

1. Which of the following are general properties of bases in aqueous solution?
- feel slippery and increase $[\text{H}_3\text{O}^+]$
 - turn litmus red and accept a proton
 - conduct electricity and turn litmus blue
 - feel slippery and react with Au to produce $\text{H}_{2(g)}$
2. The conjugate base of H_2PO_4^- is
- PO_4^{3-}
 - HPO_4^{2-}
 - HPO_4^-
 - 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**
- $\text{NaCl} > \text{HNO}_2 > \text{HCN}$
 - $\text{HCN} > \text{HNO}_2 > \text{NaCl}$
 - $\text{NaCl} > \text{HCN} > \text{HNO}_2$
 - $\text{HNO}_2 > \text{HCN} > \text{NaCl}$
4. Which of the following acids has the weakest conjugate base?
- HIO_3
 - HNO_2
 - H_3PO_4
 - 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
- 0.010 M
 - 0.050 M
 - 0.10 M
 - 0.20 M

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

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

- I only.
- II only.
- III only.
- 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 $\text{Sr}(\text{OH})_2$.
- 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. $\text{Ca}(\text{NO}_3)_2$
 D. NaCH_3COO
11. Which of the following represents the hydrolysis reaction that occurs in a solution of $\text{K}_2\text{C}_2\text{O}_4$?
- A. $\text{K}_2\text{C}_2\text{O}_4 \rightleftharpoons 2\text{K}^+ + \text{C}_2\text{O}_4^{2-}$
 B. $\text{K}^+ + 2\text{H}_2\text{O} \rightleftharpoons \text{KOH} + \text{H}_3\text{O}^+$
 C. $\text{C}_2\text{O}_4^{2-} + \text{H}_2\text{O} \rightleftharpoons \text{HC}_2\text{O}_4^- + \text{OH}^-$
 D. $\text{K}_2\text{C}_2\text{O}_4 + \text{H}_2\text{O} \rightleftharpoons \text{K}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2$
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
- accepts OH^- in solution.
 - releases OH^- in solution.
 - accepts protons in solution.
 - donates protons in solution.
14. In which one of the following equations are the Brønsted-Lowry acids and bases all correctly identified?

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

15. Which of the following statements applies to 1.0 M $\text{NH}_3(aq)$ but not to 1.0 M $\text{NaOH}(aq)$? (11)
- partially ionizes
 - neutralizes an acid
 - has a pH greater than 7
 - turns bromocresol green from yellow to blue
16. In which of the following are reactants favoured?
- $\text{HNO}_2 + \text{CN}^- \rightleftharpoons \text{NO}_2^- + \text{HCN}$
 - $\text{H}_2\text{S} + \text{HCO}_3^- \rightleftharpoons \text{HS}^- + \text{H}_2\text{CO}_3$
 - $\text{H}_3\text{PO}_4 + \text{NH}_3 \rightleftharpoons \text{H}_2\text{PO}_4^- + \text{NH}_4^+$
 - $\text{CH}_3\text{COOH} + \text{PO}_4^{3-} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{HPO}_4^{2-}$
17. What is the pOH of a solution prepared by adding 0.50 mol of NaOH to prepare 0.50 L of solution?
- 0.00
 - 0.30
 - 14.00
 - 13.70
18. What is the $[\text{H}_3\text{O}^+]$ in a solution with a pOH = 5.20?
- 1.4×10^{-14} M
 - 1.6×10^{-9} M
 - 6.3×10^{-6} M
 - 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 $\text{C}_6\text{H}_5\text{NH}_2$ is

- A. $\text{C}_6\text{H}_5\text{NH}^-$
- B. $\text{C}_6\text{H}_5\text{NH}_3$
- C. $\text{C}_6\text{H}_5\text{NH}_2^+$
- D. $\text{C}_6\text{H}_5\text{NH}_3^+$

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. $[\text{HF}] > [\text{F}^-] > [\text{OH}^-]$
- B. $[\text{F}^-] > [\text{HF}] > [\text{OH}^-]$
- C. $[\text{OH}^-] > [\text{HF}] > [\text{F}^-]$
- D. $[\text{OH}^-] > [\text{F}^-] > [\text{HF}]$

