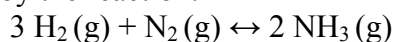


Quiz: Ch 15 – 16  
AP Chem (30 pts)  
Version C

Name:  
I have neither given nor received aid on this quiz.  
Period: 6 7 Date: \_\_\_\_\_

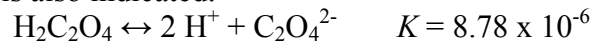
**Complete in pencil. Erase mistakes completely. If you need more space, use the back of this sheet or attach further sheets as is necessary. For problems involving calculations, no credit will be given if work is not shown.**

1. (14 pts) An initial mixture of nitrogen gas and hydrogen gas reacts endothermically in a rigid container at 25°C by the reaction:



- a. (3 pts) At equilibrium, the concentrations are  $[\text{H}_2] = 4.0 \text{ M}$ ,  $[\text{N}_2] = 7.0 \text{ M}$ , and  $[\text{NH}_3] = 2.0 \text{ M}$ . Write the expression for  $K_p$  and calculate its numerical value.
- b. (3 pts) Calculate the concentrations of nitrogen gas and hydrogen gas that were reacted initially to achieve the stated equilibrium concentrations.
- c. (4 pts) Explain in which direction (forward, backward, or not at all) the above reaction will shift, and why it shifts that way, if:
- Ammonia is added.
  - The temperature is increased.
- d. (4 pts) Explain how the equilibrium constant of the above reaction will be affected, and why it will be (or will not be) affected, if:
- The pressure is decreased.
  - A catalyst is added.

2. (8 pts) The overall dissociation of oxalic acid,  $\text{H}_2\text{C}_2\text{O}_4$ , is represented below. The overall dissociation constant is also indicated.



- a. (5 pts) Give the chemical equations and equilibrium constant expressions representing the first and second dissociations of oxalic acid. Calculate the value of the first dissociation constant,  $K_{a1}$ , for oxalic acid if the value of the second dissociation constant,  $K_{a2}$ , is  $3.40 \times 10^{-5}$ .
- b. (3 pts) To a 0.015-molar solution of oxalic acid, a strong acid is added until the pH is 0.5. Calculate the  $[\text{C}_2\text{O}_4^{2-}]$  in the resulting solution. (Assume the change in volume is negligible.)
3. (4 pts) Predict whether an aqueous solution of the following compound will be acidic, basic, or neutral. Explain briefly.  
 $\text{NH}_4\text{CHO}_2$        $K_b(\text{NH}_3) = 1.8 \times 10^{-5}$ ;  $K_a(\text{HCHO}_2) = 1.8 \times 10^{-4}$

4. (4 pts) Give the formula for an acid that is very similar to  $\text{H}_2\text{SO}_3$ , but that is stronger.

Give the formula for an acid that is very similar to  $\text{H}_2\text{SO}_3$ , but that is weaker, but for a different reason than that used in the above question.