

Announcements – Lecture XX I – Monday, June 24th

FINAL LAB : TUE, JUN 25th, 1:30-4:30

EXAM III : FRI, JUN 28th, IN CLASS
3 OR 4 questions taken from:
LAB OWLS, 3.4, 4.2, 4.5, 5.5, 5.6



Quiz 17

Last Name: _____

A chunk of silver weighing 19.7 grams and originally at 97.48°C is dropped into an insulated cup containing 76.6 grams of water at 23.38°C. Assuming that all of the heat is transferred to the water, the final temperature of the water is

24.44 °C

Heat Capacity : H₂O = 4.184 J/g°C

Ag = 0.237 J/g°C

$$\begin{aligned}q_{\text{H}_2\text{O}} &= m \times C \times \Delta T \\&= 76.6 (4.184) \Delta T \\&= 320.49 (T_f - 23.38) \\&= 320.49 T_f - 7493.16\end{aligned}$$

$$\begin{aligned}q_{\text{Ag}} &= m \times C \times \Delta T \\&= 19.7 (0.237) \Delta T \\&= 4.6689 (T_f - 97.48) \\&= 4.6689 T_f - 455.12\end{aligned}$$

$$\begin{aligned}\Sigma q_i's &= 0 \\q_{\text{H}_2\text{O}} + q_{\text{Ag}} &= 0\end{aligned}$$

$$\begin{aligned}320.49 T_f - 7493.16 + 4.6689 T_f - 455.12 &= 0 \\325.16 T_f - 7948.28 &= 0 \\325.16 T_f &= 7948.28\end{aligned}$$

$$T_f = \frac{7948.28}{325.16} = 24.44^\circ\text{C}$$

5.4 Enthalpy Changes and Chemical Reactions

C: Determining Enthalpy Change – Calorimetry

A 0.242g sample of naphthalene ($C_{10}H_8$) is burned in a bomb calorimeter containing 1025g of water. How much will the temperature rise

Heat capacity of the calorimeter = 802 J/°C

Heat of combustion $C_{10}H_8$ = -5.15×10^3 kJ/mol

Heat capacity of water = 4.184 J/g.°C

$$C_{10}H_8: 10(12.01) + 8(1.01) = 128.18 \text{ g.mol}^{-1}$$

$$\frac{0.242 \text{ g}}{128.18 \text{ g}} \times 1 \text{ mol} = 1.89 \times 10^{-3} \text{ mol}$$

$$q_{\text{RXN}} = -5.15 \times 10^6 \text{ J.mol}^{-1} (1.89 \times 10^{-3} \text{ mol}) \\ = -9.72 \times 10^3 \text{ J}$$

$$q_{\text{RXN}} + q_{\text{H}_2\text{O}} + q_{\text{cal}} = 0$$

$$q_{\text{H}_2\text{O}} + q_{\text{cal}} = -q_{\text{RXN}} = 9.72 \times 10^3 \text{ J}$$

$$q_{\text{H}_2\text{O}} = m \times C \times \Delta T \\ = 1025 \times 4.184 \times \Delta T = 4.29 \times 10^3 \Delta T$$

$$q_{\text{cal}} = 802 \Delta T$$

$$q_{\text{H}_2\text{O}} + q_{\text{cal}} = 9.72 \times 10^3$$

$$4.29 \times 10^3 \Delta T + 802 \Delta T = 9.72 \times 10^3$$

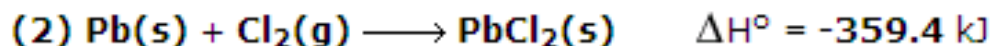
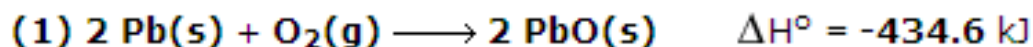
$$5.09 \times 10^3 \Delta T = 9.72 \times 10^3$$

$$\Delta T = \frac{9.72 \times 10^3}{5.09 \times 10^3} = 1.91^\circ\text{C}$$

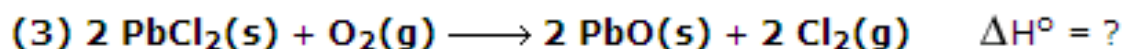
5.5 Hess's Law

A: Hess's Law

Given the standard enthalpy changes for the following two reactions:

