Acid/Base Homework Booklet #1 Name_____Period_____

Show all work in the homework booklet. The more the work shown, the easier it will be to prepare for exams.

1. An Arrhenius base is defined as a compound that
   A. releases protons in solution
   B. releases OH^- in solution
   C. accepts OH^- in solution
   D. accepts protons in solution

2. A substance which produces hydroxide ions in solution is a definition of which of the following?
   A. a Bronsted-Lowry base
   B. an Arrhenius base
   C. an Arrhenius acid
   D. a Bronsted-Lowry acid

3. Which of the following tests could be used to distinguish between 1.0 M HCl and 1.0 M NaOH?

   I. electrical conductivity
   II. reaction with zinc to produce hydrogen gas
   III. reaction with red litmus paper turning blue

   A. II and III only
   B. I and II only
   C. I, II and III
   D. III only

4. Which of the following is generally true of acids, but **not** for bases?
   A. feels slippery
   B. releases protons in solution
   C. pH > 7
   D. conducts electrical current well in solution

5. Which of the following best describes an acidic solution?

	Litmus Colour	Reaction with Zn
A.	blue	reaction
B.	red	reaction
C.	red	no reaction
D.	blue	no reaction

6. When a small solid sample is added to a solution of H_2SO_4, a precipitate forms and the solution becomes less acidic. Which of the following substances could have caused these results?
   A. $Cu(OH)_2$
   B. $Ba(OH)_2$
   C. $Ba(NO_3)_2$
   D. $MgSO_4$

7. The conjugate base of an acid is produced by
   A. removing an electron from the acid.
   B. adding a proton to the acid.
   C. adding an electron to the acid.
   D. removing a proton from the acid.

8. The conjugage acid of $C_6H_5NH_2$ is
   A. $C_6H_5NH^-$
   B. $C_6H_5NH_3^+$
   C. $C_6H_5NH_3$
   D. $C_6H_5NH_2^+$

9. The conjugage base of HBO_3^{-2} is
   A. $H_2BO_3^{-2}$
   B. $H_2BO_3^-$
   C. BO_3^{-3}
   D. BO_3^{-2}

10. What is the conjugate base of $H_2PO_4^-$?
   A. H_3PO_4
   B. HPO_4^{-2}
   C. OH-
   D. PO_4^{-3}

11. What is the conjugate acid of HPO_4^{-2}?
   A. H_3PO_4
   B. H_3O^+
   C. PO_4^{-3}
   D. $H_2PO_4^-$

12. Identify a conjugate pair from the equilibrium provided:

$$PO_4^{-3} + HCO_3^- \leftrightarrows HPO_4^{-2} + CO_3^{-2}$$

A. HCO_3- and HPO_4^{-2}
B. CO_3^{-2} and PO_4^{-3}
C. PO_4^{-3} and HCO_3^-
D. PO_4^{-3} and HPO_4^{-2}

13. Consider the following equilibrium:

$$H_2C_2O_4\,(aq) + HPO_4^{-2}\,(aq) \leftrightarrows H_2PO_4^-\,(aq) + HC_2O_4^-\,(aq)$$

In the above equilibrium, a conjugage pair is
A. $H_2C_2O_4$ and $H_2PO_4^-$
B. $HC_2O_4^-$ and HPO_4^{-2}
C. HPO_4^{-2} and $H_2PO_4^-$
D. $HC_2O_4^-$ and $H_2PO_4^-$

14. Consider the following equilibrium:

$$H_2C_2O_4\,(aq) + HPO_4^{-2}\,(aq) \leftrightarrows H_2PO_4^-\,(aq) + HC_2O_4^-\,(aq)$$

In the above equilibrium, the two acids are
A. $HC_2O_4^-$ and $H_2PO_4^-$
B. $HC_2O_4^-$ and HPO_4^{-2}
C. $H_2C_2O_4$ and $H_2PO_4^-$
D. HPO_4^{-2} and $H_2PO_4^-$

15. Consider the following reaction:

$$H_2SO_3 + CH_3NH_2 \leftrightarrows HSO_3^- + CH_3NH_3^+$$

Which of the following describes a conjugate acid-base pair in the equilibrium above?

	Acid	Base
A.	$CH_3NH_3^+$	CH_3NH_2
B.	H_2SO_3	$CH_3NH_3^+$
C.	$CH_3NH_3^+$	HSO_3^-
D.	HSO_3^-	H_2SO_3

16. Consider the following equilibrium:

$$HCO_3^- + H_2PO_4^- \leftrightarrows HPO_4^{-2} + H_2CO_3$$

What are the Bronsted-Lowry acids in this equilibrium?

A. $H_2PO_4^-$ and HPO_4^{-2}
B. $H_2PO_4^-$ and H_2CO_3
C. HCO_3^- and HPO_4^{-2}
D. HCO_3^- and H_2CO_3

17. Consider the following Bronsted-Lowry equilibrium:

$$C_6H_5NH_{2\,(aq)} + H_2O_{\,(l)} \leftrightarrows C_6H_5NH_3^+{}_{(aq)} + OH^-{}_{(aq)}$$

The substances acting as acids and bases from left to right are:

A. base, acid, acid, base
B. acid, base, acid, base
C. acid, base, base, acid
D. base, acid, base, acid

18. In which of the following is HSO_3^- acting as a Bronsted-Lowry acid?

A. $H_2C_2O_4 + HSO_3^- \rightarrow HC_2O_4^- + H_2SO_3$
B. $NH_3 + HSO_3^- \rightarrow NH_4^+ + SO_3^{-2}$
C. $HSO_3^- + H_2O \rightarrow H_2SO_3 + OH^-$
D. $HSO_3^- + HPO_4^{-2} \rightarrow H_2SO_3 + PO_4^{-3}$

19. Select the equation that best represents the reaction of CH_3NH_2 acting as a base with water.

A. $CH_3NH_{2\,(aq)} + H_2O_{\,(l)} \leftrightarrows CH_3^+{}_{(aq)} + NH_{3\,(aq)} + OH^-{}_{(aq)}$
B. $CH_3NH_{2\,(aq)} + H_2O_{\,(l)} \leftrightarrows CH_3NH_3^+{}_{(aq)} + OH^-{}_{(aq)}$
C. $CH_3NH_{2\,(aq)} + H_2O_{\,(l)} \leftrightarrows CH_3NH^-{}_{(aq)} + H_3O^+{}_{(aq)}$
D. $CH_3NH_{2\,(aq)} + H_2O_{\,(l)} \leftrightarrows CH_3NH_2OH^-{}_{(aq)} + H^+{}_{(aq)}$

20. The ion $H_2PO_4^-$ is an amphiprotic anion.

a. Define the term **amphiprotic**.

b. Write a balanced equation for the reaction when $H_2PO_4^-$ reacts with HCO_3^-.

