1. Which of the following are general properties of bases in aqueous solution?

   A. feel slippery and increase $\left[H_3O^+\right]$
   B. turn litmus red and accept a proton
   C. conduct electricity and turn litmus blue
   D. feel slippery and react with Au to produce $H_{2(g)}$

2. The conjugate base of $H_2PO_4^-$ is

   A. PO_4^{3-} C. HPO_4^{2-}
   B. HPO_4^- D. H_3PO_4

3. The electrical conductivities of 0.10 M solutions of NaCl, HCN and HNO_2 are measured. The order by conductivity from highest to lowest is **(2 ma**

   A. $NaCl > HNO_2 > HCN$
   B. $HCN > HNO_2 > NaCl$
   C. $NaCl > HCN > HNO_2$
   D. $HNO_2 > HCN > NaCl$

4. Which of the following acids has the weakest conjugate base?

   A. HIO_3
   B. HNO_2
   C. H_3PO_4
   D. CH_3COOH

5. When 10.0 mL of 0.10 M HCl is added to 10.0 mL of water, the concentration of H_3O^+ in the final solution is

   A. 0.010 M
   B. 0.050 M
   C. 0.10 M
   D. 0.20 M

6. Which of the following chemical species are amphiprotic in aqueous solution?

I.	F^-
II.	NH_4^+
III.	HPO_4^{2-}

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

7. A solution is prepared by mixing 1.50×10^{-3} mol HCl with 3.00×10^{-3} mol KOH. Calculate the moles of OH^- present after mixing.

A. 0 mol
B. 1.50×10^{-3} mol
C. 3.00×10^{-3} mol
D. 4.50×10^{-3} mol

8. Calculate the pH in a 0.020 M solution of $Sr(OH)_2$.

A. 1.40
B. 1.70
C. 12.30
D. 12.60

9. The K_b value for HPO_4^{2-} is

A. 2.2×10^{-13}
B. 6.2×10^{-8}
C. 1.6×10^{-7}
D. 7.5×10^{-3}

10. Which of the following 1.0 M salt solutions is acidic?

A. BaS
B. NH_4Cl
C. $Ca(NO_3)_2$
D. $NaCH_3COO$

11. Which of the following represents the hydrolysis reaction that occurs in a solution of $K_2C_2O_4$?

A. $K_2C_2O_4 \rightleftarrows 2K^+ + C_2O_4^{2-}$
B. $K^+ + 2H_2O \rightleftarrows KOH + H_3O^+$
C. $C_2O_4^{2-} + H_2O \rightleftarrows HC_2O_4^- + OH^-$
D. $K_2C_2O_4 + H_2O \rightleftarrows K_2CO_3 + CO_2 + H_2$

12. 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.	colour of the indicator phenolphthalein

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

13. An *Arrhenius base* is defined as a compound that

A. accepts OH^- in solution.

B. releases OH^- in solution.

C. accepts protons in solution.

D. donates protons in solution.

14. In which one of the following equations are the Brønsted-Lowry acids and bases all correctly identified?

	Acid	+	Base	$\rightleftarrows$	Base	+	Acid
A.	H_2O_2	+	SO_3^{2-}	$\rightleftarrows$	HO_2^-	+	HSO_3^-
B.	H_2O_2	+	SO_3^{2-}	$\rightleftarrows$	HSO_3^-	+	HO_2^-
C.	SO_3^{2-}	+	H_2O_2	$\rightleftarrows$	HO_2^-	+	HSO_3^-
D.	SO_3^{2-}	+	H_2O_2	$\rightleftarrows$	HSO_3^-	+	HO_2^-

