Practice Exam

Printed Name:_____

Student Number: _____

Signature: _____

CHEMISTRY 1420   THIRD EXAM   100 POINTS

Each multiple choice test question is worth 4 points. Read each question very carefully. There is no partial credit for the multiple choice test questions. The four numerical questions on the exam are worth 10 points each. On the four numerical questions (i.e., non-multiple choice questions) partial credit will be past upon the work shown. **NOTE: TO RECEIVE PARTIAL CREDIT FOR ANY NON-MULTIPLE CHOICE PROBLEM, THE WORK SHOWN MUST BE CONSISTENT WITH THE ANSWER GIVEN!!**

Question 1:   Which of the following is not an example of a strong acid?

(a) $HClO_4$

(b)   HF

(c) H_2SO_4

(d)   HI

(e)   HCl

Question 2: Which of the following is not an example of a base?

(a)   LiOH

(b)   NaOH

(c)   KOH

(d) CH_3COOH

(e) NH_4OH

Question 3: What is the volume of 0.550 Molar HCl required to completely neutralize 25.00 ml of 0.275 Molar NaOH

(a)   25.00 ml

(b)   12.50 ml

(c)   50.00 ml

(d) 37.50 ml

(e) None of the above answers are correct

Question 4: What is the volume of 0.550 Molar HCl required to completely neutralize 25.00 ml of 0.275 Molar Ba(OH)$_2$

(a) 25.00 ml

(b) 12.50 ml

(c) 50.00 ml

(d) 37.50 ml

(e) None of the above answers are correct

Question 5: What is the conjugate base of $H_2PO_4^-$?

(a) H_3PO_4

(b) HPO_4^{2-}

(c) PO_4^{3-}

(d) HPO_4^-

(e) $H_3PO_4^-$

Question 6: What is the conjugate acid of $H_2PO_4^-$?

(a) H_3PO_4

(b) HPO_4^{2-}

(c) PO_4^{3-}

(d) HPO_4^-

(e) $H_3PO_4^-$

Question 7: What is the pH of a 0.00100 Molar HCl solution?

(a) 1.00

(b)   2.00

(c)   3.00

(d)   4.00

(e)   None of the above answers are correct

Question 8: What is the pH of a 0.0100 Molar NaOH solution?

(a)   2.00

(b)   12.00

(c)   3.00

(d)   11.00

(e)   None of the above answers are correct

Question 9: $Ba(OH)_2$ is a strong base, which completely dissociates in water. What is the pH of a 0.00100 Molar $Ba(OH)_2$ solution?

(a)   11.00

(b)   3.00

(c)   10.00

(d)   11.30

(e)   11.70

Question 10:   What is the $[H_3O^+]$ in a solution that has a pH of 3.50?

(a) $[H_3O^+] = 3.16 \times 10^{-4}$

(b) $[H_3O^+] = 3.02 \times 10^{-2}$

(c) $[H_3O^+] = 6.32 \times 10^{-4}$

(d) $[H_3O^+] = 6.02 \times 10^{-3}$

(e) $[H_3O^+] = 3.08 \times 10^{-3}$

Question 11: The acid dissociation constant for HCN is $K_a = 4.0 \times 10^{-10}$. What is the

numerical value of K_b for the CN^- ?

(a) 2.50×10^{-4}

(b) 2.50×10^{-3}

(c) 2.50×10^{-5}

(d) 4.00×10^{-24}

(e)   Cannot be calculated

Question 12: Carbonic acid, H_2CO_3, is a diprotic acid. Which of the following equilibrium corresponds to the second stepwise acid dissociation constant?

(a) $CO_{2(gas)} + H_2O$ <---------> H_2CO_3

(b) $H_2CO_3 + H_2O$ <-----------> $H_3O+ + HCO_3^-$

(c) $H_2CO_3 + 2 H_2O$ <-----------> $2 H_3O^+ + CO_3^{2-}$

(d) $CO_3^{2-} + H_2O$ <-----------> $OH^- + HCO_3^-$

(e)   None of the above equations are correct

Question 13: The two-stepwise acid dissociation constants for carbonic acid are $K_{a1} = 4.2 \times 10^{-7}$ and $K_{a2} = 4.8 \times 10^{-11}$

What is the numerical value of the equilibria constant for the following equilibrium

$$H_2CO_3 + 2 H_2O \text{ <-----------> } 2 H_3O^+ + CO_3^{2-}$$
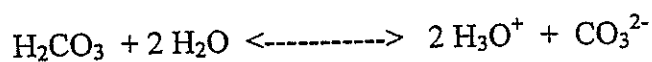
(a) 2.02×10^{-17}

(b) 2.38×10^{-8}

(c) 2.08×10^{-4}

(d) 4.2×10^{-7}

(e) 4.8×10^{-11}

Question 14: Which of the following statements defines Lewis acids and Lewis bases?

(a)   A Lewis acid is a substance that can accept a pair of electrons and a Lewis base is a substance that can donate a pair of electrons

(b)   A Lewis acid is a substance that can donate a proton donor and a Lewis base is a substance that can accept a proton

(c)   A Lewis base is a substance that can accept a pair of electrons and a Lewis acid is a substance that can donate a pair of electrons

(d)   A Lewis base is a substance that can donate a proton donor and a Lewis acid is a substance that can accept a proton

(e)   None of the above definitions are correct

Question 15: Which of the following statements defines Bronsted-Lowry acids and bases?

(a)   A Bronsted-Lowry acid is a substance that can accept a pair of electrons and a Bronsted-Lowry base is a substance that can donate a pair of electrons

(b)   A Bronsted-Lowry acid is a substance that can donate a proton donor and a Bronsted-Lowry base is a substance that can accept a proton

(c)   A Bronsted-Lowry base is a substance that can accept a pair of electrons and a Bronsted-Lowry acid is a substance that can donate a pair of electrons

(d)   A Bronsted-Lowry base is a substance that can donate a proton donor and a Bronsted-Lowry acid is a substance that can accept a proton

(e)   None of the above definitions are correct

NUMERICAL (NON-MULTIPLE CHOICE) QUESTIONS: Each numerical question is worth 10 points. Remember partial credit is based on the work shown, and to receive partial credit the work must be consistent with the answer shown.

Question 16 (10 Points) A 0.025 Molar formic acid solution has a pH of 2.85. Formic acid is a monoprotic acid. What is the ionization constant, K_a, of this acid?

Question 17 (10 Points)

What is the pH of a 0.010 Molar acetic acid solution, $HC_2H_3O_2$, solution? The acid dissociation constant of acetic acid is $K_a = 1.78 \times 10^{-5}$.

Question 18. (10 Points)

What is the pH of a solution 0.0015 Molar ammonia, NH_3, solution? The equilibrium constant for ammonia is $K_b = 1.8 \times 10^{-5}$.

Question 19: (10 Points)

What is the pH of a 0.100 Molar Na_2CO_3 solution? The two-stepwise acid dissociation constants for carbonic acid are $K_{a1} = 4.2 \times 10^{-7}$ and $K_{a2} = 4.8 \times 10^{-11}$