21. The two reactants in an acid/base reaction are $HSO_3^-{}_{(aq)}$ and $SO_4^{-2}{}_{(aq)}$.

    a. Write the equation for the above reaction.

    b. Define the term conjugage acid/base pair.

    c. Write the formulas for a conjugate acid/base pair for the above reaction.

22. The two reactants in an acid/base reaction are $HSO_3^-{}_{(aq)}$ and $H_2CO_3{}_{(aq)}$.

    a. Write the equation for the above reaction.

    b. Define the term conjugage acid/base pair.

    c. Write the formulas for a conjugate acid/base pair for the above reaction.

23. An solution of $HC_2O_4^{-1}{}_{(aq)}$ turns blue litmus paper red. Write a balanced equation to represent the equilibrium between the $HC_2O_4^{-1}$ and H_2O.

24. Which of the following are amphiprotic in aqueous solutions?

I. H_3BO_3
II. $H_2BO_3^-$
III. HBO_3^{-2}
IV. BO_3^{-3}

A. I and II only B. I only C. IV only D. II and III only

25. Which of the following represents the predominant reaction between NH_3 and H_2O?

A. $NH_3 + H_2O \leftrightarrows H_3O^+ + NH_2^-$
B. $NH_3 + H_2O \leftrightarrows NH_4^+ OH^-$
C. $NH_3 + H_2O \leftrightarrows NH_3O + H_2$
D. $NH_3 + H_2O \leftrightarrows NH_5^{+2} + O^{-2}$

26. Water will act as an acid when it reacts with which of the following:

I. CN^-
II. NH_3
III. $HClO_4$
IV. CH_3COO^-

A. II, III and IV only
B. I, II, and IV only
C. II and III only
D. I and IV only

27. In which of the following reactions is water behaving as a Bronsted-Lowry acid?

A. $NH_4^+ + H_2O \rightarrow NH_3 + H_3O^+$
B. $2H_2O \rightarrow 2H_2 + O_2$
C. $NH_3 + H_2O \rightarrow NH_4^+ + OH^-$
D. $HCl + H_2O \rightarrow H_3O^+ + Cl^-$

28. Water has the greatest tendency to act as an acid with which of the following?

A. $H_2PO_4^-$
B. Cl^-
C. NO_2^-
D. CH_3COO^-

29. Water has the greatest tendency to act as an acid with which of the following?
    A. $H_2PO_4^-$
    B. HCO_3^-
    C. $HC_2O_4^-$
    D. HSO_3^-

30. Water has the greatest tendency to act as a base with which of the following?
    A. HCO_3^-
    B. HSO_3^-
    C. $HC_2O_4^-$
    D. $H_2PO_4^-$

31. The predominant acid-base reaction between H_2O_2 and H_2O is
    A. $H_2O_2 + H_2O \rightarrow H_3O_2^+ + OH^-$
    B. $H_2O_2 + H_2O \rightarrow 3OH^- + H^+$
    C. $H_2O_2 + H_2O \rightarrow O_2^{-2} + H_2O$
    D. $H_2O_2 + H_2O \rightarrow HO_2^- + H_3O^+$

32. Consider the following equilibrium:

$$H_2C_2O_4\,(aq) + HPO_4^{-2}\,(aq) \leftrightarrows H_2PO_4^-\,(aq) + HC_2O_4^-\,(aq)$$

    In the above equilibrium, the strongest acid is
    A. $H_2PO_4^-$ B. HPO_4^{-2} C. $HC_2O_4^-$ D. $H_2C_2O_4$

33. The strength of the acids HCl, H_2SO_3 and H_3PO_4 from weakest to strongest is
    A. $HCl < H_2SO_3 < H_3PO_4$
    B. $HCl < H_3PO_4 < H_2SO_3$
    C. $H_3PO_4 < H_2SO_3 < HCl$
    D. $H_2SO_3 < H_3PO_4 < HCl$

34. The strength of the ions $HC_2O_4^-$, HSO_3^- and $H_2PO_4^-$ from weakest to strongest **acid** is
    A. $HC_2O_4^- < HSO_3^- < H_2PO_4^-$
    B. $HSO_3^- < H_2PO_4^- < HC_2O_4^-$
    C. $H_2PO_4^- < HSO_3^- < HC_2O_4^-$
    D. $HC_2O_4^- < H_2PO_4^- < HSO_3^-$

35. Which of the following is the weakest base?
    A. F^-
    B. IO_3^-
    C. HS^-
    D. CN^-

36. Which of the following is the weakest acid?
    A. $H_2PO_4^-$
    B. HSO_3^-
    C. $HC_2O_4^-$
    D. HCO_3^-

37. Which of the following is the weakest base?
    A. HSO_3^-
    B. $HC_2O_4^-$
    C. $H_2PO_4^-$
    D. HCO_3^-

38. Aqua regia is a concentrated aqueous solution of HCl and HNO_3. The strongest acid in aqua regia is
    A. HNO_3
    B. HCl
    C. H_2O
    D. H_3O^+

39. Which of the following is the strongest base that can exist in an aqueous solution?
    A. H_3O^+
    B. NH_2^-
    C. PO_4^{-3}
    D. OH^-

40. Which of the following reactions favours the formation of products?
    A. $HCN + HCOO^- \leftrightarrows HCOOH + CN^-$
    B. $NH_4^+ + C_2O_4^{-2} \leftrightarrows HC_2O_4^- + NH_3$
    C. $H_2CO_3 + IO_3^- \leftrightarrows HIO_3 + HCO_3^-$
    D. $HNO_2 + F^- \leftrightarrows HF + NO_2^-$

41. In which of the following are reactants favoured?
    A. $CH_3COOH + PO_4^{-3} \leftrightarrows CH_3COO^- + HPO_4^{-2}$
    B. $HNO_2 + CN^- \leftrightarrows NO_2^- + HCN$
    C. $H_3PO_4 + NH_3 \leftrightarrows H_2PO_4^- + NH_4^+$
    D. $H_2S + HCO_3^- \leftrightarrows HS^- + H_2CO_3$

42. Consider the following equilibrium:

$$HF_{(aq)} + HPO_4^{-2}{}_{(aq)} \leftrightarrows F^-_{(aq)} + H_2PO_4^-{}_{(aq)}$$

For the above equilibrium, identify the weaker acid and determine whether reactants or products are favored.

	Weaker Acid	Side favored
A.	$H_2PO_4^-$	reactants
B.	$H_2PO_4^-$	products
C.	HF	reactants
D.	HF	products

43. Consider the following equilibrium:

$$H_2SO_{3\,(aq)} + H_2PO_4^-{}_{(aq)} \leftrightarrows HSO_3^-{}_{(aq)} + H_3PO_{4\,(aq)}$$

For the above equilibrium, identify the stronger acid and determine whether reactants or products are favored.

	Stronger Acid	Side favored
A.	H_2SO_3	products
B.	H_3PO_4	reactants
C.	H_2SO_3	reactants
D.	H_3PO_4	products

44. Consider the following equilibrium:

$$HCO_3^- + H_2PO_4^- \leftrightarrows H_2CO_3 + HPO_4^{-2}$$

Which of the following statements is true?