15. Which of the following statements applies to 1.0 M $NH_{3(aq)}$ but not to 1.0 M $NaOH_{(aq)}$? **(1 ı**

A. partially ionizes
B. neutralizes an acid
C. has a pH greater than 7
D. turns bromcresol green from yellow to blue

16. In which of the following are reactants favoured?

A. $HNO_2 + CN^- \rightleftarrows NO_2^- + HCN$

B. $H_2S + HCO_3^- \rightleftarrows HS^- + H_2CO_3$

C. $H_3PO_4 + NH_3 \rightleftarrows H_2PO_4^- + NH_4^+$

D. $CH_3COOH + PO_4^{3-} \rightleftarrows CH_3COO^- + HPO_4^{2-}$

17. What is the pOH of a solution prepared by adding 0.50 mol of NaOH to prepare 0.50 L of solution?

A. 0.00
B. 0.30
C. 14.00
D. 13.70

18. What is the $\left[H_3O^+\right]$ in a solution with a pOH = 5.20?

A. 1.4×10^{-14} M
B. 1.6×10^{-9} M
C. 6.3×10^{-6} M
D. 7.1×10^{-1} M

19. Which of the following solutions will have a pH = 1.00 ?

I.	0.10 M HCl
II.	0.10 M HNO_2
III.	0.10 M NaOH

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

20. K_a for the acid $H_2AsO_4^-$ is 5.6×10^{-8}. What is the value of K_b for $HAsO_4^{2-}$?

A. 5.6×10^{-22}
B. 3.2×10^{-14}
C. 1.8×10^{-7}
D. 2.4×10^{-4}

21. A hydronium ion has the formula

A. H_2^+
B. OH^-
C. H_2O^+
D. H_3O^+

22. The conjugate acid of $C_6H_5NH_2$ is

A. $C_6H_5NH^-$
B. $C_6H_5NH_3$
C. $C_6H_5NH_2^+$
D. $C_6H_5NH_3^+$

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

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

24. In a 1.0 M HF solution, the concentration of HF, F^-, and OH^-, from highest to lowest is

A. $[HF] > [F^-] > [OH^-]$
B. $[F^-] > [HF] > [OH^-]$
C. $[OH^-] > [HF] > [F^-]$
D. $[OH^-] > [F^-] > [HF]$

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

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

26. What is the $\left[OH^-\right]$ of a solution with $\left[H_3O^+\right] = 9.3 \times 10^{-2}\,M$?

A. $9.3 \times 10^{-16}\,M$
B. $8.6 \times 10^{-13}\,M$
C. $1.1 \times 10^{-13}\,M$
D. $9.3 \times 10^{-2}\,M$

27. The pH of $0.10\,M$ HNO_3 is

A. 0.79
B. 1.00
C. 1.26
D. 13.00

28. What is the pOH of a solution made by adding $50.0\,mL$ of $0.50\,M$ NaOH to $250.0\,mL$ of water?

A. 0.30
B. 1.00
C. 1.08
D. 12.92

29. Which of the following $1.0\,M$ solutions will have the lowest pH?

A. HCl
B. HCN
C. H_3PO_4
D. $H_2C_2O_4$

30. The value of K_b for HTe^- is 4.8×10^{-7}. The value of K_a for H_2Te is

A. 4.8×10^{-21}
B. 2.3×10^{-13}
C. 2.1×10^{-8}
D. 4.8×10^{-7}

31. In an aqueous solution of NaCl, the pH is

A. less than 7 and the solution is acidic.
B. equal to 7 and the solution is neutral.
C. greater than 7 and the solution is basic.
D. greater than 7 and the solution is acidic.

32. Which of the following reactions is not a neutralization reaction?

A. $KOH + HF \rightarrow KF + H_2O$
B. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
C. $Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$
D. $Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + CO_2 + H_2O$

33. What is the conjugate acid and what is the conjugate base of HPO_4^{2-} ?

	Conjugate Acid	Conjugate Base
A.	PO_4^{3-}	$H_2PO_4^-$
B.	$H_2PO_4^-$	PO_4^{3-}
C.	$H_2PO_4^-$	H_3PO_4
D.	H_3PO_4	PO_4^{3-}

34. Which of the following would be the same when comparing equal volumes of 1.0 M HBr and 1.0 M CH_3COOH?

A. the pH
B. the electrical conductivity
C. the titration curve for reaction with a base
D. the moles of base required for neutralization

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

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

36. Consider the following reaction:

$$HPO_4^{2-} + H_2SO_3 \rightleftarrows H_2PO_4^- + HSO_3^-$$

What is the strongest acid and strongest base in the above system?