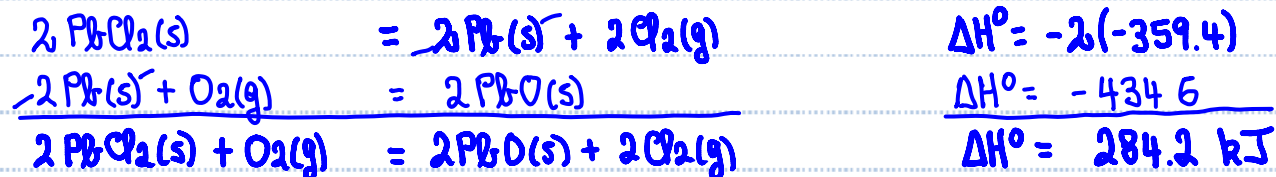


what is the standard enthalpy change for the reaction:



2... x2 + Reversed

1... AS IS



HESS'S LAW:

Reverse a reaction

Multiply reaction by an integer

Add two OR MORE reactions

... Reverse the sign of ΔH° .

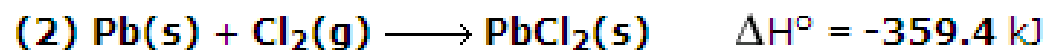
... Multiply ΔH° by the integer.

... Add up the ΔH° 's of each.

5.5 Hess's Law

A: Hess's Law

Given the standard enthalpy changes for the following two reactions:

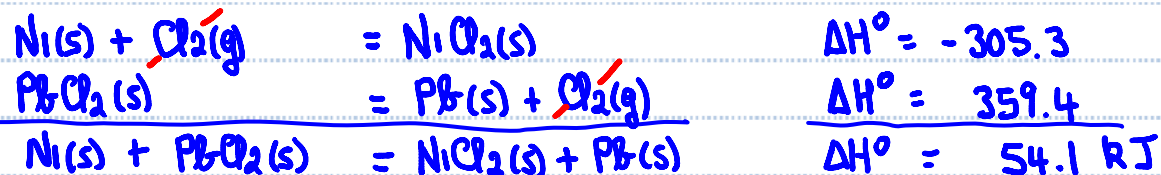


what is the standard enthalpy change for the reaction:



1. As is

2. Reversed



$$\Delta H_{\text{rxn}}^\circ = \Delta H_1^\circ - \Delta H_2^\circ$$

5.6 Standard Heats of Reaction

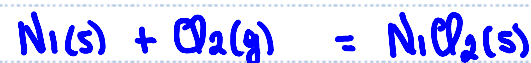
A: Standard Heat of Formation

ΔH_f° : The standard molar enthalpy of formation is the enthalpy change for the formation of 1 mole of a compound from its elements in their standard states.

$$\Delta H_f^\circ \text{CH}_4(\text{g}) = -74.9 \text{ kJ}\cdot\text{mol}^{-1}$$



$$\Delta H_f^\circ \text{NiCl}_2(\text{s}) = -305 \text{ kJ}\cdot\text{mol}^{-1}$$



$$\Delta H_f^\circ \text{PbCl}_2(\text{s}) = -359 \text{ kJ}\cdot\text{mol}^{-1}$$



$$\Delta H_f^\circ \text{Cl}_2(\text{g}) = 0$$

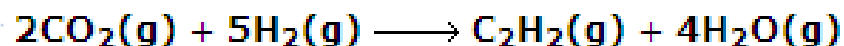


↪ The ΔH_f° for the formation of any element in its standard state is zero

5.6 Standard Heats of Reaction

A: Standard Heat of Formation and Hess's Law

Using standard heats of formation, calculate the standard enthalpy change for the following reaction.



$$\begin{aligned}\Delta H_{\text{RXN}}^{\circ} &= \sum \Delta H_f^{\circ} \text{ PRODUCTS} - \sum \Delta H_f^{\circ} \text{ REACTANTS} \\ &= \Delta H_f^{\circ} \text{C}_2\text{H}_2(\text{g}) + 4 \Delta H_f^{\circ} \text{H}_2\text{O}(\text{g}) - 2 \Delta H_f^{\circ} \text{CO}_2(\text{g}) - \underbrace{5 \Delta H_f^{\circ} \text{H}_2(\text{g})}_{\downarrow = 0}\end{aligned}$$

$$= \underline{\Delta H_f^{\circ} \text{C}_2\text{H}_2(\text{g})} + 4 \underline{\Delta H_f^{\circ} \text{H}_2\text{O}(\text{g})} - 2 \underline{\Delta H_f^{\circ} \text{CO}_2(\text{g})}$$

Simply look these values up!