1. In a gaseous equilibrium: \( 2A + B \rightleftharpoons 2C \), the equilibrium concentrations of \( A, B \) and \( C \) are \( 5.50 \times 10^{-3}, 2.25 \times 10^{-3} \) and \( 1.02 \times 10^{-2} \) respectively. What is the value for \( K \) in this reaction?

2. Methanol is manufactured according to the following equation. The equilibrium constant at 400 K for the reaction is 1.609. The equilibrium concentrations are as follows: \([CH_3OH] = 0.818M, [CO]= 1.402M\). What is the \([H_2]\) in the vessel?

\[
CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)
\]

3. The initial concentration of a solution of acetic acid is 0.0020M. What is the \( K_a \) for HAc if the \( pH \) of the solution is 6.00. (Ans: 5.00 \times 10^{-5})

4. In the gaseous equilibrium \( 2A \rightleftharpoons 2C + D \) the concentration of \( A \) is \( 6.59 \times 10^{-4} M \). The concentration of \( C \) is \( 4.06 \times 10^{-3} M \), and the concentration of \( D \) is \( 2.03 \times 10^{-3} M \). What is the \( K_c \) for this equilibrium? (Ans: 7.71 \times 10^{-2})

5. The following reaction is used as a source of hydrogen for the production of ammonia. The equilibrium constant for this reacti

\[
C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)
\]

6. NaCN(s) + HCl(g) \( \rightleftharpoons \) HCN(g) + NaCl(s).
   a. Write the equilibrium constant expression.
   b. The equilibrium constant for this reaction is \( 2.405 \times 10^6 \). In what direction is the reaction favored? What is the concentration of HCl remaining when the concentration of HCN is \( 0.8959M \)? (Ans: 3.725 \times 10^{-7} M)

7. The \( pH \) of a 0.400 M solution of iodic acid, HIO\(_3\), is 0.726 at 25\( ^\circ \)C. What is the \( K_a \) at this temperature? (Ans: 0.167)

8. The \( pH \) of a 0.150 M solution of hypochlorous acid, HClO, is found to be 4.55 at 25\( ^\circ \)C. Calculate the \( K_a \) for HClO at this temperature. (Ans: 5.2 \times 10^{-8})

9. What is the \( pH \) of 0.01 M carbonic acid, \( K_a = 4.3 \times 10^{-7} \)?
10. What is the \( pH \) of 1.2M sulfurous acid, \( K_a = 7.7 \times 10^{-13} \)?
11. What is the \( pH \) of 0.90M aniline (\( C_8H_{14}NH_2 \)) a weak base. \( K_b = 3.8 \times 10^{-10} \)?
12. Using the \( K_a \) values from 9 and 10, which acid is the stronger acid and why?
13. Silver bromate, AgBrO\(_3\), is slightly soluble in water. A saturated solution is found to contain 0.276 g AgBrO\(_3\) dissolved in 150.0mL of water. Calculate the \( K_{sp} \) for silver bromate. (Ans: 6.09 \times 10^{-5})
14. 2.50 L of a saturated solution of calcium fluoride leaves a residue of 0.0427 g of CaF\(_2\) when evaporated to dryness. Calculate the \( K_{sp} \) of CaF\(_2\). (Ans: 4.20 \times 10^{-11})
15. The \( K_{sp} \) of CaSO\(_4\), is 9.1 \times 10^{-6}. What is the molar concentration of calcium sulfate in a saturated solution?
16. The \( K_{sp} \) of lead (II) iodide is 6.3 \times 10^{-6} at 25\( ^\circ \)C. What is the iodide ion concentration? (0.012M)
17. Will a precipitate of Ca(OH)\(_2\) form when 320. mL of a 0.046 M solution of NaOH mixes with 400. mL of a 0.085M solution of CaCl\(_2\)? \( K_{sp} \) for calcium hydroxide is 5.5\times 10^{-6}. (Ans: 1.9 \times 10^{-5} yes)