	Strongest acid	Strongest base
A.	$H_2PO_4^-$	HSO_3^-
B.	$H_2PO_4^-$	HPO_4^{2-}
C.	H_2SO_3	HSO_3^-
D.	H_2SO_3	HPO_4^{2-}

37. When a solution has $pOH = 5.30$, the $\left[OH^-\right]$ is

A. 5.0×10^{-6} M
B. 2.0×10^{-9} M
C. 0.72 M
D. 13.27 M

38. How many moles of HI are needed to prepare 3.0 L of an HI solution with a pH of 1.00?

A. 0.030 mol
B. 0.30 mol
C. 3.0 mol
D. 30 mol

39. Which of the following 1.0×10^{-3} M solutions has a pH of 3.0?

A. HCl
B. HCN
C. NaOH
D. K_2SO_4

40. Which of the following expressions shows the relationship between K_a and K_b for a conjugate pair?

A. $K_a \times K_b = 14$
B. $K_a + K_b = 14$
C. $K_a \times K_b = K_w$
D. $K_a \div K_b = K_w$

41. Which of the following will be the most basic?

A. 1.0 M NO_3^-

B. 1.0 M SO_4^{2-}

C. 1.0 M CO_3^{2-}

D. 1.0 M PO_4^{3-}

42. Dissolving $NaCH_3COO$ in water will produce a solution which is

A. basic with pH > 7

B. basic with pH < 7

C. acidic with pH > 7

D. acidic with pH < 7

43. Which of the following represents the complete neutralization of H_3PO_4 by NaOH?

A. $H_3PO_4 + NaOH \rightarrow NaH_2PO_4 + H_2O$

B. $H_3PO_4 + 3NaOH \rightarrow Na_3PO_4 + 3H_2O$

C. $H_3PO_4 + 2NaOH \rightarrow Na_2HPO_4 + 2H_2O$

D. $H_3PO_4 + NaOH \rightarrow NaH + HPO_4 + H_2O$

44. The conjugate base of HBO_3^{2-} is

A. BO_3^{2-} C. HBO_3^-

B. BO_3^{3-} D. $H_2BO_3^-$

45. When comparing equal volumes of 0.10 M HNO_3 with 0.10 M HNO_2, what would be observed?

A. The pH values would be the same.

B. The electrical conductivities would be different.

C. The effects on blue litmus paper would be different.

D. The volumes of 0.10 M NaOH needed for neutralization would be different.

46. Consider the equilibrium:

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

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

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

47. The ionization of water can be represented by

A. $2H_2O_{(\ell)} \rightarrow 2H_{2(g)} + O_{2(g)}$

B. $H_2O_{(\ell)} \rightarrow 2H^+_{(aq)} + O^{2-}_{(aq)}$

C. $H_2O_{(\ell)} \rightarrow H_3O_{(aq)} + OH_{(aq)}$

D. $2H_2O_{(\ell)} \rightarrow H_3O^+_{(aq)} + OH^-_{(aq)}$

48. Calculate the pOH of a 0.050 M HBr solution.

A. 0.30
B. 1.30
C. 12.70
D. 13.70

49. Calculate the value of K_b for HPO_4^{2-}.

A. 4.5×10^{-2}

B. 1.6×10^{-7}

C. 2.2×10^{-27}

D. 6.2×10^{-22}

50. Which of the following is the net ionic equation describing the hydrolysis of $KCN_{(aq)}$?

A. $K^+_{(aq)} + H_2O_{(\ell)} \rightleftarrows KOH_{(aq)} + H^+_{(aq)}$

B. $KCN_{(aq)} + H_2O_{(\ell)} \rightleftarrows K^+_{(aq)} + CN^-_{(aq)}$

C. $CN^-_{(aq)} + H_2O_{(\ell)} \rightleftarrows HCN_{(aq)} + OH^-_{(aq)}$

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

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

A. $NaNO_3$
B. $NaHCO_3$
C. $NaHSO_4$
D. $NaHPO_4$

52. The property common to both 0.10 M HCl and 0.10 M NaOH is that both solutions

A. taste bitter.
B. have a pH > 7.
C. conduct electricity.
D. react with magnesium to produce hydrogen gas.

53. Consider the following Brønsted-Lowry equilibrium:

$$C_6H_5NH_{2(aq)} + H_2O_{(\ell)} \rightleftarrows C_6H_5NH_3^+{}_{(aq)} + OH^-_{(aq)}$$

