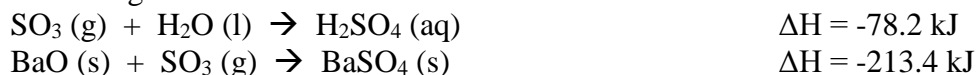


Chapter 17 – Hess’s Law & Assorted Thermochemistry

- Hess’s law of heat summation: _____
- When the reverse of a chemical reaction is written, what happens to the sign of ΔH ? Why?
- Calculate the enthalpy change, ΔH (in kJ) for the reaction:

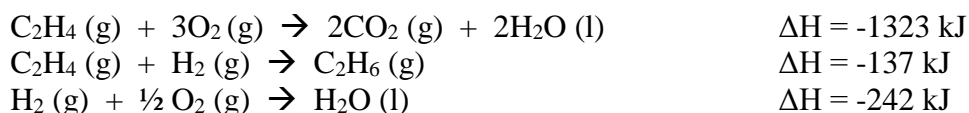
$$\text{BaO (s)} + \text{H}_2\text{SO}_4 \text{ (aq)} \rightarrow \text{BaSO}_4 \text{ (s)} + \text{H}_2\text{O (l)}$$

Use the following data:



- The following equation shows the combustion of ethane.

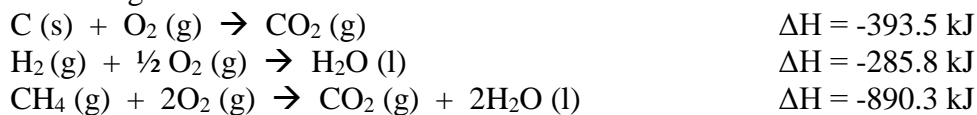
$$2\text{C}_2\text{H}_6 \text{ (g)} + 7\text{O}_2 \text{ (g)} \rightarrow 4\text{CO}_2 \text{ (g)} + 6\text{H}_2\text{O (l)}$$
 Use Hess’s law and following data to calculate the enthalpy change.



- Calculate the enthalpy change, ΔH (in kJ) for the reaction:

$$\text{C (s)} + 2\text{H}_2 \text{ (g)} \rightarrow \text{CH}_4 \text{ (g)}$$

Use the following data:



- Calculate the standard molar enthalpy of formation, ΔH_f° , for the following using table 17.4 on page 580.
 - $\text{H}_2 \text{ (g)} + \frac{1}{2} \text{O}_2 \text{ (g)} \rightarrow \text{H}_2\text{O (l)}$
 - $\text{C (s)} + 2\text{H}_2 \text{ (g)} \rightarrow \text{CH}_4 \text{ (g)}$
 - $2\text{Al (s)} + \frac{3}{2} \text{O}_2 \text{ (g)} \rightarrow \text{Al}_2\text{O}_3 \text{ (s)}$
 - $\frac{1}{2} \text{N}_2 \text{ (g)} + \frac{3}{2} \text{H}_2 \text{ (g)} \rightarrow \text{NH}_3 \text{ (g)}$

7. If 80.0 g of aluminum initially at 70°C is dropped into 250.0 mL of water the temperature of the water rises to 22°C. What was the initial temperature of the water. The specific heat of aluminum is 0.215 cal/g°C.
8. A piece of unknown metal with a mass of 23.8 g is heated to 100.0°C and dropped into 50 mL of water at 24.0°C. The final temperature of the system is 32.5°C. What is the specific heat of the metal in J/g°C?
9. How much heat is released when 108 g of water at 0°C freezes to ice.
 $\Delta H_{\text{solid}} = -6.02 \text{ kJ/mol}$
10. You burn 1.5 g of benzoic acid, $\text{C}_7\text{H}_6\text{O}_2$ (aq), in a combustion calorimeter and find that the temperature of the calorimeter increases from 22.5°C to 31.69°C. The calorimeter contains 775 g of water. Calculate the molar heat of combustion, ΔH (in kJ/mol), of benzoic acid.
$$2\text{C}_7\text{H}_6\text{O}_2 (\text{aq}) + 15\text{O}_2 (\text{g}) \rightarrow 14\text{CO}_2 (\text{g}) + 6\text{H}_2\text{O} (\text{g})$$
11. Calculate the heat energy required to raise the temperature of 4.5 g of water from -8°C to 105.7°C. Draw a diagram to show phase changes.
 $C_{\text{ice}} = 2.06 \text{ J/g}^\circ\text{C}$
 $C_{\text{liquid}} = 4.18 \text{ J/g}^\circ\text{C}$
 $C_{\text{steam}} = 2.02 \text{ J/g}^\circ\text{C}$
 $\Delta H_{\text{fus}} = 6.02 \text{ kJ/mol}$
 $\Delta H_{\text{vap}} = 40.7 \text{ kJ/mol}$
12. How much heat energy is released when 80.0 g of oxygen gas reacts?
$$\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g}) + 2220 \text{ kJ}$$
13. The temperature of a 6.0-g sample of glass changed from 20°C to 45°C when it absorbed 550 J of heat. What is the specific heat of this glass sample?