A. Products are favored because $H_2PO_4^-$ is a stronger acid than HPO_4^{-2}
B. Reactants are favored because H_2CO_3 is a stronger acid than $H_2PO_4^-$
C. Reactants are favored because HCO_3^- is a stronger base than H_2CO_3
D. Products are favored because $H_2PO_4^-$ is a stronger acid than H_2CO_3

45. An acid-base reaction occurs between $H_2PO_4^-$ and $HC_2O_4^-$. Write the equation for the equilibrium that results.

A. $H_2PO_4^- + HC_2O_4^- \leftrightarrows HPO_4^{-2} + C_2O_4^{-2}$
B. $H_2PO_4^- + HC_2O_4^- \leftrightarrows H_3PO_4 + H_2C_2O_4$
C. $H_2PO_4^- + HC_2O_4^- \leftrightarrows HPO_4^{-2} + H_2C_2O_4$
D. $H_2PO_4^- + HC_2O_4^- \leftrightarrows H_3PO_4 + C_2O_4^{-2}$

46. Consider the following equilibrium:

$$H_3AsO_3 + HSeO_3^- \leftrightarrows H_2AsO_3^- + H_2SeO_3$$

Products are favored in this equilibrium. Which of the following describes the relative strengths of the acids?

	Stronger Acid	Weaker Acid
A.	$H_2AsO_3^-$	$HSeO_3^-$
B.	H_2SeO_3	H_3AsO_3
C.	$HSeO_3^-$	$H_2AsO_3^-$
D.	H_3AsO_3	H_2SeO_3

47. Consider the following acid-base equilibria and their K_{eq}:

(A) $H_2AsO_4^{-1} + HSO_3^- \leftrightarrows HAsO_4^{-2} + H_2SO_3 \quad K_{eq} = 4.2 \times 10^{-3}$

(B) $HSeO_3^{-1} + H_2AsO_4^{-1} \leftrightarrows HAsO_4^{-2} + H_2SeO_3 \quad K_{eq} = 1.2 \times 10^{1}$

(C) $H_3AsO_4 + HSO_3^- \leftrightarrows H_2AsO_4^{-1} + H_2SO_3 \quad K_{eq} = 7.9 \times 10^{4}$

a. Write the formula of the weaker acid in equation (A) _____

b. Write the formula of the weaker acid in equation (B) _____

c. Write the formula of the weaker acid in equation (C) _____

d. List the acids from the equilibria above in order from **weakest acid to strongest acid.**

48. An acid-base reaction occurs between HSO_3^- and HCO_3^-

a. Write the equation for the equilibrium that results.

b. Identify one conjugate acid-base pair in the reaction.

c. State whether reactants or products are favored and explain how you arrived at your answer.

49. a. Write the equation to represent the reaction that results when $HC_6H_5O_7^{-2}$ ions are mixed with $H_2PO_4^-$ ions.

b. Identify the two bases in the reaction in part a)

c. Predict whether the reaction will favour the reactants or products. Justify your answer.

Prediction: _____

Justification: _____

50. Consider the following equilibrium:

$$HCO_3^- + H_2C_6H_5O_7^- \leftrightarrows$$

What are the Bronsted-Lowry acids in this equilibrium?

A. HCO_3^- and $HC_6H_5O_7^{-2}$
B. $H_3C_6H_5O_7$ and H_2CO_3
C. $H_2C_6H_5O_7^-$ and CO_3^{-2}
D. $H_2C_6H_5O_7^-$ and H_2CO_3

51. a. Write an equation to represent the predominant reaction when $HC_2O_4^-$ is mixed with HSO_4^-.

b Identify a conjugate acid-base pair.

c. Predict whether the equilibrium will favour the formation of reactants or products. Explain.

52. a. Write an equation to represent the predominant reaction when $H_2C_6H_5O_7^-$ is mixed with $HC_2O_4^-$.

b. Identify a conjugate acid-base pair.

c. Predict whether the equilibrium will favour the formation of reactants or products.

53. Which of the following relationships is used to calculate K_w at 30°C?

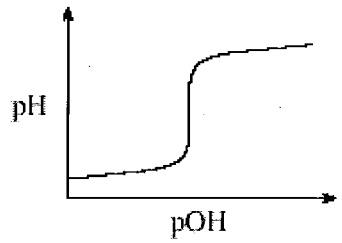
A. $K_w = [H_3O^+] + [OH^-]$
B. $K_w = pH + pOH$
C. $K_w = -\log [H_3O^+]$
D. $K_w = [H_3O^+] [OH^-]$

54. When the $[H_3O^+]$ in a solution is increased to twice the original concentration, the change in pH could be from

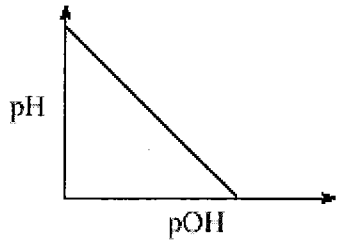
A. 8.5 to 6.5
B. 5.0 to 2.5
C. 2.0 to 4.0
D. 1.7 to 1.4

55. Which of the following graphs describes the relationship between pH and pOH in pure water?

A.



B.



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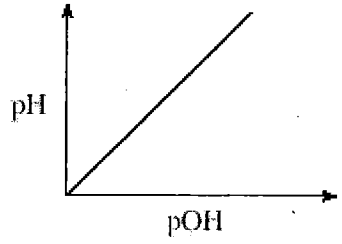
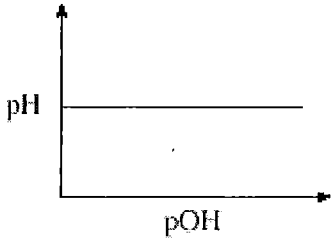
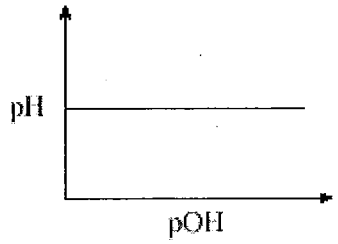


D.

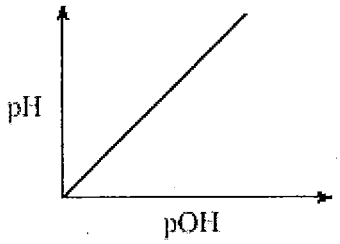


56. Which of the following graphs describes the relationship between pH and pOH in an aqueous solution?

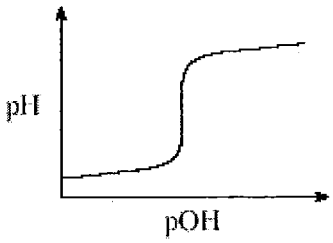
A.