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

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

54. Consider the following equilibrium:

$$H_2C_2O_{4(aq)} + HPO_4^{2-}{}_{(aq)} \rightleftarrows HC_2O_4^-{}_{(aq)} + H_2PO_4^-{}_{(aq)}$$

In the above equilibrium, a conjugate pair is

A. HPO_4^{2-} and $HC_2O_4^-$
B. HPO_4^{2-} and $H_2PO_4^-$
C. $H_2C_2O_4$ and HPO_4^{2-}
D. $H_2C_2O_4$ and $H_2PO_4^-$

55. The strength of the acids HCl, H_2SO_3 and H_3PO_4 from the weakest to strongest is

A. HCl, H_3PO_4, H_2SO_3
B. HCl, H_2SO_3, H_3PO_4
C. H_2SO_3, H_3PO_4, HCl
D. H_3PO_4, H_2SO_3, HCl

56. Consider the following equilibrium at 25°C :

$$2H_2O_{(\ell)} \rightleftarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

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

A. $\left[OH^-\right]$ decreases and pH increases.
B. $\left[OH^-\right]$ decreases and pH decreases.
C. $\left[OH^-\right]$ increases and pH increases.
D. $\left[OH^-\right]$ increases and pH decreases.

57. What is the value of the ionization constant for water at $25°C$?

A. 7.0
B. 14.0
C. 1.0×10^{-7}
D. 1.0×10^{-14}

58. Which of the following equations represents the dissociation of $Sr(NO_3)_2$ in water?

A. $Sr(NO_3)_{2(s)} \rightarrow Sr^{2+}_{(aq)} + 6NO^{-}_{(aq)}$
B. $Sr(NO_3)_{2(s)} \rightarrow Sr^{2+}_{(aq)} + 2NO_3{}^{-}_{(aq)}$
C. $Sr(NO_3)_{2(s)} \rightarrow 2Sr^{2+}_{(aq)} + NO_3{}^{-}_{(aq)}$
D. $Sr(NO_3)_{2(s)} \rightarrow Sr^{2+}_{(aq)} + (NO_3)_2{}^{2-}_{(aq)}$

59. What is the equilibrium constant expression representing the predominant reaction for the hydrolysis of $NaHCO_{3(aq)}$?

A. $K_w = [H_3O^+][OH^-]$
B. $K_{eq} = \dfrac{[Na^+][HCO_3{}^-]}{[NaHCO_3]}$
C. $K_a = \dfrac{[H_3O^+][CO_3{}^{2-}]}{[HCO_3{}^-]}$
D. $K_b = \dfrac{[H_2CO_3][OH^-]}{[HCO_3{}^-]}$

60. 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 $K_2C_2O_4$
D. 1.0 M $NaHCO_3$

61. An *Arrhenius base* is defined as a substance that

A. releases $H^+_{(aq)}$
B. releases $OH^-_{(aq)}$
C. accepts a proton
D. donates a proton

62. The conjugate acid of $HAsO_4{}^{2-}$ is

A. $AsO_4{}^{3-}$
B. $AsO_4{}^{2-}$
C. $H_2AsO_4{}^-$
D. $H_2AsO_4{}^{2-}$

63. Which of the following will have the greatest electrical conductivity?

A. 1.0 M HF
B. 1.0 M HBr
C. 1.0 M HCN
D. 1.0 M H_2SO_3

64. Consider the equilibrium:

$$C_6H_5COOH + NO_2^- \rightleftarrows HNO_2 + C_6H_5COO^-$$

Identify the stronger acid and predict whether reactants or products are favoured.

