CHEMISTRY 1220

CHAPTER 16 PRACTICE EXAM

1. The pH of a 0.10 M solution of NH_3 containing 0.10 M NH_4Cl is 9.20. What is the **$[H_3O^+]$**?
a) 1.6×10^{-5} b) 1.0×10^{-1} c) 6.3×10^{-10} d) 1.7×10^{-10} e) 2.0×10^{-9}

2. Calculate the pH of an aqueous solution which is 0.0020 M $HClO_4$.
a) 1.30 b) 1.70 c) 2.30 d) 2.70 e) 2.00

3. According to the Bronsted-Lowry Concept of acids and bases which of the following statements, a-d,
is FALSE?
a) A base is a species that accepts a proton.
b) Acid-base reactions are restricted to aqueous solutions.
c) Some species can act as either acids or bases, depending on what the other reactant is.
d) NH_3 is a Bronsted base.
e) All of the above, a-d, are part of this theory.

4. Given that K_w for water is 2.40×10^{-14} (M^2) at 37°C, compute the pH of a neutral aqueous solution at 37°C (normal human body temperature). Answer the following TWO questions. What is the pH of a neutral solution at 37°C? AND If a solution has pH = 7.00 is it acidic, basic, or neutral at 37°C?
a) 6.82, acidic b) 6.82, basic c) 7.19, acidic d) 7.19, basic e) 7.00, neutral

5. The K_a values for HS^- and HPO_4^{2-} are 1.2×10^{-13} and 4.8×10^{-13} respectively. Therefore it follows the HS^- is a acid than HPO_4^{2-} and S_2^- is a base than PO_4^{3-}.
a) stronger, stronger b) stronger, weaker c) weaker, stronger d) weaker, weaker

6. What is the ionization constant of an acid if the hydronium ion concentration of a 0.500 M solution is 1.70×10^{-4} M?
a) 3.62×10^{-7} b) 2.89×10^{-8} c) 5.80×10^{-8} d) 1.16×10^{-7} e) 1.70×10^{-3}

7. Consider the following salts. Which one(s) when dissolved in water will produce an acidic solution?
1) NH_4Cl 2) $KHSO_4$ 3) NaCN
a) only 1 b) only 2 c) only 3 d) 1 and 2 e) 2 and 3

8. A 0.010 M solution of HNO_2 is 19% ionized. What is the K_a?
a) 4.5×10^{-4} b) 3.9×10^{-4} c) 3.6×10^{-4} d) 5.0×10^{-4} e) 5.4×10^{-4}

9. What is the pH of a 0.20 M NH_4Cl solution (K_b: NH_3 = 1.8 x 10^{-5})?
a) 2.72 b) 3.11 c) 4.98 d) 5.12 e) 7.61

10. Ascorbic acid, $H_2C_6H_6O_2$, is a diprotic acid. The K_1 and K_2 values are 7.9 x 10^{-5} and 1.6 x 10^{-12} respectively. What is the $C_6H_6O_2^{2-}$ ion concentration in a 0.10 M solution of ascorbic acid?
a) 1.6 x 10^{-6} b) 1.6 x 10^{-12} c) 7.9 x 10^{-12} d) 2.8 x 10^{-3} e) 5.6 x 10^{-3}

11. What is the pH of a solution of 0.31 M acid and 0.65 M of its conjugate base if the ionization constant, K_a, is 5.22×10^{-7}?

a) 6.60 b) 6.81 c) 7.00 d) 7.21 e) 7.42

12. Rubidium hydroxide is a strong base. Compute $[Rb^+]$ and $[OH^-]$ for a solution that is prepared by dissolving 2.0 g of RbOH in enough water to make 200.0 mL of solution. (atomic weights: Rb = 85.47, O = 16.00, H = 1.008)

a) 1.9×10^{-2}, 1.9×10^{-2}

b) 1.9×10^{-2}, 5.3×10^{-13}

c) 5.3×10^{-13}, 1.9×10^{-2}

d) 9.8×10^{-2}, 9.8×10^{-2}

e) 9.8×10^{-1}, 9.8×10^{-1}

13. You are given two solutions: 0.50 M HCl (aq) and 0.50 M $Ca(OH)_2$(aq). What is the $[H^+]$ in the HCl solution? What is the $[OH^-]$ in the $Ca(OH)_2$ solution? (The solutions are NOT mixed together).