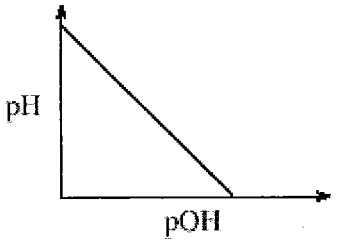
B.



C.



D.



57. What is the $[Sr(OH)_2]$ in a solution with the pH = 11.00?
    A. 1.0×10^{-3} M
    B. 2.0×10^{-11} M
    C. 5.0×10^{-4} M
    D. 1.0×10^{-11} M

58. What is the pH of a 0.10 M $Sr(OH)_2$ solution?
    A. 0.70
    B. 13.30
    C. 1.00
    D. 13.00

59. What is the pOH of a solution prepared by adding 0.50 moles of NaOH to 0.50 L of water?
    A. 13.70
    B. 0.00
    C. 0.30
    D. 14.00

60. The pH of 0.10 M HNO_3 is
    A. 13.00
    B. 0.79
    C. 1.00
    D. 1.26

61. How many moles of HI are needed to prepare 3.0 L of an HI solution with a pH of 1.00?
    A. 30. mol
    B. 0.030 mol
    C. 3.0 mol
    D. 0.30 mol

62. Calculate the pOH of a 0.050 M HBr solution.
    A. 13.70
    B. 0.30
    C. 1.30
    D. 12.70

63. What is the pH of a 0.50 M NaOH solution?
    A. 13.70
    B. 0.30
    C. 12.70
    D. 1.30

64. What is the pH of a 0.0050 M $Sr(OH)_2$ solution?
    A. 12.00
    B. 12.70
    C. 2.30
    D. 2.00

65. Which of the following equations can be used to calculate pOH?
    A. $pOH = -\log[H_3O^+]$
    B. $pOH = -\log Kw$
    C. $pOH = pKw - pH$
    D. $pOH = pKw + pH$

66. What is the pOH of 0.05 M $Sr(OH)_2$?
    A. 1.0
    B. 13.0
    C. 1.3
    D. 12.7

67. Complete the following table:

$[H_3O^+]$	$[OH^-]$	pH	pOH
5×10^{-4} M			
		12.4	
	8.25×10^{-8} M		
			10.369

68. Calculate the pH of a saturated solution of $Mg(OH)_2$.

69. Calculate the pH of 0.025 M $Sr(OH)_2$.

70. In order to change the pH of a solution from 2.0 to 4.0 the $[H_3O^+]$ must
    A. decrease by a factor of 100
    B. increase by a factor of 2
    C. decrease by a factor of 2
    D. increase by a factor of 100

71. What is the $[H_3O^+]$ in a solution with a pOH = 5.20?
    A. 7.1×10^{-1} M
    B. 1.4×10^{-14} M
    C. 6.3×10^{-6} M
    D. 1.6×10^{-9} M

72. Which of the following 1.0×10^{-3} M solutions has a pH of 3.00?
    A. K_2SO_4
    B. HCN
    C. HCl
    D. NaOH

73. What is the pOH of 0.2 M HNO_3?
    A. 13.3
    B. 5×10^{-14}
    C. 0.2
    D. 0.7

74. A sample of pure NaOH (s) is dissolved in water to make 10.0 L of solution and a pH = 11.75 results. Calculate the mass of pure NaOH that was dissolved.

75. Which of the following solutions will have the lowest [OH-]?
A. NaCl
B. NaF
C. NaH_2PO_4
D. $NaHCO_3$

76. Consider the following statements about water at 60°C:

I. The pH of water at 60°C < 7.00
II The pOH of water at 60°C >7.00
III. The pH = pOH of water at 60°C.

Which of the above statements are true?
A. III only B. I and II C. I and III D. I, II and III

77. Which of the following is a definition of pK_w?
A. $pK_w = [H_3O^+][OH^-]$
B. $pK_w = pH - pOH$
C. $pK_w = -\log K_w$
D. $pK_w = 7.0$ at 25° C

78. What is the value of pK_w for water at 25°C?
A. 7.00
B. 1.0×10^{-14}
C. 1.0×10^{-7}
D. 14.00

79. Consider the following equilibrium at 25 °C:

$$2H_2O_{(l)} \leftrightarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

What happens to $[OH^-]$ and pH as 0.1 M HCl is added?

	$[OH^-]$	pH
A.	increases	decreases
B.	decreases	increases
C.	decreases	decreases
D.	increases	increases

80. Consider the following equilibrium:

$$2H_2O_{(l)} \leftrightarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

What changes occur to $[H_3O^+]$ and pH when NaOH is added?

	$[H_3O^+]$	pH
A.	decreases	decreases
B.	increases	increases
C.	increases	decreases
D.	decreases	increases

81. What happens to the ion concentrations in water when a small amount of $HCl_{(aq)}$ is added?
   A. $[H_3O^+]$ increases and $[OH^-]$ stays unchanged
   B. $[H_3O^+]$ increases and $[OH^-]$ decreases
   C. $[H_3O^+]$ and $[OH^-]$ both increase
   D. $[H_3O^+] = [OH^-] = 1.0 \times 10^{-7}$ M

82. Consider the ionization of water:

$$2H_2O_{(l)} \leftrightarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

What happens to the pH when 0.1 M NaOH is added to the water?
   A. pH decreases since $[H_3O^+]$ decreases
   B. pH increases since $[H_3O^+]$ decreases
   C. pH increases since $[H_3O^+]$ increases
   D. pH decreases since $[H_3O^+]$ increases

83. In a solution of 0.10 M H_2SO_4, the ions present in order of decreasing concentration are
   A. $[H_3O^+] > [HSO_4^-] > [SO_4^{-2}] > [OH^-]$
   B. $[SO_4^{-2}] > [HSO_4^-] > [OH^-] > [H_3O^+]$
   C. $[H_3O^+] > [SO_4^{-2}] > [HSO_4^{-2}] > [OH^-]$
   D. $[OH^-] > [HSO_4^-] > [SO_4^{-2}] > [H_3O^+]$

84. Consider the following equilibrium:

$$2H_2O_{(l)} + \text{energy} \leftrightarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

The temperature is decreased and a new equilibrium is established. The new equilibrium can be described by
   A. pH < pOH and $K_w = 1.0 \times 10^{-14}$
   B. pH > pOH and $K_w = 1.0 \times 10^{-14}$
   C. pH = pOH and $K_w < 1.0 \times 10^{-14}$
   D. pH = pOH and $K_w > 1.0 \times 10^{-14}$

85. Consider the following equilibrium:

$$2H_2O_{(l)} + \text{energy} \leftrightarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

A few drops of HCl are added and a new equilibrium is established. The new equilibrium can be described by

A. pH < pOH and $K_w = 1.0 \times 10^{-14}$
B. pH = pOH and $K_w > 1.0 \times 10^{-14}$
C. pH = pOH and $K_w < 1.0 \times 10^{-14}$
D. pH > pOH and $K_w = 1.0 \times 10^{-14}$