	Stronger Acid	Side Favoured
A.	HNO_2	reactants
B.	HNO_2	products
C.	C_6H_5COOH	reactants
D.	C_6H_5COOH	products

65. Which of the following represents the equilibrium expression for the ionization of water?

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

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

B. $K_w = \dfrac{1}{[H_3O^+][OH^-]}$

D. $K_w = \dfrac{[H_3O^+][OH^-]}{[H_2O]}$

66. Determine the pH of 3.0 M KOH .

A. 0.48
B. 11.00
C. 13.52
D. 14.48

67. Four acids are analyzed and their K_a values are determined. Which of the following values represents the strongest acid?

A. $K_a = 2.2 \times 10^{-13}$
B. $K_a = 6.2 \times 10^{-8}$
C. $K_a = 1.7 \times 10^{-5}$
D. $K_a = 1.2 \times 10^{-2}$

68. The dissociation of NH_4NO_3 is represented by

A. $NH_4NO_{3(s)} \rightarrow {NH_4}^+_{(aq)} + {NO_3}^-_{(aq)}$

B. ${NH_4}^+_{(aq)} + {NO_3}^-_{(aq)} \rightarrow NH_4NO_{3(s)}$

C. ${NH_4}^+_{(aq)} + H_2O_{(\ell)} \rightarrow {H_3O}^+_{(aq)} + NH_{3(aq)}$

D. ${NO_3}^-_{(aq)} + H_2O_{(\ell)} \rightarrow HNO_{3(aq)} + {OH}^-_{(aq)}$

69. A solution of $Al(NO_3)_3$ will be

A. basic.
B. acidic.
C. neutral.
D. amphiprotic.

70. A *Brønsted-Lowry acid* is defined as a substance that

A. releases ${H}^+_{(aq)}$

B. releases ${OH}^-_{(aq)}$

C. accepts a proton

D. donates a proton

71. Which of the following represents the reaction of ${H_2PO_4}^-$ acting as an acid?

A. ${H_2PO_4}^- + H_2O \rightleftarrows H_3PO_4 + {OH}^-$

B. ${H_2PO_4}^- + H_2O \rightleftarrows {H_3O}^+ + H_3PO_4$

C. ${H_2PO_4}^- + H_2O \rightleftarrows {H_3O}^+ + {HPO_4}^{2-}$

D. ${H_2PO_4}^- + 2H_2O \rightleftarrows {H_4PO_4}^+ + 2{OH}^-$

72. Consider the following equilibrium:

$$HS^- + H_3BO_3 \rightleftarrows {H_2BO_3}^- + H_2S$$

The two species acting as Brønsted-Lowry bases in the above equilibrium are

A. HS^- and H_2S

B. H_3BO_3 and H_2S

C. HS^- and ${H_2BO_3}^-$

D. H_3BO_3 and ${H_2BO_3}^-$

73. List the bases ${C_2O_4}^{2-}$, NH_3, and ${PO_4}^{3-}$ in order from strongest to weakest.

A. ${PO_4}^{3-} > NH_3 > {C_2O_4}^{2-}$

B. ${C_2O_4}^{2-} > NH_3 > {PO_4}^{3-}$

74. A basic solution can be defined as one in which

A. $\left[H_3O^+\right]$ is not present

B. $\left[H_3O^+\right]$ is equal to $\left[OH^-\right]$

C. $\left[H_3O^+\right]$ is less than $\left[OH^-\right]$

D. $\left[H_3O^+\right]$ is greater than $\left[OH^-\right]$

75. What is the $\left[H_3O^+\right]$ in $0.025\,M\ HNO_3$?

A. $4.0 \times 10^{-13}\,M$

B. $0.025\,M$

C. $1.60\,M$

D. $12.40\,M$

76. Write the base ionization constant expression for

$$NH_{3(aq)} + H_2O_{(\ell)} \rightleftarrows NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$$

