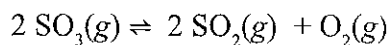


Unit 9

NMSI Super Problem: General Equilibrium



A 5.00 mol sample of sulfur trioxide, SO_3 , is placed into a 5.00 L reaction vessel and allowed to decompose at 400 K according to the reaction above. Once equilibrium is established, 3.00 mol of sulfur dioxide, SO_2 , is present.

- Write the expression for the equilibrium constant, K_c , for the reaction above.
- Calculate
 - the initial molar concentration of SO_3
 - the equilibrium concentrations of O_2 , SO_2 , and SO_3
- Calculate the equilibrium constant, K_c for this reaction.
- Calculate the equilibrium constant, K_p for this reaction.

The reaction vessel above is cooled from 400 K to 298 K. The mixture reestablishes equilibrium with fewer moles of sulfur dioxide and oxygen gas at the new temperature.

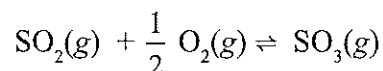
- Is the forward reaction endothermic or exothermic? Justify your answer.

54° ✕ Predict the sign of the standard entropy change, ΔS° , for the reaction. Explain.

- 5K2** ✖ The value of the standard free energy change, ΔG° , for the reaction is $+141.8 \text{ kJ mol}^{-1}$. Calculate the value of the equilibrium constant, K , at 298 K.

- h. Determine whether the number of moles of SO_3 will increase, decrease, or stay the same after each of the following disturbances. Justify each response.
- The temperature of the equilibrium mixture is decreased.
 - The volume of the reaction container is increased.

In a different experiment, sulfur dioxide and oxygen gases were added to a reaction vessel at 400 K and the following reaction occurred and equilibrium was established.



- Calculate the equilibrium constant, K_c for this reaction at 400. K.