86. Which of the following is true for pure water?

A. $[H_3O^+] < [OH^-]$
B. $[H_3O^+] > [OH^-]$
C. $[H_3O^+] = [OH^-]$
D. $[H_3O^+] = 0.0\ M$

87. Which of the following is true for pure water at 5° C in which the pH = 7.53?

A. $[H_3O^+] < [OH^-]$
B. $[H_3O^+] = K_w$
C. $[H_3O^+] = [OH^-]$
D. $[H_3O^+] > [OH^-]$

88. Which of the following is true for pure water at 75° C in which the pH = 6.83?

A. $[H_3O^+] < [OH^-]$
B. $[H_3O^+] > [OH^-]$
C. $[H_3O^+] = [OH^-]$
D. $[H_3O^+] = K_w$

89. Which of the following statements is true for an acidic solution at 25°C?

A. $[H_3O^+] > [OH^-]$
B. pH > 7.0
C. pOH < 7.0
D. $[H_3O^+] < [OH^-]$

90. Consider the following equilibrium:

$$2H_2O_{(l)} + \text{energy} \leftrightarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

The [OH^-] will decrease and the K_w will decrease when

A. the temperature is decreased
B. the temperature is increased
C. a strong base is added
D. a strong acid is added

91. The ionization of water is endothermic. How is K_w related to the temperature of water?

A. K_w remains constant as temperature decreases.
B. K_w increases as temperature decreases.
C. K_w decreases as temperature increases.
D. K_w increases as temperature increases.

92. The ionization of pure water is shown by the reaction:

$$2H_2O_{(l)} + 57.1\ kJ \leftrightarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

At a certain temperature the K_w of the water is 4.6×10^{-15}.

a. Is the temperature above or below 25°C? Explain your answer using the words exothermic or endothermic and Le Chatelier's Principle.

b. Calculate the pH and pOH of this water

c. Is the water acidic, basic or neutral? Explain your answer.

93. The ionization of pure water is shown by the reaction:

$$2H_2O_{(l)} + 57.1\ kJ \leftrightarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

At a certain temperature the pH of the water is 7.27.

a. Is the temperature above or below 25°C? Explain your answer using the words exothermic or endothermic and Le Chatelier's Principle.

b. Is the water acidic, basic or neutral? Explain your answer.

c. Calculate the K_w of water at this temperature.

94. Consider the following equilibrium:

$$energy + 2H_2O_{(l)} \leftrightarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

a. Explain how pure water can have a pH = 6.80.

b. Calculate the value of K_w for the sample of water with a pH of 6.80.

95. At 10°C, the pH of pure water is 7.265.

a. Determine the pOH of water at 10°C.

b. Calculate Kw of pure water at 10°C.

96. The relationship $\frac{[H_2P_2O_7^{-2}][H_3O^+]}{[H_3P_2O_7^-]}$ is the

A. K_b for $H_2P_2O_7^{-2}$
B. K_a for $H_3P_2O_7^-$
C. K_b for $H_3P_2O_7^-$
D. K_a for $H_2P_2O_7^{-2}$

97. The relationship $\frac{[H_3BO_3][OH^-]}{[H_2BO_3^-]}$ is the expression for

A. K_a for H_3BO_3
B. K_b for $H_2BO_3^-$
C. K_b for H_3BO_3
D. K_a for $H_2BO_3^-$

98. The K_a expression for HTe^- is

A. $K_a = \frac{[HTe^-][OH^-]}{[Te^{-2}]}$
B. $K_a = \frac{[Te^{-2}][H_3O^+]}{[HTe^-]}$
C. $K_a = \frac{[H_2Te][OH^-]}{[HTe^-]}$
D. $K_a = \frac{[HTe^-][H_3O^+]}{[H_2Te]}$

99. The K_b expression for HSe^- is

A. $K_b = \frac{[Se^{-2}][H_3O^+]}{[HSe^-]}$

B. $K_b = \frac{[HSe^-][H_3O^+]}{[H_2Se]}$

C. $K_b = \frac{[HSe^-][OH^-]}{[Se^{-2}]}$

D. $K_b = \frac{[H_2Se][OH^-]}{[HSe^-]}$

100. Consider the following acid equilibrium:

$$HCN_{(aq)} + H_2O_{(l)} \leftrightarrows H_3O^+_{(aq)} + CN^-_{(aq)}$$

When writing the K_a expression for HCN, why is $H_2O_{(l)}$ not included in the expression?

A. The concentration of $H_2O_{(l)}$ is relatively constant.

B. The concentration of $H_2O_{(l)}$ is too large.

C. The concentration of $H_2O_{(l)}$ is too small.

D. The concentration of $H_2O_{(l)}$ does not exist.

101. What is the K_a expression for H_3PO_4?

A. $K_a = \frac{[H_3O^+][H_2PO_4^-]}{[H_3PO_4]}$

B. $K_a = \frac{[PO_4^{-3}]}{[H^+]^3}$

C. $K_a = \frac{[H_3O^+][PO_4^{-3}]}{[H_3PO_4]}$

D. $K_a = \frac{[H_3O^+]^3[PO_4^{-3}]}{[H_3PO_4]}$

102. Which of the following 1.0 M solutions will have the highest pOH?

A. HCN

B. H_3PO_4

C. $H_2C_2O_4$

D. HCl

103. Which of the following 1.0 M solutions will have the lowest pH?

A. H_2CO_3

B. H_3PO_4

C. HCN

D. $HClO_4$

104. Which of the following will be the most basic?
   A. 1.0 M NO_3^-
   B. 1.0 M PO_4^{-3}
   C. 1.0 M SO_4^{-2}
   D. 1.0 M CO_3^{-2}

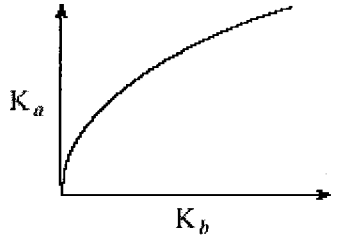
105. Which of the following will be the most acidic?
   A. 1.0 M NO_2^-
   B. 1.0 M SO_4^{-2}
   C. 1.0 M SO_3^{-2}
   D. 1.0 M CO_3^{-2}

106. Which of the following Ka values represents the acid with the strongest conjugate base?
   A. $K_a = 7.8 \times 10^{-3}$
   B. $K_a = 4.2 \times 10^{-12}$
   C. $K_a = 9.5 \times 10^{-9}$
   D. $K_a = 2.0 \times 10^{-5}$

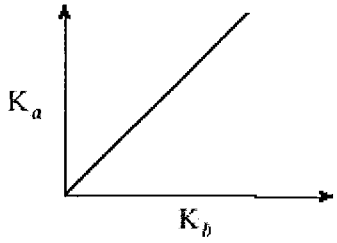
107. Which of the following will have the smallest K_b value?
   A. HPO_4^{-2}
   B. IO_3^-
   C. NH_3
   D. CN^-

108. Which of the following graphs describes the relationship between K_a and K_b for all conjugage pairs?

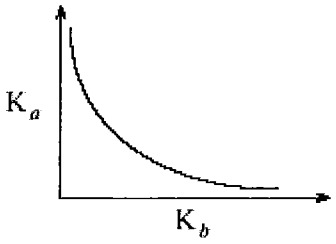
A.



