

5.8: End of Chapter Key Terms

Energy in Physics and Chemistry Key Terms

1. **Energy:** The capacity to do work or produce heat; exists in various forms such as kinetic, potential, thermal, chemical, and nuclear.
2. **Kinetic Energy:** The energy an object possesses due to its motion; calculated as $\frac{1}{2}mv^2$ where m is mass and v is velocity.
3. **Potential Energy:** The energy stored in an object due to its position or configuration, such as gravitational potential energy or elastic potential energy.
4. **Thermal Energy:** The total kinetic energy of particles in a substance; often associated with temperature.
5. **Chemical Energy:** The potential energy stored in chemical bonds between atoms and molecules.
6. **Nuclear Energy:** The energy stored in the nucleus of an atom; released during nuclear fission or fusion.
7. **Law of Conservation of Energy:** A principle stating that energy cannot be created or destroyed, only transformed from one form to another.
8. **Work:** The transfer of energy that occurs when a force is applied over a distance; calculated as $W = Fd \cos \theta$ where F is force, d is distance, and θ is the angle between the force and displacement vectors.
9. **Power:** The rate at which work is done or energy is transferred; measured in watts (W).
10. **Heat:** The transfer of thermal energy between substances of different temperatures.
11. **Temperature:** A measure of the average kinetic energy of particles in a substance.
12. **Specific Heat Capacity:** The amount of heat required to raise the temperature of one gram of a substance by one degree Celsius.
13. **Calorimetry:** The measurement of the amount of heat released or absorbed during a chemical reaction.
14. **Enthalpy (H):** The total heat content of a system; changes in enthalpy (ΔH) are used to describe heat changes at constant pressure.
15. **Entropy (S):** A measure of the disorder or randomness in a system; systems tend to move towards higher entropy.
16. **Free Energy (G):** The energy in a system that can be used to do work; changes in free energy (ΔG) predict the spontaneity of a process.
17. **Endothermic Reaction:** A chemical reaction that absorbs energy from its surroundings, resulting in a decrease in temperature.
18. **Exothermic Reaction:** A chemical reaction that releases energy to its surroundings, resulting in an increase in temperature.
19. **Activation Energy:** The minimum energy required for a chemical reaction to occur.
20. **Catalyst:** A substance that increases the rate of a chemical reaction without being consumed in the process by lowering the activation energy.
21. **Bond Energy:** The amount of energy required to break one mole of bonds in a substance.
22. **First Law of Thermodynamics:** The principle of conservation of energy applied to thermodynamic systems, stating that the total energy of an isolated system is constant.
23. **Second Law of Thermodynamics:** States that the total entropy of an isolated system can never decrease over time; systems naturally progress towards thermodynamic equilibrium, the state of maximum entropy.
24. **Third Law of Thermodynamics:** States that the entropy of a perfect crystal approaches zero as the temperature approaches absolute zero.
25. **Gibbs Free Energy:** A thermodynamic quantity representing the amount of energy available to do work; $\Delta G = \Delta H - T \Delta S$.
26. **Chemical Equilibrium:** A state in which the forward and reverse reactions occur at the same rate, resulting in no net change in the concentration of reactants and products.
27. **Electrochemical Cell:** A device that generates electrical energy from chemical reactions or facilitates chemical reactions through the introduction of electrical energy.
28. **Redox Reaction:** A chemical reaction involving the transfer of electrons from one substance to another, comprising oxidation and reduction processes.
29. **Oxidation:** The loss of electrons by a molecule, atom, or ion.
30. **Reduction:** The gain of electrons by a molecule, atom, or ion.

- 31. **Fuel Cell:** A device that converts the chemical energy of a fuel into electrical energy through a chemical reaction with oxygen or another oxidizing agent.
 - 32. **Photovoltaic Cell:** A device that converts light energy into electrical energy using the photovoltaic effect.
 - 33. **Battery:** A device consisting of one or more electrochemical cells that store chemical energy and convert it to electrical energy.
 - 34. **Heat Engine:** A device that converts thermal energy into mechanical work.
 - 35. **Carnot Cycle:** A theoretical cycle that represents the most efficient sequence of processes possible for a heat engine.
 - 36. **Thermochemistry:** The study of the heat energy associated with chemical reactions and changes of state.
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