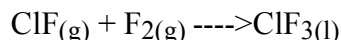


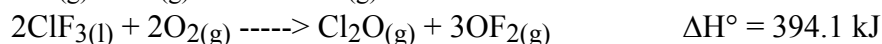
CHEM 100
Chemistry I
Problem Set V
Chapter 6

Due: Monday, 23-October-2006 at the beginning of class. Show all work clearly. Remember that this is to be your own work.

1) Oxidation of ClF by F₂ yields ClF₃, an important fluorinating agent formerly used to produce the uranium compounds in nuclear fuels:



Use the following thermochemical equations to calculate ΔH° for the production of ClF₃:

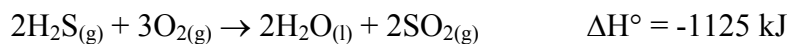


2) The heat of combustion of benzoic acid, HC₇H₅O₂, is 3221.6 kJ/mole. A 1.200 g sample of benzoic acid is burned in an apparatus called a *bomb calorimeter*. (This is used for very accurate determinations.) The temperature of the calorimeter, with its water and other stuff present, increased from 22.45°C to 26.10°C.

a) Calculate the total heat capacity of the calorimeter.

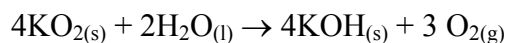
b) If the calorimeter contained 1.500 kg of water, what is the heat capacity of the calorimeter when it contains no water?

3) An industrial process for manufacturing sulfuric acid, H₂SO₄, uses hydrogen sulfide, H₂S, from the purification of natural gas. In the first step of this process, the hydrogen sulfide is burned to obtain sulfur dioxide, SO₂:



The density of sulfur dioxide at 25°C and 1.00 atm is 2.62 g/L, and the molar heat capacity is 30.2 J/(mol•°C). **(a)** How much heat would be evolved in producing 1.00 L of SO₂ at 25°C and 1 atm? **(b)** Suppose heat from this reaction is used to heat 1.00 L of SO₂ from 25°C and 1.00 atm to 500°C for its use in the next step of the process. What percentage of the heat evolved is required for this?

4) A rebreathing mask contains potassium superoxide, KO₂, which reacts with moisture in the breath to give oxygen:



Estimate the grams of potassium superoxide required to supply a person's oxygen needs for one hour. Assume a person requires 1.75×10^2 kcal of energy for this time period. Further assume that this energy can be equated to the heat of combustion of a quantity of glucose, $C_6H_{12}O_6$, to $CO_{2(g)}$ and $H_2O_{(l)}$. From the amount of glucose required to give 1.75×10^2 kcal of heat, calculate the amount of oxygen consumed and hence the amount of $KO_{2(s)}$ required. The ΔH_f° for glucose_(s) is -1273 kJ/mol.

5) Does a negative ΔH_{rxn} mean that the heat can be thought of as a reactant or as a product? Explain your choice.