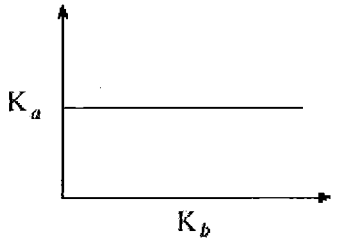
B.



C.



D.



109. What is the value of K_b for $HC_2O_4^-$?

A. 1.7×10^{-13}
B. 5.9×10^{-2}
C. 1.6×10^{-10}
D. 6.4×10^{-5}

110. What is the value of K_b for $HC_6H_5O_7^{-2}$?

A, 5.9×10^{-10}
B. 1.7×10^{-5}
C. 4.1×10^{-7}
D. 2.1×10^{-8}

111. What is the value of K_b for $H_2C_6H_5O_7^-$?

A. 1.4×10^{-11}
B. 7.1×10^{-4}
C. 5.9×10^{-10}
D. 1.7×10^{-5}

112. What is the K_b value for $H_2PO_4^-$?

A. 7.5×10^{-3}
B. 1.6×10^{-7}
C. 6.2×10^{-8}
D. 1.3×10^{-12}

113. What is the K_b value for HPO_4^{-2}?

A. 1.6×10^{-7}
B. 6.2×10^{-8}
C. 7.5×10^{-3}
D. 1.3×10^{-12}

114. A 0.0200 M solution of methylamine, CH_3NH_2, has a pH = 11.40. Calculate the K_b for methylamine.

115. A 0.20 M solution of a weak acid HA has a pH = 1.32. Use calcaulations and the table of "Relative Strengths of Bronsted-Lowry Acids and Bases" from the Data Booklet to determine the identity of the acid.

116. A 0.20 M solution of a weak acid HA has a pH = 3.87. Use calcaulations and the table of "Relative Strengths of Bronsted-Lowry Acids and Bases" from the Data Booklet to determine the identity of the acid.

117. A 0.20 M solution of a weak base NaX has a pH = 8.744. Use calcaulations and the table of "Relative Strengths of Bronsted-Lowry Acids and Bases" from the Data Booklet to determine the identity of the NaX.

118. A 2.00 M diprotic acid has a pH of 0.50. Calculate its K_a value.

119. A 0.360 M diprotic acid has a pH of 4.50. Calculate its K_a value.

120. A 0.875 M solution of an unknown base has a pH of 8.16. Calculate the K_b of the weak base.

121. A unknown solution has a concentration of 0.560 M has a pH of 5.44. Calculate the unknown solution's K_a or K_b.

122. Which of the following is the net ionic equation describing the hydrolysis of KCN?

A. $CN^-_{(aq)} + H_2O_{(l)} \leftrightarrows HCN_{(aq)} + OH^-_{(aq)}$

B. $K^+_{(aq)} + H_2O_{(l)} \leftrightarrows KOH_{(aq)} + H^+_{(aq)}$

C. $KCN_{(aq)} + H_2O_{(l)} \leftrightarrows K^+_{(aq)} + CN^-_{(aq)}$

D. $CN^-_{(aq)} + H_2O_{(l)} \leftrightarrows 2H^+_{(aq)} + CNO^-_{(aq)}$

123. Which of the following is the net ionic equation describing the hydrolysis of KHC_2O_4?

A. $HC_2O_4^-_{(aq)} + H_2O \leftrightarrows C_2O_4^{-2}_{(aq)} + H_3O^+_{(aq)}$

B. $KHC_2O_4{}_{(aq)} + H_2O_{(l)} \leftrightarrows H_2C_2O_4{}_{(aq)} + KOH_{(aq)}$

C. $KHC_2O_4{}_{(aq)} + H_2O_{(l)} \leftrightarrows KC_2O_4^-{}_{(aq)} + H_3O^+_{(aq)}$

D. $HC_2O_4^-{}_{(aq)} + H_2O_{(l)} \leftrightarrows H_2C_2O_4{}_{(aq)} + OH^-_{(aq)}$

124. Which of the following represents the equilibrium constant expression for the hydrolysis reaction that occurs in $NaF_{(aq)}$?

A. $K_w = [H_3O^+][OH^-]$

B. $K_a = \dfrac{[H_3O^+][F^-]}{[HF]}$

C. $K_b = \dfrac{[HF][OH^-]}{[F^-]}$

D. $K_{eq} = \dfrac{[Na^+][F^-]}{[NaF]}$

125. Which of the following represents the equilibrium constant expression for the hydrolysis reaction that occurs in $NH_4NO_{3(aq)}$?

A. $K_b = \dfrac{[NH_3][OH^-]}{[NH_4^+]}$

B. $K_{eq} = \dfrac{[NH_4^+][NO_3^-]}{[NH_4NO_3]}$

C. $K_b = \dfrac{[HNO_3][OH^-]}{[NO_3^-]}$

D. $K_a = \dfrac{[H_3O^+][NH_3]}{[NH_4^+]}$

126. Which of the following describes the net ionic equation for the hydrolysis of a $NaNO_2$ solution?

A. $NaNO_{2\,(s)} + H_2O_{\,(l)} \leftrightarrows NaOH + HNO_{2\,(aq)}$

B. $NO_2^-{}_{(aq)} + H_2O_{\,(l)} \leftrightarrows HNO_{2\,(aq)} + OH^-{}_{(aq)}$

C. $NaNO_{2\,(s)} \leftrightarrows Na^+{}_{(aq)} + NO_2^-{}_{(aq)}$

D. $Na^+{}_{(aq)} + 2H_2O\,(l) \leftrightarrows H_3O^+{}_{(aq)} + NaOH_{\,(aq)}$

127. Which of the following describes the net ionic equation for the hydrolysis of a $NaCH_3COO$ solution?

A. $Na^+{}_{(aq)} + 2H_2O\,(l) \leftrightarrows H_3O^+{}_{(aq)} + NaOH_{\,(aq)}$

B. $CH_3COO^-{}_{(aq)} + H_2O_{\,(l)} \leftrightarrows HCH_3COO_{\,(aq)} + OH^-{}_{(aq)}$

C. $NaCH_3COO_{\,(s)} + H_2O_{\,(l)} \leftrightarrows NaOH + HCH_3COO_{\,(aq)}$

D. $NaCH_3COO_{\,(s)} \leftrightarrows Na^+{}_{(aq)} + CH_3COO^-{}_{(aq)}$

128. What is the equilibrium expression for the predominant equilibrium in $NaHCO_{3\,(aq)}$?

A. $K_b = \dfrac{[HCO_3^-]}{[H_2CO_3]\,[OH^-]}$

B. $K_a = \dfrac{[H_3O^+]\,[CO_3^{-2}]}{[HCO_3^-]}$

C. $K_b = \dfrac{[H_2CO_3]\,[OH^-]}{[HCO_3^-]}$

D. $K_a = \dfrac{[HCO_3^-]}{[H_3O^+]\,[CO_3^{-2}]}$

129. Consider the following reaction:

$$NO_2^-{}_{(aq)} + H_2O_{(l)} \leftrightarrows HNO_{2\,(aq)} + OH^-{}_{(aq)}$$

This reaction represents which of the following?

