

Suggested Problems for CHEM 3410, Chapter 7

1) We have the following chemical system at equilibrium at 527 °C where the volume is 5.6 L.



predict the i) the stress, ii) what the system does (shifts to products or reactants) for Q_c to equal K_c (for the reaction to shift back to equilibrium)

- a) You add COCl_2 gas.
 - i. Example: the stress is adding a reactant
 - ii. Example: The reaction shifts to products to reestablish equilibrium
- b) You add CO gas.

- c) You increase the temperature to 600 °C.

- d) You decrease the volume of the container to 4.3 L.

- e) Add a catalyst.

- f) Add 1.3 L of N_2 .

2) The heat of fusion of water, ΔH_{fus} , at 0 °C is 6.02 kJ/mol. What is ΔS_{fus} for 1 mole of H_2O ?

3) Hydrate lime $\text{Ca}(\text{OH})_2(\text{s})$ can be reformed into quicklime, $\text{CaO}(\text{s})$, by heating...



Note → Need ΔH for $\text{Ca}(\text{OH})_2$

At what temperature is this reaction spontaneous under standard conditions (that is, where CO_2 is formed at 1 atm pressure)?

- 3)
- (a) Calculate ΔG° and K_p for the following equilibrium reaction at 25 °C. The ΔG_f° values are 0 for $\text{Cl}_2(\text{g})$, -286 kJ/mol for $\text{PCl}_3(\text{g})$, and -325 kJ/mol for $\text{PCl}_5(\text{g})$.
 - (b) Calculate ΔG for the reaction if the partial pressures of the initial mixture are $P_{\text{PCl}_5} = 0.0029$ atm, $P_{\text{PCl}_3} = 0.27$ atm, and $P_{\text{Cl}_2} = 0.40$ atm.



4) Write the K_p for $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$ using fugacities.