

Bioenergetics

Photosynthesis

Equation

$\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{glucose} + \text{O}_2$ Light energy Chloroplasts

Endothermic

Energy from environment Transferred by light

Rate factors

Light intensity CO_2 concentration Temperature Chlorophyll amount

Limiting factors

Rate graphs Plateau Measure oxygen / bubbles

Interacting factors **Higher tier**

Any can limit Two or three factors

Inverse square law **Higher tier**

$\text{Intensity} \propto 1 \div \text{distance}^2$

Greenhouse economics **Higher tier**

Heat, light, CO_2 Profit

Uses of glucose

Respiration Starch, fat or oil Cellulose Amino acids with nitrate

Respiration

Exothermic

Always in living cells Energy to surroundings

Aerobic

Glucose + oxygen CO_2 + water Transfers more energy

Anaerobic in muscles

Glucose $\rightarrow$ lactic acid Transfers less energy

Anaerobic in yeast and plants

Ethanol + CO_2 Fermentation Bread, alcoholic drinks

Exercise

Heart rate up Breathing rate up Breath volume up Fatigue

Oxygen debt **Higher tier**

Lactic acid to liver Converted to glucose

Metabolism

Sum of all reactions Glycerol + 3 fatty acids Amino acids to protein Excess protein to urea