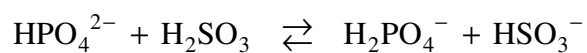
25. In which of the following reactions is water behaving as a Brønsted-Lowry acid?
- A. $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
 - B. $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$
 - C. $\text{NH}_3 + \text{H}_2\text{O} \rightarrow \text{NH}_4^+ + \text{OH}^-$
 - D. $\text{NH}_4^+ + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{NH}_3$
26. What is the $[\text{OH}^-]$ of a solution with $[\text{H}_3\text{O}^+] = 9.3 \times 10^{-2} \text{ M}$?
- A. $9.3 \times 10^{-16} \text{ M}$
 - B. $8.6 \times 10^{-13} \text{ M}$
 - C. $1.1 \times 10^{-13} \text{ M}$
 - D. $9.3 \times 10^{-2} \text{ M}$
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. $\text{H}_2\text{C}_2\text{O}_4$
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
- less than 7 and the solution is acidic.
 - equal to 7 and the solution is neutral.
 - greater than 7 and the solution is basic.
 - greater than 7 and the solution is acidic.
32. Which of the following reactions is not a neutralization reaction?
- $\text{KOH} + \text{HF} \rightarrow \text{KF} + \text{H}_2\text{O}$
 - $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
 - $\text{Ca}(\text{OH})_2 + 2\text{HCl} \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O}$
 - $\text{Na}_2\text{CO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{CO}_2 + \text{H}_2\text{O}$
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 ?
- the pH
 - the electrical conductivity
 - the titration curve for reaction with a base
 - the moles of base required for neutralization
35. Which of the following represents the predominant reaction between NH_3 and H_2O ?
- $\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_3\text{O} + \text{H}_2$
 - $\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-$
 - $\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_5^{2+} + \text{O}^{2-}$
 - $\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{NH}_2^-$

36. Consider the following reaction:



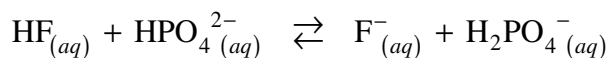
What is the strongest acid and strongest base in the above system?

	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 $\text{pOH} = 5.30$, the $[\text{OH}^-]$ is
- A. $5.0 \times 10^{-6} \text{ M}$
 - B. $2.0 \times 10^{-9} \text{ M}$
 - 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 $1.0 \times 10^{-3} \text{ M}$ 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?
- 1.0 M NO_3^-
 - 1.0 M SO_4^{2-}
 - 1.0 M CO_3^{2-}
 - 1.0 M PO_4^{3-}
42. Dissolving NaCH_3COO in water will produce a solution which is
- basic with $\text{pH} > 7$
 - basic with $\text{pH} < 7$
 - acidic with $\text{pH} > 7$
 - acidic with $\text{pH} < 7$
43. Which of the following represents the complete neutralization of H_3PO_4 by NaOH ?
- $\text{H}_3\text{PO}_4 + \text{NaOH} \rightarrow \text{NaH}_2\text{PO}_4 + \text{H}_2\text{O}$
 - $\text{H}_3\text{PO}_4 + 3\text{NaOH} \rightarrow \text{Na}_3\text{PO}_4 + 3\text{H}_2\text{O}$
 - $\text{H}_3\text{PO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{HPO}_4 + 2\text{H}_2\text{O}$
 - $\text{H}_3\text{PO}_4 + \text{NaOH} \rightarrow \text{NaH} + \text{HPO}_4 + \text{H}_2\text{O}$
44. The conjugate base of HBO_3^{2-} is
- BO_3^{2-}
 - BO_3^{3-}
 - HBO_3^-
 - H_2BO_3^-
45. When comparing equal volumes of 0.10 M HNO_3 with 0.10 M HNO_2 , what would be observed?
- The pH values would be the same.
 - The electrical conductivities would be different.
 - The effects on blue litmus paper would be different.
 - The volumes of 0.10 M NaOH needed for neutralization would be different.

46. Consider the equilibrium:

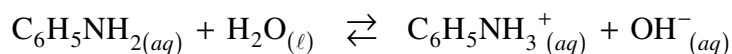


For the above equilibrium, identify the weaker acid and determine whether reactants or products are favoured.

