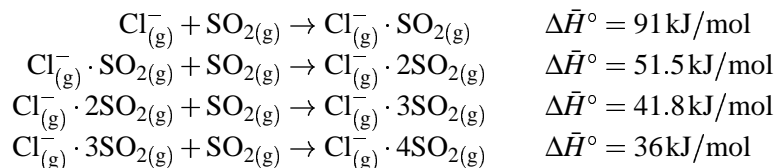


Chemistry 2720 Fall 2001 Assignment 4

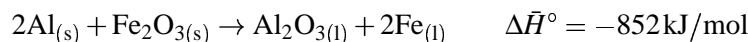
Due: Tuesday, Oct. 2, 9:25 a.m.

1. Given the following data



what is the enthalpy change for the disproportionation process $\text{Cl}_{(g)}^- \cdot 4\text{SO}_{2(g)} \rightarrow \text{Cl}_{(g)}^- + 4\text{SO}_{2(g)}$?
[2 marks]

2. Formaldehyde (methanal, CH_2O) is a gas at room temperature. It has a standard enthalpy of combustion of -570.78 kJ/mol .
- (a) What is the standard enthalpy of formation of this compound? [4 marks]
- (b) Combustion is generally carried out in a bomb calorimeter, a constant-volume device. Calculate the heat generated by the combustion of 1.0045 g of formaldehyde at constant volume at 25°C . [8 marks]
3. 80 mL of 0.50 mol/L HCl solution is mixed with 45 mL of 0.85 mol/L NaOH solution. Both solutions have initial temperatures of 22°C . What is the maximum temperature which the mixture reaches? [10 marks]
- Note: Make a reasonable assumption about the solution densities.
4. The thermite reaction



is extremely rapid so that it occurs under quasi-adiabatic conditions. (The heat simply doesn't have time to escape.) The temperature of the products can be as high as 3000°C .

- (a) The thermite reaction is commonly used to weld metals together. In welding, the interface between two metal pieces is melted. When the molten metal resolidifies, the two pieces are joined. Supposing that all of the heat released in the initial reaction were used to weld two iron rails for which a secure weld required the melting of 10 g of iron, what is the minimum mass of thermite reagent required for this weld if the initial temperature of the iron pieces is 20°C , assuming a stoichiometric mixture and that all of the heat generated goes into the iron to be melted? Iron melts at 1808 K with an enthalpy of fusion of 267 J/g . [6 marks]
- (b) Given that the specific heat capacity of liquid iron is $46.024 \text{ J K}^{-1} \text{ mol}^{-1}$ and assuming that the maximum temperature is only reached when the reaction is carried out in isolation, estimate the specific heat capacity of $\text{Al}_2\text{O}_{3(l)}$. [8 marks]