

大同大學 106學年度(寒)轉學入學考試試題

考試科目:化學

系別:生物工程學系

P. 1/2

註:本次考試 不可以參考自己的書籍及筆記; 不可以使用字典; 不可以使用計算器
(1~16題每題5分, 17~18題各10分)

1. Calculate the percent ionization of formic acid in a solution that is 0.010 M HCOOH and 0.005 M HCOONa and compare your answer to the percent ionization you would calculate if the sodium formate were not present. Explain the difference, if any. ($K_a = 1.7 \times 10^{-4}$)

2. How many moles of NaF must be dissolved in 1.00 liter of a saturated solution of PbF_2 at $25^\circ C$ to reduce the $[Pb^{2+}]$ to 1.0×10^{-6} M? (K_{sp} of PbF_2 at $25^\circ C = 4.0 \times 10^{-8}$)

3. When 2.0×10^{-2} mole of nicotinic acid (a monoprotic acid) is dissolved in 350. mL of water, the pH is 3.05. What is the K_a of nicotinic acid?

4. Calculate the pH of a solution that is 0.15 M CH_3COOH and 0.75 M CH_3COONa .

5. The pH of a 0.02 M solution of an unknown weak base is 8.1. What is the pK_b of the unknown base?

6. Given the following data, calculate the boiling point of HCOOH (formic acid).

	ΔH_f° (kJ/mol)	S° (J/K·mol)
HCOOH(l)	-410	130
HCOOH(g)	-363	251

7. The pH of a 0.6 M solution of a weak acid is 4.0. What percent of the acid has ionized?

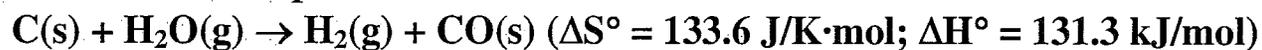
8. At $25^\circ C$, the base ionization constant for NH_3 is 1.8×10^{-5} . If 0.0800 mole of solid magnesium chloride is dissolved in a solution prepared by adding 0.0500 mol of solid ammonium chloride to 100. mL of 0.150 M ammonia, will a precipitate of magnesium hydroxide form? [Assume the volume of the solution is unchanged. The solubility product constant for magnesium hydroxide is 1.5×10^{-11} .]

9. The concentration of Mg^{2+} in seawater is 5.0×10^{-2} M. What hydroxide concentration is needed to remove 90% of the Mg^{2+} by precipitation? (For $Mg(OH)_2$, $K_{sp} = 1.2 \times 10^{-11}$.)

10. At 700 K, the equilibrium constant for the reaction $\text{CO(g)} + \text{H}_2\text{O(g)} \rightleftharpoons \text{CO}_2\text{(g)} + \text{H}_2\text{(g)}$ is 5.10. What is ΔG° for this reaction at this temperature?

11. Calculate the pH at the equivalence point for the titration of 0.22 M HCN with 0.22 M NaOH. ($K_a = 4.9 \times 10^{-10}$ for HCN.)

12. Assuming ΔS° and ΔH° do not vary with temperature, at what temperature will the reaction shown below become spontaneous?



13. A 8.0 M solution of formic acid (HCOOH) is 0.47% ionized. What is the K_a of formic acid?

14. A solution containing $\text{NH}_3\text{(aq)}$ and $\text{NH}_4\text{Cl(aq)}$ has a pH of 9.5. What is the $[\text{NH}_3]/[\text{NH}_4^+]$ ratio in this solution? (For ammonia, $K_b = 1.8 \times 10^{-5}$.)

15. Solid sodium iodide is slowly added to a solution that is 0.0050 M Pb^{2+} and 0.0050 M Ag^+ . ($K_{sp}(\text{PbI}_2) = 1.4 \times 10^{-8}$; $K_{sp}(\text{AgI}) = 8.3 \times 10^{-17}$)
Calculate the Ag^+ concentration when PbI_2 just begins to precipitate.

16. For a certain reaction, $\Delta G^\circ = 87 \text{ kJ/mol}$, $\Delta H^\circ = 100 \text{ kJ/mol}$ at STP. At what temperature, in K, is the reaction in equilibrium, assuming that ΔS° and ΔH° are temperature-independent?

17. Draw the structural formula for each of the following.

a. 3-isobutylhexane

b. 2,2,4-trimethylpentane, also called *isooctane*. This substance is the reference (100 level) for octane ratings.

c. 2-*tert*-butylpentane

d. The names given in parts a and c are incorrect. Give the correct names for these hydrocarbons.

18. Name each of the following.

