

R&R #15

I. Concept Questions

Disturbance	Action needed to return to equilibrium	Effect of equilibrium	Effect on K
<i>Reactions Involving Solids, Liquids, or Gases</i>			
Addition of reactant			
Addition of product			
Rise in temperature			
Drop in temperature			
<i>Reactions Involving Gases</i>			
Decrease in volume (_____ in pressure)			
Increase in volume (_____ in pressure)			

II. Practice Problems

1. Explain the effect of each of the following stresses on the position of the following equilibrium:



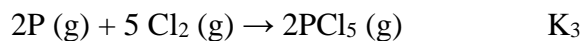
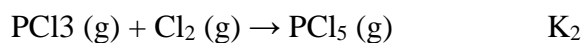
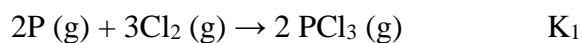
The reaction as written is exothermic.

(a) The equilibrium mixture is cooled.

(b) The volume of the equilibrium mixture is reduced at constant temperature.

- (c) Gaseous argon (which does not react) is added to the equilibrium mixture while both the total gas pressure and the temperature are kept constant.

2. Write down K_3 using K_1 and K_2 .



$K_3 =$

3. Hemoglobin (Hb) can form a complex with both O_2 and CO. For the reaction $\text{HbO}_2(\text{aq}) + \text{CO}(\text{g}) \rightarrow \text{HbCO}(\text{aq}) + \text{O}_2(\text{g})$ at body temperature, K is about 200. If the ratio $[\text{HbCO}]/[\text{HbO}_2]$ comes close to 1, death is probable. What partial pressure of CO in the air is likely to be fatal? Assume the partial pressure of O_2 is 0.20 atm.

4. The reaction of hydrogen and iodine to give hydrogen iodide has an equilibrium constant, K_c , of 56 at 435 °C.

(a) What is the value of K_p ?

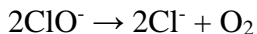
(b) Suppose you mix 0.045 mol of H_2 and 0.045 mol of I_2 in a 10.0-L flask at 425 °C. What is the total pressure of the mixture before and after equilibrium is achieved?

(c) What is the partial pressure of each gas at equilibrium?

III. MCAT Questions (source: [M Prep - Tags \(mcatquestion.com\)](https://www.mcatquestion.com))

1. For a particular reaction, the ratio of the forward rate over the reverse rate is measured (forward rate / reverse rate). Which of the following will most increase this quotient?
- A Include a catalyst.
 - B Add thermal energy to the system.
 - C Remove thermal energy from the system.
 - D None of the above.

2. Sodium hypochlorite, NaClO , is highly soluble in water and decomposes to liberate $\text{O}_2(\text{g})$. What would happen to the freezing point of a 0.05 M solution of sodium hypochlorite after it has completely decomposed?



- A The freezing point would increase because the molarity of the solution would decrease.
- B The freezing point would remain the same because the molarity of the solution would be unchanged.
- C The freezing point would decrease because the molarity of the solution would increase.
- D The answer cannot be determined from the given information.
3. A reaction, $\text{A} + 2\text{B} \rightarrow \text{C} + \text{D}$ takes place in a chamber. 5 moles of A and 12 moles of B are mixed together to produce 3 moles of C at equilibrium. Assuming all of the reactants and products are in aqueous solution and volume remains constant, what is the equilibrium constant for the reaction? (Assume $V=1 \text{ L}$)
- A 14/27
- B 9
- C 9/12
- D 1/8
4. Which of the following is true of a reversible reaction where $Q > K$?
- A The reaction is at equilibrium.
- B The reaction will increase the concentration of products over time.
- C The reaction will increase the concentration of reactants over time.
- D The reaction will be at equilibrium once the activation energy is reached.

5. Increasing the temperature in an exothermic reaction will:

- A shift the equilibrium right.
- B shift the equilibrium left.
- C have no effect on the reaction.
- D shift the equilibrium to the left or the right depending on the catalyst used.