Important Classes of Biological Reactions

Chemical reactions are processes in which the atoms making up molecules are rearranged. This can occur in 4 different ways.

"LEO the Lion says GER"

1. Oxidation/Reduction (Redox) Reactions

i) Oxidation involves the loss of electrons by one reactant.
LEO – loss of electrons is oxidation

ii) Reduction involves the gain of electrons by another reactant.
GER - gain of electrons is reduction

In biological systems redox reactions involve the removal of H atoms from one molecule and the addition of H atoms to another molecule (recall $p^+ + e^- = H$ atom)

e.g. $6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$

In photosynthesis H atoms are transferred from water to carbon dioxide, reducing carbon dioxide to form glucose

2. Neutralization (Acid-Base) Reactions:

Involves an acid combining with a base to produce a salt and water. Recall:

i) Acids release H^+ ions/are proton donors
ii) Bases release OH^- ions/are proton acceptors

e.g.

HCl	+	$NaHCO_3$	→	$NaCl$ +	H_2O	+	CO_2
Acid		base		salt	water		gas

In humans, stomach acid is neutralized by sodium bicarbonate in pancreatic juice.

3. Condensation reactions

Small molecules (monomers) are joined together to form a larger molecule (macro-molecule).

Condensation reactions are polymerization reactions in which many small molecules (monomers) are linked together to form a long chain or larger molecule called a polymer.

e.g.

glucose	+	fructose	→	sucrose	+	H_2O

- A water molecule **<u>is released</u>** during each condensation reaction.
- Energy is required for the reaction to occur and is stored within chemical bonds

4. Hydrolysis reactions:

Reactions where macromolecules are broken apart into smaller molecules.

e.g.

sucrose	+	H_2O	→	glucose	+	fructose

- A water molecule **<u>is added</u>** during each hydrolysis reaction.
- Energy is released