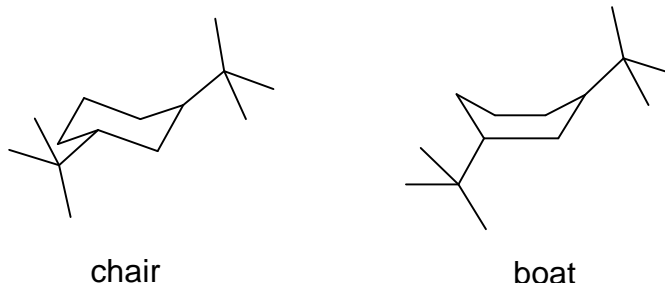# Chemistry 2000 Spring 2001 Section B Assignment 2

Due: Thursday, Feb. 15, 10:50 a.m.

1. The liquid compound 1,3-di-t-butylcyclohexane exists in two forms which are known as the "chair" and "boat" conformations:

chair   boat

   (Only the carbon skeletons are shown.) At 580 K, there is an equilibrium between these two forms when 6.42% of the molecules are in the chair form. What is the equilibrium constant for the chair $\rightleftharpoons$ boat conversion? [4 marks]

2. The equilibrium constant for the reaction $2NO_{(g)} + Br_{2(g)} \rightleftharpoons 2NOBr_{(g)}$ is 116.6 at 25°C. If 0.105 atm of NO, 0.400 atm of bromine and 0.969 of NOBr are mixed, in which direction will the reaction proceed? [4 marks]

3. Phosgene ($COCl_2$) is produced by the reaction $CO_{(g)} + Cl_{2(g)} \rightleftharpoons COCl_{2(g)}$. The equilibrium constant for this reaction is 0.20 at 600°C.

   (a) If 0.3 atm each of carbon monoxide and of chlorine are mixed in a rigid container at 600°C, what equilibrium partial pressure of phosgene is obtained? [7 marks]

   (b) If the container in which the reaction occurs has a volume of 10 L, how many moles of phosgene are formed? [4 marks]

4. The equilibrium constant for the reaction $CO_{2(g)} + H_2O_{(l)} \rightleftharpoons H_2CO_{3(aq)}$ is 3.36×10^{-2} at 25°C. The normal atmospheric pressure of carbon dioxide is 33 Pa. A solution is made by dissolving 18 g of NaCl in 150 g of water. Assuming that no solvent evaporates, what is the concentration of H_2CO_3 when this solution comes to equilibrium? [7 marks]