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

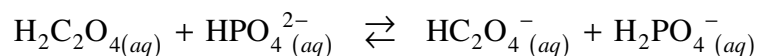
47. The ionization of water can be represented by
- $2\text{H}_2\text{O}_{(\ell)} \rightarrow 2\text{H}_{2(g)} + \text{O}_{2(g)}$
 - $\text{H}_2\text{O}_{(\ell)} \rightarrow 2\text{H}^+_{(aq)} + \text{O}^{2-}_{(aq)}$
 - $\text{H}_2\text{O}_{(\ell)} \rightarrow \text{H}_3\text{O}^+_{(aq)} + \text{OH}^-_{(aq)}$
 - $2\text{H}_2\text{O}_{(\ell)} \rightarrow \text{H}_3\text{O}^+_{(aq)} + \text{OH}^-_{(aq)}$
48. Calculate the pOH of a 0.050 M HBr solution.
- 0.30
 - 1.30
 - 12.70
 - 13.70
49. Calculate the value of K_b for HPO_4^{2-} .
- 4.5×10^{-2}
 - 1.6×10^{-7}
 - 2.2×10^{-27}
 - 6.2×10^{-22}
50. Which of the following is the net ionic equation describing the hydrolysis of $\text{KCN}_{(aq)}$?
- $\text{K}^+_{(aq)} + \text{H}_2\text{O}_{(\ell)} \rightleftharpoons \text{KOH}_{(aq)} + \text{H}^+_{(aq)}$
 - $\text{KCN}_{(aq)} + \text{H}_2\text{O}_{(\ell)} \rightleftharpoons \text{K}^+_{(aq)} + \text{CN}^-_{(aq)}$
 - $\text{CN}^-_{(aq)} + \text{H}_2\text{O}_{(\ell)} \rightleftharpoons \text{HCN}_{(aq)} + \text{OH}^-_{(aq)}$
 - $\text{CN}^-_{(aq)} + \text{H}_2\text{O}_{(\ell)} \rightleftharpoons 2\text{H}^+_{(aq)} + \text{CNO}^-_{(aq)}$
51. Which of the following 1.0 M salt solutions will be acidic?
- NaNO_3
 - NaHCO_3
 - NaHSO_4
 - NaHPO_4
52. The property common to both 0.10 M HCl and 0.10 M NaOH is that both solutions
- taste bitter.
 - have a $\text{pH} > 7$.
 - conduct electricity.
 - react with magnesium to produce hydrogen gas.

53. Consider the following Brønsted-Lowry equilibrium:



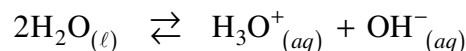
The substances acting as acids and bases from left to right are

- 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:



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. $\text{H}_2\text{C}_2\text{O}_4$ and HPO_4^{2-}
 - D. $\text{H}_2\text{C}_2\text{O}_4$ 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 :



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

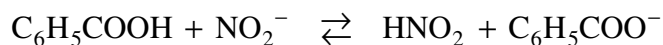
- A. $[\text{OH}^-]$ decreases and pH increases.
- B. $[\text{OH}^-]$ decreases and pH decreases.
- C. $[\text{OH}^-]$ increases and pH increases.
- D. $[\text{OH}^-]$ increases and pH decreases.

57. What is the value of the ionization constant for water at 25°C ?
- 7.0
 - 14.0
 - 1.0×10^{-7}
 - 1.0×10^{-14}
58. Which of the following equations represents the dissociation of $\text{Sr}(\text{NO}_3)_2$ in water?
- $\text{Sr}(\text{NO}_3)_{2(s)} \rightarrow \text{Sr}_{(aq)}^{2+} + 6\text{NO}_{3(aq)}^-$
 - $\text{Sr}(\text{NO}_3)_{2(s)} \rightarrow \text{Sr}_{(aq)}^{2+} + 2\text{NO}_{3(aq)}^-$
 - $\text{Sr}(\text{NO}_3)_{2(s)} \rightarrow 2\text{Sr}_{(aq)}^{2+} + \text{NO}_{3(aq)}^-$
 - $\text{Sr}(\text{NO}_3)_{2(s)} \rightarrow \text{Sr}_{(aq)}^{2+} + (\text{NO}_3)_{2(aq)}^{2-}$
59. What is the equilibrium constant expression representing the predominant reaction for the hydrolysis of $\text{NaHCO}_{3(aq)}$?
- $K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$
 - $K_{eq} = \frac{[\text{Na}^+][\text{HCO}_3^-]}{[\text{NaHCO}_3]}$
 - $K_a = \frac{[\text{H}_3\text{O}^+][\text{CO}_3^{2-}]}{[\text{HCO}_3^-]}$
 - $K_b = \frac{[\text{H}_2\text{CO}_3][\text{OH}^-]}{[\text{HCO}_3^-]}$
60. Which of the following salt solutions will be neutral?
- 1.0 M NH_4Cl
 - 1.0 M LiClO_4
 - 1.0 M $\text{K}_2\text{C}_2\text{O}_4$
 - 1.0 M NaHCO_3
61. An Arrhenius base is defined as a substance that
- releases $\text{H}^+_{(aq)}$
 - releases $\text{OH}^-_{(aq)}$
 - accepts a proton
 - donates a proton
62. The conjugate acid of HAsO_4^{2-} is
- AsO_4^{3-}
 - AsO_4^{2-}
 - H_2AsO_4^-
 - $\text{H}_2\text{AsO}_4^{2-}$

