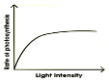
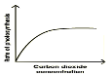
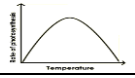
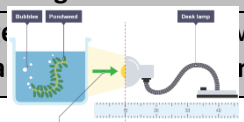
1 - Photosynthesis	
Photosynthesis	An **endothermic** reaction in which plants taken in **energy** to make **glucose** for plants. It occurs in **chloroplasts** in **palisade cells** in **leaves**.
Word equation	**carbon dioxide + water** $\xrightarrow{\text{light}}$ **glucose + oxygen**
Symbol equation	$6\ CO_2 + 6\ H_2O \xrightarrow{\text{light}} C_6H_{12}O_6 + 6\ O_2$
Chlorophyll	**Green pigment** in chloroplasts. Absorbs **energy** from **sunlight** required for photosynthesis.
Uses of glucose	For **respiration** to **release energy**. **Stored** as insoluble **starch** for using later. **Making** other substances e.g. **cellulose** (for cell walls), **lipids** and **proteins** (with nitrate ions).

2 – Limiting Factors for Rate of Photosynthesis	
Limiting factors	A factor that **limits** the **rate** of **photosynthesis**. If the **factor increases**, **rate increases**.
Light intensity 	As **light intensity** increases -> **rate** increases (as it is the **LF**). Graph **flattens** -> rate is **constant ->** other factor is now the **LF**.
CO_2 conc. 	As **CO_2 conc.** increases -> **rate** increases (as it is the **LF**). Graph **flattens** -> rate is **constant** -> other factor is now the **LF**.
Temperature 	As **temp** increases -> **rate** increases (as it is the **LF**). **Optimum** temperature -> **maximum rate**. **Beyond** optimum-> **rate** decreases -> **enzymes denatured**.
Chlorophyll	May be limiting factor due to **infectious disease** (**tobacco mosaic virus**) or **lack** of **minerals** (**magnesium**).

3 – Investigating Rate of Photosynthesis with Pondweed	
Independent variable	**Light intensity** -> change by **moving lamp**. **Light intensity** $\propto$ **1/distance^2** (inverse square law).
Dependent variable	**Rate** of **photosynthesis**. Count **bubbles** of **oxygen**. Or measure **volume** of **oxygen** with **gas syringe**.
Control variables	Same piece of **pondweed**, constant **temperature**, same **power light** source, same **CO_2 concentration**, same length of **time**.

4 - Respiration	
Respiration	**Exothermic** reaction -> releases **energy** from **glucose**.
	Aerobic -> uses **oxygen**. **Anaerobic** -> does **not** use **oxygen**.
Uses of energy	**Muscle contraction**, keeping body **temperature constant**, building up **larger molecules** from **smaller** ones.
Aerobic respiration	**glucose** + **oxygen** -> **carbon dioxide** + **water**
	$C_6H_{12}O_6 + 6\ O_2$ -> **$6\ CO_2 + 6\ H_2O$**
	Occurs in **mitochondria**.
Anaerobic respiration in muscle cells	**glucose** -> **lactic acid**
	Occurs when **oxygen cannot** be **supplied** fast enough -> **exercise**.
	Incomplete oxidation of glucose -> **less energy** released.
Anaerobic respiration in yeast cells	**glucose** -> **ethanol** + **carbon dioxide**
	Known as **fermentation**.
	Ethanol -> making **alcohol**. **Carbon dioxide** -> making **bread** rise.

5 - Exercise	
Muscle cells	When exercising -> more **energy** required for contraction -> cells respire **faster**.
Heart Rate	**Increases** during **exercise** to **pump blood faster**. **Oxygen** and **glucose delivered** to muscle cells **faster**. **Carbon dioxide removed** from muscle cells **faster**.
Breathing	**Breathing rate** and **volume** of **breaths increases** -> **oxygen** inhaled faster -> **carbon dioxide** exhaled faster.
Anaerobic Respiration	Occurs if **insufficient oxygen** is **supplied** -> **lactic acid** causes **muscle pain** and **fatigue**.
Oxygen debt	Amount of **oxyge** with and **remove** the **lactic acid** built up during **a** **n**.



GCSE Science

Biology B4 – Bioenergetics