Unit 9: Thermal Chemistry

Learning Targets

1. Interpret phase diagrams for various substances.
    - I can identify the solid, liquid, and gas regions.
    - I can label the triple point and identify where melting, boiling, and sublimation occur.

2. Use the concept of specific heat to understand differences in temperature changes among substances.
    - I can relate mass, specific heat, and energy input to the temperature change of a substance.
    - I can use the equation $q=mC_p\Delta T$ and solve for the missing variable.

3. Explain how changes in state affect the amount of energy needed to change the temperature of a substance.
    - I can use a graph of temperature vs energy to identify the temperature at which a substance melts or boils.
    - I can use the enthalpy of vaporization and enthalpy of fusion to find how much energy it takes to boil or melt a substance.
    - I can perform multi-step calculations involving energy, specific heat, and enthalpy of phase changes.

4. Apply heat energy changes to chemical reactions.
    - I can define endothermic and exothermic and relate those terms to the change in enthalpy of a reaction.
    - I can draw an energy diagram for endothermic and exothermic reactions and label the ΔH, activation energy, reactants, and products.
    - I can use the standard enthalpy of formation of reactants and products to calculate the enthalpy change for a reaction.

5. Use Hess's Law to determine the enthalpy change of a chemical reaction.
    - I can combine two or three reactions (and their enthalpy changes) to form another single reaction (and thereby find the reaction's enthalpy change).

6. Describe a reaction's change in entropy.
    - I can define entropy as the amount of disorder.
    - I can predict whether a reaction's entropy change is positive or negative based on the gaseous state of reactants and products.
    - I can use a table of standard entropy values to calculate the entropy change of a reaction.

7. Use free energy as a means of determining if a reaction is spontaneous.
    - I can use $\Delta G = \Delta H - T\Delta S$ to calculate free energy and use the result to determine if a reaction is spontaneous. (Negative ΔG value indicates a spontaneous reaction.)
    - I can use a table of standard ΔG_f values to calculate ΔG of a reaction.
    - I can couple a 2^{nd} reaction with a 1^{st} reaction to make the 1^{st} reaction spontaneous.