. |
| 27 Formation of lipids from glycerol and fatty acids |
| 28 Use of glucose and nitrates to make amino acids (plants only) |
| 29 Respiration |
| 30 Breakdown of proteins to urea |