Energy and Chemical Reactions

S T U D Y L I S T From Paul Groves

Exothermic & Endothermic

I can…

- state the sign of ΔH is based on observations of warming or cooling of the surroundings.
- correctly apply the terms exothermic and endothermic to situations where the surroundings are warming or cooling.
- draw a PE curve (uphill or downhill) based on information about warming or cooling of the surroundings.
- state that an **EXOTHERMIC** reaction:
  - feels **hot**
  - has a **downhill** Potential Energy diagram
  - has an equation where energy is on the **right**
  - has **more potential energy in the reactants** than in the products
  - has a **negative** ΔH value

Measuring Heat

- state the units of heat capacity (J/°C) and specific heat capacity (J/g·°C) and the use of each.
- convert between the heat units of calories and Joules. (4.184 J = 1 calorie)
- use calorimetry ($q = mC\Delta T$) to calculate heat changes during temperature changes.
- calculate the heat transferred when two objects, at different temperatures, come into contact.
- calculate the final temperature of a hot object added to a cold sample of water.

Chemical Work = Expanding Gases

- relate physical work ($w=F\cdot d$) and chemical work ($w=P\cdot\Delta V$).
- calculate **PV work** done by an expanding gas.
- state that no work is done in a **constant volume** situation such as a bomb calorimeter.

Energy = Heat and Work

- state the difference between work and heat energy.
- state the difference between system and surroundings.
- recognize the system and the surroundings in a chemical or physical system.
- calculate the change in internal energy based on changes in heat absorbed by the system and work done by the system.
- state that ΔH is a more general (and useful) measure of energy than ΔE and that $\Delta H = q$ when a reaction occurs at constant pressure.

Calculating ΔH -- Hess's Law

- state the definition of a state function.
- list examples of properties that are and are not state functions.
- write the equation for the **heat of formation** of a substance.
- state that the heat of formation of an **element** under standard conditions has a value of zero.
- use **Hess's Law** to calculate the energy of a chemical or physical change.

Calculating Heat During Phase Changes – Heats of Fusion and Vaporization

- use heats of vaporization or heats of fusion to calculate heat changes during phase changes.
- write an equation showing the heat of fusion or heat of vaporization.

Calculating ΔH (Enthalpy) of a Reaction using Data

- use $q = mC\Delta T$ to calculate the heat of a reaction or phase changes in J and then kJ.
- calculate the moles of substance changed.
- Calculate ΔH by dividing kJ by moles.