A. the dissociation of $NaNO_2$

B. the titration of NO_2^-

C. the ionization of HNO_2

D. the hydrolysis of $NaNO_2$

130. Which of the following is the net ionic equation that describes the hydrolysis that occurs in a K_2CO_3 solution?

A. $K_2CO_{3\,(aq)} + 2H_2O_{(l)} \leftrightarrows H_2CO_{3\,(aq)} + 2\,KOH_{(aq)}$

B. $K_2CO_{3\,(aq)} + 2H_2O_{(l)} \leftrightarrows H_2CO_{3\,(aq)} + 2\,K^+{}_{(aq)} + 2\,OH^-{}_{(aq)}$

C. $CO_3^{-2}{}_{(aq)} + H_2O_{(l)} \leftrightarrows HCO_3^-{}_{(aq)} + OH^-{}_{(aq)}$

D. $CO_3^{-2}{}_{(aq)} + 2H_2O_{(l)} \leftrightarrows H_2CO_{3\,(aq)} + H_3O+_{(aq)}$

131. Which of the following salt solutions is acidic?

A. $NaHCO_3$

B. KBr

C. $Li_2C_2O_4$

D. $FeCl_3$

132. For each of the following salts:
- write out all hydrolysis equilibria that the salts would participate in
- calculate the appropriate K_a or K_b for each hydrolysis
- predict whether the solution will be acidic, basic or neutral

a. $Fe(NO_3)_3$

b. $NaNO_2$

c. $Ca(HC_2O_4)_2$

d. NH_4IO_3

133. For each of the following salts:
- write out all hydrolysis equilibria that the salts would participate in
- calculate the appropriate K_a or K_b for each hydrolysis
- predict whether the solution will be acidic, basic or neutral

a. $AlBr_3$

b. K_2SO_3

c. $Ca(H_2PO_4)_2$

d. NH_4CN

134. Which of the following solutions has a pH less than 7.00?
A. KCH_3COO
B. NaCl
C. NH_4NO_3
D. LiOH

135. Which of the following solutions has a pH less than 7.00?
A. $LiNO_3$
B. KF
C. NH_4Cl
D. NaCN

136. In a solution of 0.10 M NaCN, the order of ion concentration, from highest to lowest is
A. $[Na^+] > [CN^-] > [OH^-] > [H_3O^+]$
B. $[Na^+] > [OH^-] > [CN^-] > [H_3O^+]$
C. $[OH^-] > [Na^+] > [CN^-] > [H_3O^+]$
D. $[H_3O^+] > [OH^-] > [CN^-] > [Na^+]$

137. Which of the following salts will dissolve to produce a basic solution?
A. NH_4CH_3COO
B. $KHSO_4$
C. $Al(NO_3)_3$
D. NH_4CN

138. In an aqueous solution of NaCl, the pH is
A. greater than 7 and the solution is acidic
B. less than 7 and the solution is acidic
C. equal to 7 and the solution is neutral
D. greater than 7 and the solution is basic

139. In an aqueous solution of NaCN, the pH is
A. equal to 7 and the solution is neutral
B. greater than 7 and the solution is basic
C. greater than 7 and the solution is acidic
D. less than 7 and the solution is acidic

140. Dissolving $NaCH_3COO$ in water will produce a solution which is
A. acidic with pH < 7
B. acidic with pH > 7
C. basic with pH < 7
D. basic with pH > 7

141. Which of the following salt solutions will be neutral?
A. 1.0 M NH_4Cl
B. 1.0 M $LiClO_4$
C. 1.0 M HNO_2
D. 1.0 M K_2CO_3

142. Which of the following salt solutions will be acidic?
A. $NaHPO_4$
B. NH_4Br
C. CaC_2O_4
D. $KClO_4$

143. Which of the following salt solutions will be acidic?
   A. $CaSO_4$
   B. $FeBr_3$
   C. KI
   D. $Na_3C_6H_5O_7$

144. Which of the following salt solutions will be acidic?
   A. Na_3BO_3
   B. $CrBr_3$
   C. $Ca(CH_3COO)_2$
   D. KBr

145. Which of the following solutions has the lowest pH?
   A. 0.1 M NH_4NO_3
   B. 0.1 M Na_3PO_4
   C. 0.1 M Na_2CO_3
   D. 0.1 M NaCN

146. Consider the salt ammonium acetate, NH_4CH_3COO.

   a. Write the dissociation equation of NH_4CH_3COO .

   b. Write the hydrolysis equations which occur.

   c. Explain why a solution of NH_4CH_3COO has a pH = 7.00. Support your answer with calculations

147. Water will act as an acid with which of the following?

I. H_2CO_3
II. HCO_3^-
III. CO_3^{-2}

A. I and II only
B. I only
C. III only
D. II and III only

148. Which of the following represents the predominant reaction between HCO_3^- and water?

A. $HCO_3^- + H_2O \rightarrow H_2CO_3 + OH^-$
B. $2HCO_3^- \rightarrow H_2O + CO_2$
C. $2HCO_3^- + H_2O \rightarrow H_3O^+ + CO_3^{-2} + OH^- + CO_2$
D. $HCO_3^- + H_2O \rightarrow CO_3^{-2} + H_3O^+$

149. Water will act as an acid when it reacts with which of the following:

I. NO_2^-
II. NO_3^-
III. $HC_2O_4^-$
IV. HCO_3^-

A. II, III and IV only
B. I and IV only
C. II and III only
D. I, II, and IV only

150. Which of the following will form a basic aqueous solution?

A. $HC_2O_4^-$
B. HPO_4^{-2}
C. HSO_4^-
D. HSO_3^-

151. Which of the following will form a basic aqueous solution?

A. HSO_4^-
B. HCO_3^-
C. $HC_2O_4^-$
D. HSO_3^-

152. Which of the following 1.0 M salt solutions will be acidic?

A. $NaHCO_3$

B. $NaHC_2O_4$

C. $(NH_4)_2SO_3$

D. NaCl

153. What is the equilibrium constant expression representing the predominant reaction for the hydrolysis of $NaHC_2O_{4\,(aq)}$?