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 H₂SO₃

64. Consider the equilibrium:



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 ₆ H ₅ COOH	reactants
D.	C ₆ H ₅ COOH	products

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

- A. $K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$
- B. $K_w = \frac{1}{[\text{H}_3\text{O}^+][\text{OH}^-]}$
- C. $K_w = [\text{H}_3\text{O}^+] + [\text{OH}^-]$
- D. $K_w = \frac{[\text{H}_3\text{O}^+][\text{OH}^-]}{[\text{H}_2\text{O}]}$

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. $\text{NH}_4\text{NO}_{3(s)} \rightarrow \text{NH}_4^+_{(aq)} + \text{NO}_3^-_{(aq)}$
- B. $\text{NH}_4^+_{(aq)} + \text{NO}_3^-_{(aq)} \rightarrow \text{NH}_4\text{NO}_{3(s)}$
- C. $\text{NH}_4^+_{(aq)} + \text{H}_2\text{O}_{(\ell)} \rightarrow \text{H}_3\text{O}^+_{(aq)} + \text{NH}_3_{(aq)}$
- D. $\text{NO}_3^-_{(aq)} + \text{H}_2\text{O}_{(\ell)} \rightarrow \text{HNO}_{3(aq)} + \text{OH}^-_{(aq)}$

69. A solution of $\text{Al}(\text{NO}_3)_3$ will be

- A. basic.
- B. acidic.
- C. neutral.
- D. amphoteric.

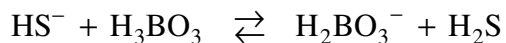
70. A Brønsted-Lowry acid is defined as a substance that

- A. releases $\text{H}^+_{(aq)}$
- B. releases $\text{OH}^-_{(aq)}$
- 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. $\text{H}_2\text{PO}_4^- + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{PO}_4 + \text{OH}^-$
- B. $\text{H}_2\text{PO}_4^- + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{H}_3\text{PO}_4$
- C. $\text{H}_2\text{PO}_4^- + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{HPO}_4^{2-}$
- D. $\text{H}_2\text{PO}_4^- + 2\text{H}_2\text{O} \rightleftharpoons \text{H}_4\text{PO}_4^+ + 2\text{OH}^-$

72. Consider the following equilibrium:



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 $\text{C}_2\text{O}_4^{2-}$, NH_3 , and PO_4^{3-} in order from strongest to weakest.

- A. $\text{PO}_4^{3-} > \text{NH}_3 > \text{C}_2\text{O}_4^{2-}$
- B. $\text{C}_2\text{O}_4^{2-} > \text{NH}_3 > \text{PO}_4^{3-}$

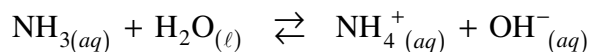
74. A basic solution can be defined as one in which

- A. $[\text{H}_3\text{O}^+]$ is not present
- B. $[\text{H}_3\text{O}^+]$ is equal to $[\text{OH}^-]$
- C. $[\text{H}_3\text{O}^+]$ is less than $[\text{OH}^-]$
- D. $[\text{H}_3\text{O}^+]$ is greater than $[\text{OH}^-]$

75. What is the $[\text{H}_3\text{O}^+]$ in 0.025 M HNO_3 ?

- A. 4.0×10^{-13} M
- B. 0.025 M
- C. 1.60 M
- D. 12.40 M

76. Write the base ionization constant expression for



- A. $K_b = \frac{[\text{NH}_3]}{[\text{NH}_4^+][\text{OH}^-]}$
- B. $K_b = \frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_3]}$
- C. $K_b = \frac{[\text{NH}_3][\text{H}_2\text{O}]}{[\text{NH}_4^+][\text{OH}^-]}$
- D. $K_b = \frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_3][\text{H}_2\text{O}]}$

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

- A. $\text{NH}_4\text{NO}_3(s) \rightleftharpoons \text{NH}_4^+(aq) + \text{NO}_3^-(aq)$
- B. $\text{NH}_4^+(aq) + \text{H}_2\text{O}(\ell) \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{NH}_3(aq)$
- C. $\text{NO}_3^-(aq) + \text{H}_2\text{O}(\ell) \rightleftharpoons \text{HNO}_3(aq) + \text{OH}^-(aq)$
- D. $\text{NH}_4\text{NO}_3(aq) + \text{H}_2\text{O}(\ell) \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{NH}_3\text{NO}_3^-(aq)$

78. A solution made from baking soda (NaHCO_3) 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 $K_a > K_b$

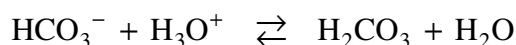
79. Which of the following represents the neutralization reaction between $\text{Ca(OH)}_{2(s)}$ and $\text{HCl}_{(aq)}$?

