

SCH 4U

Energy in Reactions

Students will be able to:

Energy in Chemical Reactions

Objective 1

- understand that energy change is one of the more important features of all chemical reactions

Objective 2

- define and use the following terms or concepts: energy (exothermic, endothermic, enthalpy, heat content), change of enthalpy or heat of reaction (ΔH), calorimetry, molecular enthalpy and molar enthalpy

Objective 3

- define kinetic energy (E_k) and potential energy (E_p) and explain the storage of energy by molecules in terms of potential and kinetic energy

Objective 4

- read, write and interpret thermochemical equations and enthalpy diagrams

Objective 5

- state the first law of thermodynamics (law of conservation of energy) and relate the heat of reaction to the change in enthalpy as the reactants are converted into products in a chemical reaction

Objective 6

- calculate the heat of reaction from a set of calorimetric data

Objective 7

- perform calculations involving uncertainties (error analysis)

Objective 8

- define or state the meaning of the following: translational, vibrational and rotational motions and identify the type of motion that the particles in a solid, liquid and gas possess

Objective 9

- identify the factors that affect the how much energy is available in a physical or chemical reaction

Objective 10

- define or state the meaning of the following: standard enthalpy, standard heat of formation, Hess' Law (an example of the law of conservation of energy)

Objective 11

- calculate the heat of reaction by summation (Hess' Law), given appropriate equations and their heats of reaction (long form)

Objective 12

- calculate the heat of reactions using standard heat of formation tables (short form)

Objective 13

- calculate the heat of reaction and the amounts of substance or heat involved, using stoichiometric relationships involving balanced chemical equations

Energy in Nuclear Reactions

Objective 14

- compare the magnitudes of the energy involved in physical, chemical and nuclear reactions (which type of reaction involves the most energy)

Objective 15

- define or state the meaning of radioactivity, half-life, fission and fusion

Objective 16

- list, use and identify the characteristics of the following symbols used for subatomic nuclear particles and natural radiation: alpha (α), ${}^4\text{He}^{+2}$, beta (β^+ or β^-), ${}^0_{-1}\text{e}$, ${}^0_{+1}\text{e}$, gamma (γ), neutron (n), ${}^1_0\text{n}$
- balance simple nuclear equations and identify a missing reactant or product

Objective 17

- compare fission and fusion reactions, their characteristics and identify devices that employ fission or fusion

Objective 18

- identify changes in kinetic and potential energy during temperature changes and changes in state
- explain the storage of energy in matter as kinetic energy (when temperature increases), as potential energy (when chemical bonds are broken during chemical decomposition or phase changes)
- explain the storage of energy as mass increase during nuclear reactions or at speeds near the speed of light

Objective 19

- identify change in mass as the source of nuclear energy and use the nuclear potential energy graph to identify exothermic and endothermic nuclear reactions

Objective 20

- calculate changes in enthalpy in nuclear reactions using mass changes and the Einstein equation $E=mc^2$