A. $K_{eq} = \dfrac{[Na^+]\,[HC_2O_4^-]}{[NaHC_2O_4]}$

B. $K_w = [H_3O^+]\,[OH^-]$

C. $K_b = \dfrac{[H_2CO_3][OH^-]}{[HC_2O_4^-]}$

D. $K_a = \dfrac{[H_3O^+]\,[C_2O_4^{-2}]}{[HC_2O_4^-]}$

154. What is the equilibrium constant expression representing the predominant reaction for the hydrolysis of $NaHSO_{3\,(aq)}$?

A. $K_b = \dfrac{[H_2SO_3][OH^-]}{[HSO_3^-]}$

B. $K_w = [H_3O^+]\,[OH^-]$

C. $K_{eq} = \dfrac{[Na^+]\,[HSO_3^-]}{[NaHSO_3]}$

D. $K_a = \dfrac{[H_3O^+]\,[SO_3^{-2}]}{[HSO_3^-]}$

155. Which of the following salts will produce a solution with the highest pH?

A. 1.0 M $NaHSO_4$

B. 1.0 M $NaHSO_3$

C. 1.0 M Na_2HPO_4

D. 1.0 M NaH_2PO_4

156. Consider the following equilibrium:

$$HPO_4^{-2}{}_{(aq)} + H_2O_{(l)} \leftrightarrows ?$$

What is the equilibrium expression?

A. $K_b = \dfrac{[H_2PO_4^-][OH^-]}{[HPO_4^{-2}]}$

B. $K_a = \dfrac{[HPO_4^{-2}]}{[H_3O^+][PO_4^{-3}]}$

C. $K_b = \dfrac{[HPO_4^{-2}]}{[H_2PO_4^-][OH^-]}$

D. $K_a = \dfrac{[H_3O^+][PO_4^{-3}]}{[HPO_4^{-2}]}$

157. The $HC_2O_4^-{}_{(aq)}$ ion will act as

A. a acid since $K_a < K_b$

B. a base since $K_a < K_b$

C. a base since $K_a > K_b$

D. a acid since $K_a > K_b$

158. The $H_2PO_4^-{}_{(aq)}$ ion will act as

A. a acid since $K_a > K_b$

B. a acid since $K_a < K_b$

C. a base since $K_a > K_b$

D. a base since $K_a < K_b$

159. What is the equilibrium expression for the predominant equilibrium in $NaHCO_3{}_{(aq)}$?

A. $K_b = \dfrac{[HCO_3^-]}{[H_2CO_3][OH^-]}$

B. $K_a = \dfrac{[HCO_3^-]}{[H_3O^+][CO_3^{-2}]}$

C. $K_b = \dfrac{[H_2CO_3][OH^-]}{[HCO_3^-]}$

D. $K_a = \dfrac{[H_3O^+][CO_3^{-2}]}{[HCO_3^-]}$

160. Which of the following amphiprotic ions will act predominantly as a base in solution?

A. HPO_4^{-2}

B. HSO_3^-

C. HSO_4^-

D. $H_2PO_4^-$

161. Calculate the pH in 0.50 M NH_3.

162. Calculate the pH in 0.050 M $Al_2(C_2O_4)_3$.

163. Calculate the pH of 0.25 M HNO_2

164. Calculate the pH of 0.25 M $NaHCO_3$

165. Calculate the pH of 0.50 M H_2S.

166. Calculate the pH of 0.25 M Na_2HPO_4

167. Calculate the pH of a saturated SrF_2 solution.

168. Calculate the pH of a 0.50 M KCN.

169. Calculate the pH of a 0.50 M NaC_6H_5O.

170. Calculate the pH of a 0.60 M NH_4I. Start by writing the equation for the predominant equilibrium reaction.

171. Calculate the pH of 3.0 M Na_2CO_3. Start by wrting the equation for the predominnat equilibrium reaction.

172. Calculate the pH of a 0.025 M $Ca(H_2PO_4)_2$ solution.

173. Which of the following acids will have the lowest conductivity?
A. 0.010 M HNO_2
B. 0.010 M H_3BO_3
C. 0.010 M H_2SO_3
D. 0.010 M HCl

174. Which of the following will have the lowest electrical conductivity?
A. 1.00 M NaH_2PO_4
B. 1.00 M HCl
C. 1.00 M $LiNO_2$
D. 1.00 M H_2SO_3

175. Which of the following is correct if the four solutions listed are compared to one another?

	Concentration	Relative Conductivity	Ionization
A. strong base	1.0 M	highest	complete
B. strong acid	0.50 M	highest	complete
C. weak acid	0.50 M	lowest	complete
D. weak base	1.0 M	lowest	complete

176. Which of the following 1.0 M solutions will have the highest electrical conductivity?
A. HNO_2
B. HF
C. HI
D. HCN

177. Which of the following 1.0 M solutions will have the lowest electrical conductivity?
A. HCN
B. H_2CO_3
C. HCOOH
D. HNO_2

178. Which of the following 1.0 M solutions will have the lowest electrical conductivity?
A. HNO_3
B. NH_4Cl
C. H_2CO_3
D. NaCN

179. Which of the following solutions will show the greatest electrical conductivity?
A. 0.1 M HCl
B. 0.1 M $H_2C_2O_4$
C. 0.5 M H_2CO_3
D. 0.5 M H_3BO_3

180. Which of the following saturated salt solutions would have the greatest electrical conductivity?
   A. $Ba_3(PO_4)_2$
   B. PbS
   C. $CsNO_3$
   D. Ag_2CrO_4

181. Which of the following saturated salt solutions would have the greatest electrical conductivity?
   A. $CaCO_3$
   B. Ag_2CO_3
   C. $Pb(IO_3)_2$
   D. $PbSO_4$

182. When comparing equal volumes of 0.10 M HNO_3 with 0.10 M HNO_2, what would be observed?
   A. The amount of NaOH needed for neutralization would be different.
   B. The pH values would be the same.
   C. The effects on blue litmus paper would be the different.
   D. The electrical conductivities would be the different.

183. Which of the following solutions would typically show the greatest electrical conductivity?
   A. 0.5 M $NaCH_3COO$
   B. 0.8 M NH_3
   C. 0.1 M KOH
   D. 1.0 M HNO_2

184. Describe two lab tests and how their outcomes could be used to distinguish between a strong acid and weak acid of equal molar concentrations.

Test #1: _____

Outcome: _____

_____

Test #2: _____

Outcome: _____

_____

185. Which of the following is a property of 1.0 M HCl but not a property of 1.0 M CH_3COOH?

A. produces H_3O^+ in solution
B. ionizes completely
C. turns litmus paper red
D. has a pH less than 7.0

186. Which of the following statements applies to 1.0 M $NH_{3\,(aq)}$ but not to 1.0 M $NaOH_{\,(aq)}$?

A. is a weak acid
B. partially ionizes
C. has $[H_3O^+] > [OH^-]$
D. has a pH greater than 7.0

187. Which of the following best describes a weak acid?

A. It must be of low solubility and completely ionized.
B. It may be very soluble, but only partially ionized.
C. Its 0.10 M solution will have a pH = 1.00.
D. It must be very soluble and completely ionized.