

Chemical Reactions

Energy: The capacity to do work or supply heat. This capacity exists in either a stored potential or an active motion.

Stored energy is called potential energy. PE is related to position of shared electrons in covalent bonds.

When shared electrons are far from the nuclei, the bond is long and weak.

If the electrons are closer to one or both of the atoms, the bond becomes shorter and stronger.

Greater capacity to be broken apart and reform into new, strong bonds

Less capacity to be broken apart

MORE PE/Chemical E

LESS PE/Chemical energy

Energy of motion- kinetic energy

Kinetic energy of molecular motion- thermal energy

1st law of thermodynamics: E cannot be either created or destroyed, only transferred

Endothermic

"within heating"

Thermal E absorbed by system

Exothermic

"outside heating"

Thermal E released by system

Spontaneous chemical reactions- able to proceed on their own without any continuous external influence, such as added E.

2 factors determine this-

1. Rxn's tend to be more spontaneous when the product molecules are less ordered than the reactant molecules.

2. Rxn's tend to be spontaneous if products have lower PE than the reactants.

The amount of disorder in a system is called Entropy.

When the shared electrons in the reaction products are held more tightly than those in the reactants.

Increased Entropy in products = Increased spontaneity

Lower PE in products than the reactants

Reactants

Products

↓ Entropy

↑ Entropy

↑ Order

↓ Order

↑ PE

↓ PE

↑ capacity for bonds to break & form stronger bonds

↓ capacity for bonds to break & form stronger bonds

→ Long, loose, weak bonds

→ Short, tight, strong bonds

Origin of Life Chemical Evolution Models

Prebiotic Soup Model:

Surface Metabolism Model

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