5.2 Molar Enthalpies

Homework Practice 1,2,3,4,5,7,9
Questions 1,2,3,4,5

- Molar enthalpy (ΔH_x): the enthalpy change associated with a physical, chemical, or nuclear change involving <u>one mole</u> of a substance.

- E.g. $1H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow 1H_2O_{(g)} + 241.8$ kJ

  - 1 mole of H_2 will consume ½ mole of O_2 and will produce 1 mole water vapour and 241.8 kJ of energy will be liberated (exothermic)
  - $\Delta H_{combustion} = -241.8$ kJ/mol

- Exothermic: ΔH is negative (thermal energy leaving the system)

- Endothermic: ΔH is positive (thermal energy entering the system)

- Calculating enthalpy for a change of state:

  $H_2O_{(l)} + 40.8 \text{ kJ} \rightarrow H_2O_{(g)}$ ($\Delta H_{vapourization} = +40.8$ kJ/mol)
  $2H_2O_{(l)} + 81.6 \text{ kJ} \rightarrow 2H_2O_{(g)}$ ($\Delta H_{vapourization} = +81.6$ kJ/2mol)

- Use the formula: $\Delta H = n\Delta H_x$ (x = types of changes p306)

  enthalpy change = moles x molar enthalpy of the change

- Enthalpy change expressed in KJ

- See sample question on p.307

Calorimetry of Physical Change

- Usually done in an isolated system (no movement of matter or energy in or out of the system)

- Assumptions:
    - No heat is transferred between the calorimeter and the outside environment.

    - Any heat absorbed or released by the calorimeter material, such as the container, is negligible. Assuming that the material is an insulator, otherwise they must be taken into account.

    - A dilute aqueous solution is assumed to have a density and specific heat capacity equal to that of pure water (1.00 g/mL and 4.18 J/g·°C or 4.18 kJ/kg·°C)

- See sample problem on p.309

Calorimetry of Chemical Change

- Usually done with dilute aqueous solutions and calculations are similar to the change of state calculations.

- There are many different ways that chemists describe situations
    - Ex. Molar enthalpy = heat of …. = enthalpy of ….

- Convert gram values into moles [m/*M* or c x v]

Formula: $nH_x = mc\Delta T$

nH_x is referring to the chemical in question
$mc\Delta T$ is referring to the water or total solution

5.2 Molar Enthalpies

Homework Practice 1,2,3,4,5,7,9
Questions 1,2,3,4,5

- Molar enthalpy (ΔH_x): the enthalpy change associated with a physical, chemical, or nuclear change involving one mole of a substance.

- E.g. $1H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow 1H_2O_{(g)} + 241.8$ kJ
    - 1 mole of H_2 will consume ½ mole of O_2 and will produce 1 mole water vapour and 241.8 kJ of energy will be liberated (exothermic)
    - $\Delta H_{combustion} = -241.8$ kJ/mol

- Exothermic: ΔH is negative (thermal energy leaving the system)

- Endothermic: ΔH is positive (thermal energy entering the system)

- Calculating enthalpy for a change of state:

    $H_2O_{(l)} + 40.8 \text{ kJ} \rightarrow H_2O_{(g)}$ ($\Delta H_{vapourization} = +40.8$ kJ/mol)
    $2H_2O_{(l)} + 81.6 \text{ kJ} \rightarrow 2H_2O_{(g)}$ ($\Delta H_{vapourization} = +81.6$ kJ/2mol)

- Use the formula: $\Delta H = n\Delta H_x$ (x = types of changes p306)

    $\boxed{\text{enthalpy change = moles x molar enthalpy of the change}}$

- Enthalpy change expressed in KJ

- See sample question on p.307

Calorimetry of Physical Change

- Usually done in an isolated system (no movement of matter or energy in or out of the system)

- Assumptions:
  - No heat is transferred between the calorimeter and the outside environment.

  - Any heat absorbed or released by the calorimeter material, such as the container, is negligible. Assuming that the material is an insulator, otherwise they must be taken into account.

  - A dilute aqueous solution is assumed to have a density and specific heat capacity equal to that of pure water (1.00 g/mL and 4.18 J/g·°C or 4.18 kJ/kg·°C)

- See sample problem on p.309

Calorimetry of Chemical Change

- Usually done with dilute aqueous solutions and calculations are similar to the change of state calculations.

- There are many different ways that chemists describe situations
  - Ex. Molar enthalpy = heat of …. = enthalpy of ….

- Convert gram values into moles [m/ *M* or c x v]

Formula: $nH_x = mc\Delta T$

nH_x is referring to the chemical in question
$mc\Delta T$ is referring to the water or total solution