

Chemistry 105 - Fundamental Chemistry

Fall 1997 - *Enthalpy Changes*

1. At high temperatures, water is decomposed to hydrogen and oxygen:



Decomposition of 10.0 g H_2O at constant pressure requires that 134 kJ of heat be absorbed by the system. Is the reaction endothermic or exothermic? What is the value of q for the reaction, per mole of water? Is the value of q equal to ΔH ? Explain. **ANSWER: endothermic, 241kJ/mol, if $q=134\text{kJ}$, $\Delta H = q$.**

2. Combustion of 0.144 g of sucrose (table sugar, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$) results in the release of 2.38 kJ of heat according to the chemical reaction:

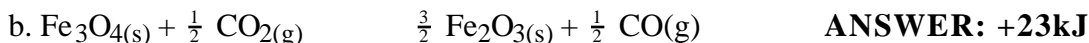
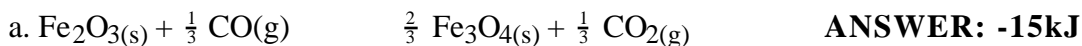


Is the reaction endothermic or exothermic? What is the value of q for the reaction per mole of sucrose? How would you expect the values of q and ΔH to compare for this reaction? Explain. **ANSWER: exothermic, 5.66×10^3 kJ/mol, if $q=2.38\text{kJ}$, $\Delta H = q$.**

3. When 0.0500 mol of solid calcium carbonate is heated in air, it decomposes to solid calcium oxide and carbon dioxide gas; 8.90 kJ of heat is absorbed. Write a chemical equation for the decomposition of one mole of calcium carbonate including the physical states of all the substances and the value of ΔH . **ANSWER: $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$, $\Delta H=178\text{kJ}$**

4. Given the reaction: $3 \text{Fe}_2\text{O}_3(\text{s}) + \text{CO}(\text{g}) \rightarrow 2 \text{Fe}_3\text{O}_4(\text{s}) + \text{CO}_2(\text{g})$ $\Delta H^\circ = -46 \text{ kJ}$

Calculate ΔH° for the following reactions:

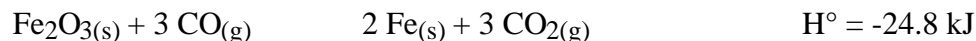


5. Calcium oxide (lime) reacts with water to form calcium hydroxide (slaked lime).



How much heat, in joules is evolved when 0.333 mol $\text{Ca}(\text{OH})_2(\text{s})$ is formed? **ANS: -21.7kJ**

6. Iron(III) oxide is reduced to iron metal by reaction with carbon monoxide.



How many kilograms of CO are consumed when 429 kJ of heat is released under these conditions? **ANSWER: 1.45kg CO**