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

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

C. $K_b = \dfrac{\left[NH_3\right]\left[H_2O\right]}{\left[NH_4^+\right]\left[OH^-\right]}$

D. $K_b = \dfrac{\left[NH_4^+\right]\left[OH^-\right]}{\left[NH_3\right]\left[H_2O\right]}$

77. The equation for the predominant hydrolysis of NH_4NO_3 can be represented by

A. $NH_4NO_{3(s)} \rightleftarrows NH_4^+{}_{(aq)} + NO_3^-{}_{(aq)}$

B. $NH_4^+{}_{(aq)} + H_2O_{(\ell)} \rightleftarrows H_3O^+{}_{(aq)} + NH_{3(aq)}$

C. $NO_3^-{}_{(aq)} + H_2O_{(\ell)} \rightleftarrows HNO_{3(aq)} + OH^-{}_{(aq)}$

D. $NH_4NO_{3(aq)} + H_2O_{(\ell)} \rightleftarrows H_3O^+{}_{(aq)} + NH_3NO_3^-{}_{(aq)}$

78. A solution made from baking soda $\left(NaHCO_3\right)$ has an amphiprotic anion which is

A. basic since $K_a < K_b$

B. basic since $K_a > K_b$

C. acidic since $K_a < K_b$

D. acidic since $K_a > K_b$

79. Which of the following represents the neutralization reaction between $Ca(OH)_{2(s)}$ and $HCl_{(aq)}$?

A. $H_2O_{(\ell)} \rightarrow H^+_{(aq)} + OH^-_{(aq)}$

B. $Ca^{2+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow CaCl_{2(s)}$

C. $Ca(OH)_{2(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + 2H_2O_{(\ell)}$

D. $Ca^{2+}_{(aq)} + 2OH^-_{(aq)} + 2H^+_{(aq)} + 2Cl^-_{(aq)} \rightarrow CaCl_{2(s)} + 2H_2O_{(\ell)}$

80. Which of the following solutions will have the lowest electrical conductivity?

A. 1.0 M HI

B. 1.0 M H_2S

C. 1.0 M NaOH

D. 1.0 M $NaNO_3$

81. Consider the following equilibrium:

$$HCO_3^- + H_3O^+ \rightleftarrows H_2CO_3 + H_2O$$

Which of the following statements is true?

A. Products are favoured because H_2O is a stronger acid than H_2CO_3

B. Products are favoured because H_3O^+ is a stronger acid than H_2CO_3

C. Reactants are favoured because HCO_3^- is a stronger base than H_2O

D. Reactants are favoured because H_3O^+ is a stronger acid than H_2CO_3

82. Which of the following factors of an acidic solution would affect its pH?

I.	the strength of the acid
II.	the concentration of the acid
III.	the temperature

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

83. Consider the following equilibrium:

$$2H_2O_{(\ell)} \rightleftarrows H_3O^+_{(aq)} + OH^-_{(aq)}$$

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

A. $[H_3O^+]$ increases and pH increases.

B. $[H_3O^+]$ increases and pH decreases.

C. $[H_3O^+]$ decreases and pH increases.

D. $[H_3O^+]$ decreases and pH decreases.

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

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

85. Which of the following represents the dissociation equation of a salt in water?

A. $KCl_{(s)} \rightarrow K^+_{(aq)} + Cl^-_{(aq)}$
B. $Ca^{2+}_{(aq)} + SO_4{}^{2-}_{(aq)} \rightarrow CaSO_{4(s)}$
C. $HCl_{(aq)} + KOH_{(aq)} \rightarrow KCl_{(aq)} + H_2O_{(\ell)}$
D. $2Na_{(s)} + 2H_2O_{(\ell)} \rightarrow 2NaOH_{(aq)} + H_{2(g)}$

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

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

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

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

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

87. Which of the following salt solutions will be acidic?

A. $KClO_4$
B. NH_4Br
C. $NaHCO_3$
D. $Na_2C_2O_4$

88. In which of the following is $HSO_3{}^-$ acting as a Brønsted-Lowry acid?

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

89. What is the conjugate base of $H_2PO_4{}^-$?

A. OH^-
B. $PO_4{}^{3-}$
C. $HPO_4{}^{2-}$
D. H_3PO_4

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

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

91. Which of the following is the strongest acid that can exist in an aqueous solution?

A. O^{2-}
B. NH_2^-
C. H_3O^+
D. $HClO_4$

92. Which of the following household products could have a pH = 12.0 ?

A. soda pop
B. tap water
C. lemon juice
D. oven cleaner

93. What is the pH of a 0.050 M KOH solution?

A. 0.30
B. 1.30
C. 12.70
D. 13.70

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

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