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

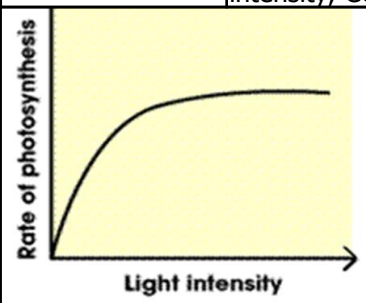
3 Chloroplast	The plant **organelle** where **photosynthesis** takes place.
4 Chlorophyll	The **green pigment** that **absorbs energy from light**.
5 Endothermic	Photosynthesis **takes energy** in (in the form of **light**). It is an endothermic reaction.
6 Diffusion	**The spreading out of particles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

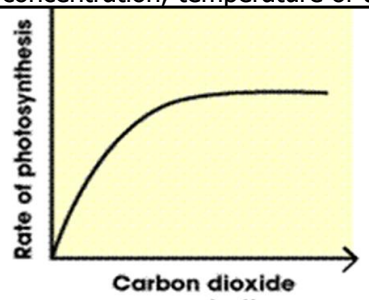
Section 3: Uses of Glucose

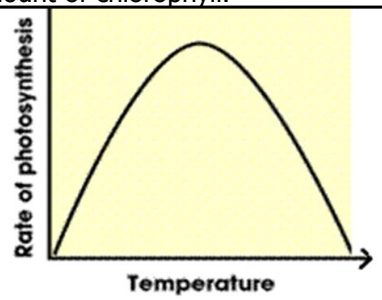
7 Used in **respiration** to provide **energy**.
8 Converted into **starch** for **storage**.
9 Converted into **fats** and **oils** for **storage**.
10 Produce **cellulose** to **strengthen** the **cell wall**.
11 Produce **amino acids** to **make proteins** (also needs nitrate ions from the soil)

Section 4: Limiting Factors

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
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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

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**. **Glucose + oxygen → carbon dioxide + water** **$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$**
18 Anaerobic Respiration (muscles)	**No oxygen** needed. Provides **less energy** than aerobic respiration as glucose **not fully oxidised**. Occurs during **intensive exercise**. In **cytoplasm**. **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**. **Glucose → ethanol + carbon dioxide**

Section 5: Response to Exercise

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

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

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