$[H^+]$ $[OH^-]$

a) $[H^+] = 0.50$ M, $[OH^-] = 0.50$ M
b) $[H^+] = 0.25$ M, $[OH^-] = 1.0$ M
c) $[H^+] = 0.50$ M, $[OH^-] = 0.25$ M
d) $[H^+] = 0.25$ M, $[OH^-] = 0.25$ M
e) $[H^+] = 0.50$ M, $[OH^-] = 1.0$ M

14. How many grams of phosphoric acid are there in 175 mL of a 3.5 M solution of phosphoric acid (MW 98.00 g/mol)?

a) 0.61 g
b) 60 g
c) 21 g
d) 4.9 g
e) 610 g

15. A solution is prepared by dissolving 516.5 mg of oxalic acid ($C_2H_2O_4$, 90.00 g/mol) to make 100.0 mL of solution. A 10.00 mL portion is then diluted to 250.0 mL. What is the molarity of the final solution?

a) 2.295×10^{-3} M
b) 6.341×10^{-2} M
c) 3.172×10^{-3} M
d) 4.685×10^{-2} M
e) 1.889×10^{-3} M

16. What is the conjugate base of methylamine, CH_3NH_2?

a) CH_3NH^+ b) CH_3NH^- c) $CH_3NH_2^+$ d) $CH_3NH_2^-$ e) $CH_3NH_3^+$

17. What is the conjugate acid of methylamine, CH_3NH_2?

a) CH_3NH^+ b) CH_3NH^- c) $CH_3NH_2^+$ d) $CH_3NH_2^-$ e) $CH_3NH_3^+$

18. The K_a values for HCNO and HNO_2 are 2.2×10^{-4} and 4.5×10^{-4} respectively. Therefore it follows the HCNO is a __ acid than HNO_2 and CNO^- is a ___ base than NO_2^-.

a) stronger, stronger

b) stronger, weaker

c) weaker, stronger

d) weaker, weaker

19. What change will be observed for the following reaction if a few drops of NaOH are added?

$$HNO_2 + H_2O \rightleftharpoons NO_2^- + H_3O^+$$

a) a decrease in the fraction of acid dissociated
b) an increase in the fraction of acid dissociated
c) no change in the fraction of acid dissociated

20. Given K_a values of 1.0×10^{-10} and 6.8×10^{-8} for C_6H_5OH and $C_5H_5NH^+$ respectively, calculate the equilibrium constant for the following reaction.

$$C_6H_5O^- + C_5H_5NH^+ \rightleftharpoons C_6H_5OH + C_5H_5N$$

a) 6.8×10^{2} b) 0.15 c) 1.5×10^{-3} d) 6.8×10^{-2} e) 6.8×10^{-8}

21. The value of K_a in water at 25°C for benzoic acid ($C_6H_5CO_2H$) is 6.46×10^{-5} M. Calculate the pH of an aqueous solution with a total concentration of benzoic acid equal to 0.025 M.

a) 1.29 b) 2.09 c) 2.90 d) 3.10 e) 3.90

22. The value of K_a in water at 25°C for chloroacetic acid is 1.35×10^{-3} M. Calculate the pH of an aqueous solution with an initial concentration of chloroacetic acid equal to 0.10 M.

a) 1.35 b) 1.96 c) 2.14 d) 3.65 e) 3.35

23. Consider the following salts. Which one(s) when dissolved in water will produce an acidic solution?

1) NH_4Cl 2) $KHSO_4$ 3) NaCN

a) only 1 b) only 2 c) only 3 d) 1 and 2 e) 2 and 3

24. A 1.50 g sample of Vitamin C is dissolved in 100.0 mL of water and titrated with 0.250 M NaOH to the methyl orange equivalence point. The volume of the base used is 34.1 mL. What is the molecular weight of Vitamin C assuming one dissociable proton per molecule?

a) 176 b) 164 c) 152 d) 146 e) 139

25. A 25.00 mL sample of 0.100 M HCl is titrated with 0.100 M NaOH. What is the pH of the solution at the points where 24.9 and 25.1 mL of NaOH have been added.

a) 3.00, 11.00
b) 3.30, 10.70
c) 3.30, 10.30
d) 3.70, 10.30
e) 3.70, 10.70

26. What is the pH of a solution of 0.65 M acid and 0.51 M of its conjugate base if the pK_a is 5.30?

a) 5.19 b) 5.41 c) 5.62 d) 5.85 e) 6.05

27. Hydrosulfuric acid (H_2S) has $K_1 = 1.1 \times 10^{-7}$ and $K_2 = 1.0 \times 10^{-13}$. What is the HS^- ion concentration of a 0.10 M solution of H_2S?

a) 1.0×10^{-4} b) 1.0×10^{-5} c) 3.3×10^{-4} d) 3.3×10^{-5} e) 1.1×10^{-7}

28. A 0.0184 M solution of HCNO is 12.8% ionized. What is the K_a?

a) 1.1×10^{-3} b) 1.5×10^{-3} c) 1.9×10^{-3} d) 3.5×10^{-4} e) 2.9×10^{-4}

29. Given the following K_a values, determine which species is the strongest base.

HF 6.8×10^{-4} HNO_2 4.5×10^{-4} HCNO 2.2×10^{-4}

a) F^- b) NO_2^- c) CNO^- d) HF e) HCNO

30. A 25.00 mL sample of 0.100 M CH_3CO_2H is titrated with 0.100 M NaOH. What is the pH of the solution at the points where 25.0 and 25.5 mL of NaOH have been added? ($K_a = 1.8 \times 10^{-5}$)

a) 8.72, 11.00 b) 8.72, 9.85 c) 7.00, 10.00 d) 7.00, 9.85 e) 7.00, 8.00