- A. $\text{H}_2\text{O}_{(\ell)} \rightarrow \text{H}^+_{(aq)} + \text{OH}^-_{(aq)}$
- B. $\text{Ca}^{2+}_{(aq)} + 2\text{Cl}^-_{(aq)} \rightarrow \text{CaCl}_{2(s)}$
- C. $\text{Ca(OH)}_{2(s)} + 2\text{HCl}_{(aq)} \rightarrow \text{CaCl}_{2(aq)} + 2\text{H}_2\text{O}_{(\ell)}$
- D. $\text{Ca}^{2+}_{(aq)} + 2\text{OH}^-_{(aq)} + 2\text{H}^+_{(aq)} + 2\text{Cl}^-_{(aq)} \rightarrow \text{CaCl}_{2(s)} + 2\text{H}_2\text{O}_{(\ell)}$

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:



Which of the following statements is true?

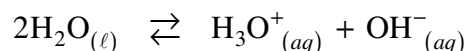
- A. Products are favoured because H_2O is a stronger acid than H_2CO_3
- B. Products are favoured because H_3O^+ is a stronger acid than H_2CO_3
- C. Reactants are favoured because HCO_3^- is a stronger base than H_2O
- D. Reactants are favoured because H_3O^+ is a stronger acid than H_2CO_3

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:



What changes occur to $[\text{H}_3\text{O}^+]$ and pH when NaOH is added?

- A. $[\text{H}_3\text{O}^+]$ increases and pH increases.
- B. $[\text{H}_3\text{O}^+]$ increases and pH decreases.
- C. $[\text{H}_3\text{O}^+]$ decreases and pH increases.
- D. $[\text{H}_3\text{O}^+]$ decreases and pH decreases.

84. The ionization of water is endothermic. How is K_w related to the temperature of water?
- K_w increases as temperature increases.
 - K_w decreases as temperature increases.
 - K_w increases as temperature decreases.
 - K_w remains constant as temperature decreases.
85. Which of the following represents the dissociation equation of a salt in water?
- $\text{KCl}_{(s)} \rightarrow \text{K}^+_{(aq)} + \text{Cl}^-_{(aq)}$
 - $\text{Ca}^{2+}_{(aq)} + \text{SO}_4^{2-}_{(aq)} \rightarrow \text{CaSO}_{4(s)}$
 - $\text{HCl}_{(aq)} + \text{KOH}_{(aq)} \rightarrow \text{KCl}_{(aq)} + \text{H}_2\text{O}_{(\ell)}$
 - $2\text{Na}_{(s)} + 2\text{H}_2\text{O}_{(\ell)} \rightarrow 2\text{NaOH}_{(aq)} + \text{H}_{2(g)}$
86. Which of the following represents the equilibrium constant expression for the hydrolysis reaction that occurs in $\text{NaF}_{(aq)}$?
- $K_b = \frac{[\text{HF}][\text{OH}^-]}{[\text{F}^-]}$
 - $K_a = \frac{[\text{F}^-][\text{H}_3\text{O}^+]}{[\text{HF}]}$
 - $K_{eq} = \frac{[\text{Na}^+][\text{F}^-]}{[\text{NaF}]}$
 - $K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$
87. Which of the following salt solutions will be acidic?
- KClO_4
 - NH_4Br
 - NaHCO_3
 - $\text{Na}_2\text{C}_2\text{O}_4$
88. In which of the following is HSO_3^- acting as a Brønsted-Lowry acid?
- $\text{HSO}_3^- + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3 + \text{OH}^-$
 - $\text{NH}_3 + \text{HSO}_3^- \rightarrow \text{NH}_4^+ + \text{SO}_3^{2-}$
 - $\text{HSO}_3^- + \text{HPO}_4^{2-} \rightarrow \text{H}_2\text{SO}_3 + \text{PO}_4^{3-}$
 - $\text{H}_2\text{C}_2\text{O}_4 + \text{HSO}_3^- \rightarrow \text{HC}_2\text{O}_4^- + \text{H}_2\text{SO}_3$
89. What is the conjugate base of H_2PO_4^- ?
- OH^-
 - PO_4^{3-}
 - HPO_4^{2-}
 - 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}