

Exam II – Chapters 13 & 14*For multiple choice questions, there is only one correct answer!***Some K_a values:**

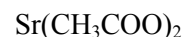
| | |
|--|-----------------------|
| Acetic acid (CH_3COOH) | 1.8×10^{-5} |
| Nitrous acid (HNO_2) | 4.5×10^{-4} |
| Formic acid (HCO_2H) | 1.8×10^{-4} |
| Hydrocyanic acid (HCN) | 4.9×10^{-10} |
| Ammonia (NH_3) | 5.6×10^{-10} |
| Methylamine (CH_3NH_2) | 2.7×10^{-11} |

- (8 pts) A student mixed together two reactants, a reaction occurred forming two new products, and equilibrium was reached. The student found the equilibrium constant to be 50. What would happen if the student took the two product chemicals and mixed them together?
 - Equilibrium will be reached when the concentration of the reactants equals the products.
 - The reaction stops once equilibrium is achieved.
 - The products will react and reach equilibrium with an equilibrium constant equal to 50.
 - The products will react and reach equilibrium with an equilibrium constant equal to 1/50.
 - Nothing will happen, only reactants can react together to form the products.
- (8 pts) The correct equilibrium expression for the formation of ammonia is:
 - $\frac{[\text{NH}_3]}{[\text{H}_2][\text{N}_2]}$
 - $\frac{[\text{H}_2][\text{N}_2]}{[\text{NH}_3]}$
 - $\frac{[\text{NH}_3]^2}{[\text{H}_2]^3[\text{N}_2]}$
 - $\frac{[\text{H}_2]^3[\text{N}_2]}{[\text{NH}_3]^2}$
- (8 pts) A student is running the reaction for the formation of ammonia in lab. The student wanted to know where her reaction was at regarding equilibrium so she sampled the mixture and found Q_C to be 2.3×10^{-2} . The value of K_C for the formation of ammonia at 500 K is 168. What is true about the student's reaction?
 - The reaction is at equilibrium.
 - The reaction needs to proceed in the forward direction to reach equilibrium.
 - The reaction needs to proceed in the reverse direction to reach equilibrium.
 - The reaction is past the point of equilibrium and stopped.
- (10 pts) When studying carbon oxidation, the following reaction is often used:

$$\text{CO}_2(\text{g}) + \text{C}(\text{s}) \leftrightarrow 2\text{CO}(\text{g}) \quad \Delta H = -55.6 \text{ kJ/mol}$$
 Determine the shift in the equilibrium for the reaction if the following changes are applied:

| | | | |
|---------------------------------|-------------------|--------------------|------------------|
| a. Carbon is added | shift left | shift right | no affect |
| b. Carbon dioxide is added | shift left | shift right | no affect |
| c. Helium gas is added | shift left | shift right | no affect |
| d. The temperature is decreased | shift left | shift right | no affect |
| e. The pressure is increased | shift left | shift right | no affect |
- (9 pts) If the pH of a solution is 5.923, calculate the
 - $[\text{H}_3\text{O}^+] =$ _____
 - $[\text{OH}^-] =$ _____
 - $\text{pOH} =$ _____

6. (8 pts) Circle all of the following salts that would be **basic**:

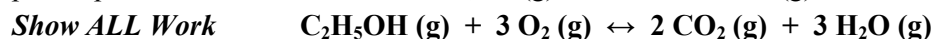


7. (8 pts) A student placed 0.025 M hydrobromic acid in water. Write the balanced equation for this reaction and calculate the pH of the resulting solution.

8. (9 pts) Place the following acids in order of **increasing** acid strength: PO₄³⁻, H₃PO₄, HPO₄²⁻, H₂PO₄⁻

least acidic _____ most acidic

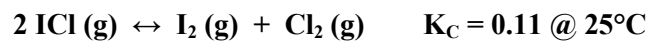
9. (8 pts) Calculate the values for K_C and K_P for the combustion of ethanol (C₂H₅OH) at 225°C if the equilibrium partial pressure of ethanol is 0.123 atm, O₂ (g) is 0.075 atm, CO₂ (g) is 0.112 atm, and H₂O (g) is 0.050 atm.



K_C = _____

K_P = _____

10. (8 pts) What is the equilibrium concentration of all species when 0.25 M I₂, 0.25 M Cl₂ and 0.10 M ICl are mixed together in a flask?



I

C

E

[ICl] = _____

[I₂] = _____

[Cl₂] = _____

11. (8 pts) A student placed 25.0 mL of 0.500 M acetic acid in a volumetric flask and diluted the sample to 100.0 mL. Write the balanced equation and calculate the pH, pOH, $[H_3O^+]$, $[OH^-]$ of the resulting solution.

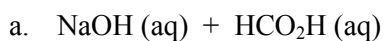
pH = _____ pOH = _____ $[H_3O^+] =$ _____ $[OH^-] =$ _____

12. (8 pts) A student placed 4.25 g of potassium nitrite in 200.0 mL of water.
- Show the equation(s) of what happens when potassium nitrite is placed in water:

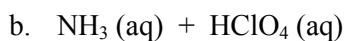
 - What is the pH of the resulting solution?

Extra Credit

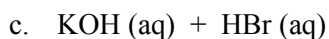
(8 pts) Please finish each reaction by writing the correct arrow and products. Then determine whether the following reactions would result in an acidic, basic, or neutral solution:



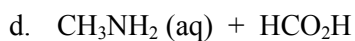
The resulting solution is: acidic basic neutral



The resulting solution is: acidic basic neutral



The resulting solution is: acidic basic neutral



The resulting solution is: acidic basic neutral