

AP Chemistry Thermochemistry Sample Problems 2008

1. When potassium melts at atmospheric pressure, the heat transfer is 14.6cal/g. The density of liquid potassium at its melting point is 0.82g/mL, and that of solid potassium is 0.86g/mL. Given that a volume change of 1.00mL at atmospheric pressure corresponds to 0.10J, calculate ΔH and ΔE for melting 1.00g potassium.

2. Calculate the energy transferred to the surroundings when water vapor in the air condenses at 25°C to give rain in a thunderstorm. Suppose that one inch of rain falls over one square mile of ground, so that 6.6×10^{10} mL has fallen. (Assume $\Delta H_{2O(l)} = 1.00\text{g/mL}$). The enthalpy of vaporization for water is 44.0kJ/mol

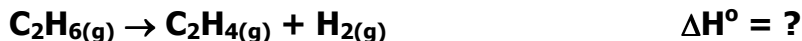
3. Given the thermochemical expression



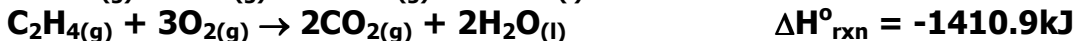
Write the thermochemical expression for the production of 4mol CO_2 by decomposition of solid barium carbonate.

4. A 3.30g sample of the sugar glucose, $\text{C}_6\text{H}_{12}\text{O}_6(s)$, was placed in a bomb calorimeter, ignited, and burned to form carbon dioxide and water. The temperature of the water changed from 22.4°C to 34.1°C. If the calorimeter contained 850.g water and had a heat capacity of 847J/°C, what is ΔE for the combustion of 1mol glucose? (The heat capacity of the bomb is the energy transfer required to raise the bomb's temperature by 1°C.

5. In designing a chemical plant for manufacturing the plastic polyethylene, you need to know the enthalpy change for the removal of H_2 from C_2H_6 (ethane) to give C_2H_4 (ethylene), a key step in the process.



From experiments you know these thermochemical expressions



Use this information to find the value of ΔH° for the formation of ethylene from ethane.

1. ΔH & $\Delta E = 61.1\text{J}$
($\Delta E = 61.1\text{J} + 6 \times 10^{-3}\text{J} = \Delta H + w$)

2. $1.6 \times 10^{11}\text{kJ}$

3. 2651kJ

4. -2810kJ

5. $\Delta H^{\circ} = 137.0\text{kJ}$