**Chemistry 17.2**

**Measuring and Expressing Enthalpy Changes**

**A burning match releases heat to its surroundings in all directions. How much heat does this exothermic reaction release? You will learn to measure heat flow in chemical and physical processes by applying the concept of specific heat.**

**Calorimetry**

What basic concepts apply to calorimetry?

**Calorimetry** is the precise measurement of the heat flow into or out of a system for chemical and physical processes.

In calorimetry, the heat released by the system is equal to the heat absorbed by its surroundings. Conversely, the heat absorbed by a system is equal to the heat released by its surroundings.

The insulated device used to measure the absorption or release of heat in chemical or physical processes is called a **calorimeter.**

Constant-Pressure Calorimeters

The heat content of a system at constant pressure is the same as a property called the **enthalpy** (*H*) of the system.

Constant-Volume Calorimeters

Calorimetry experiments can be performed at a constant volume using a bomb calorimeter.

**Thermochemical Equations**

How can you express the enthalpy change for a reaction in a chemical equation?

In a chemical equation, the enthalpy change for the reaction can be written as either a reactant or a product.

A chemical equation that includes the enthalpy change is called a **thermochemical equation.**

The **heat of reaction** is the enthalpy change for the chemical equation exactly as it is written.

**Thermochemical Equations**

The **heat of combustion** is the heat of reaction for the complete burning of one mole of a substance.

**Chemistry 17.3**

**Heat in Changes of State**

**During a race, an athlete can burn a lot of calories that either do work or are released as heat. This section will help you to understand how the evaporation of sweat from your skin helps to rid your body of excess heat.**

**Heats of Fusion and Solidification**

How does the quantity of heat absorbed by a melting solid compare to the quantity of heat released when the liquid solidifies?

The **molar heat of fusion** (∆*H*fus) is the heat absorbed by one mole of a solid substance as it melts to a liquid at a constant temperature.

The **molar heat of solidification** (∆*H*solid) is the heat lost when one mole of a liquid solidifies at a constant temperature.

The quantity of heat absorbed by a melting solid is exactly the same as the quantity of heat released when the liquid solidifies; that is, ∆*H*fus = –∆*H*solid.

**Heats of Vaporization and Condensation**

How does the quantity of heat absorbed by a vaporizing liquid compare to the quantity of heat released when the vapor condenses?

The amount of heat necessary to vaporize one mole of a given liquid is called its **molar heat of vaporization** (∆*H*vap).

The amount of heat released when 1 mol of vapor condenses at the normal boiling point is called its **molar heat of condensation** (∆*H*cond).

The quantity of heat absorbed by a vaporizing liquid is exactly the same as the quantity of heat released when the vapor condenses; that is, ∆*H*vap = –∆*H*cond.

Enthalpy changes accompany changes in state.

**Heat of Solution**

What thermochemical changes can occur when a solution forms?

During the formation of a solution, heat is either released or absorbed.

The enthalpy change caused by dissolution of one mole of substance is the molar heat of solution (∆*H*soln).

When ammonium nitrate crystals and water mix inside the cold pack, heat is absorbed as the crystals dissolve.

**END OF SHOW**

**Chemistry 17.4**

**Calculating Heats of Reaction**

**Emeralds are composed of the elements chromium, aluminum, silicon, oxygen, and beryllium. What if you wanted to determine the heat of reaction without actually breaking the gems down to their component elements? You will see how you**

**can calculate heats of reaction from known thermochemical equations and enthalpy data.**

**Hess’s Law**

What are two ways that you can determine the heat of reaction when it cannot be directly measured?

Hess’s law allows you to determine the heat of reaction indirectly.

Hess’s law of heat summation states that if you add two or more thermochemical equations to give a final equation, then you can also add the heats of reaction to give the final heat of reaction.

**Standard Heats of Formation**

For a reaction that occurs at standard conditions, you can calculate the heat of reaction by using standard heats of formation.

The **standard heat of formation** (∆*H*f0) of a compound is the change in enthalpy that accompanies the formation of one mole of a compound from its elements with all substances in their standard states at 25°C.