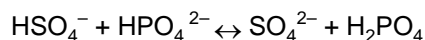


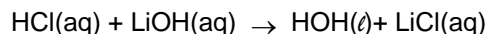
\_\_\_ 1. Given the reaction:



Which pair represents an acid and its conjugate base?

- (A)  $\text{HSO}_4^-$  and  $\text{SO}_4^{2-}$   
 (B)  $\text{HSO}_4^-$  and  $\text{HPO}_4^{2-}$   
 (C)  $\text{SO}_4^{2-}$  and  $\text{H}_2\text{PO}_4^-$   
 (D)  $\text{SO}_4^{2-}$  and  $\text{HPO}_4^{2-}$

\_\_\_ 2. Given the reaction:



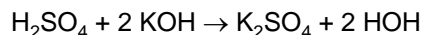
The reaction is best described as

- (A) neutralization (C) decomposition  
 (B) synthesis (D) oxidation-reduction

\_\_\_ 3. Which reaction occurs when equivalent quantities of  $\text{H}^+$  (or  $\text{H}_3\text{O}^+$ ) and  $\text{OH}^-$  are mixed?

- (A) oxidation (C) hydrolysis  
 (B) reduction (D) neutralization

\_\_\_ 4. Given the neutralization reaction:



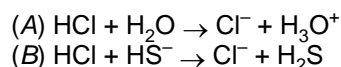
Which compound is a salt?

- (A) KOH  
 (B)  $\text{H}_2\text{SO}_4$   
 (C)  $\text{K}_2\text{SO}_4$   
 (D) HOH

\_\_\_ 5. An acid solution exactly neutralized a base solution according to the equation acid + base  $\rightarrow$  salt + water. If the neutralized mixture contained the salt KCl, the pH of the aqueous mixture would be closest to

- (A) 9 (C) 3  
 (B) 7 (D) 11

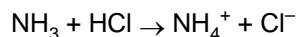
\_\_\_ 6. Given reactions A and B:



In which of the reactions does HCl donate a proton and thus act as an acid?

- (A) A, only (C) both A and B  
 (B) B, only (D) neither A nor B

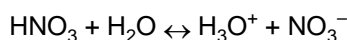
\_\_\_ 7. In the reaction:



The  $\text{NH}_3$  acts as

- (A) a Brønsted acid, only  
 (B) a Brønsted base, only  
 (C) both a Brønsted acid and a Brønsted base  
 (D) neither a Brønsted acid nor a Brønsted base

\_\_\_ 8. In the reaction:



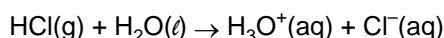
The two acids are

- (A)  $\text{H}_2\text{O}$  and  $\text{HNO}_3$   
 (B)  $\text{H}_2\text{O}$  and  $\text{NO}_3^-$   
 (C)  $\text{H}_2\text{O}$  and  $\text{H}_3\text{O}^+$   
 (D)  $\text{HNO}_3$  and  $\text{H}_3\text{O}^+$

\_\_\_ 9. Which equation illustrates  $\text{H}_2\text{O}$  acting as a proton acceptor?

- (A)  $\text{H}^+(\text{aq}) + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+(\text{aq})$   
 (B)  $\text{CH}_3\text{COO}^-(\text{aq}) + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{COOH}(\text{aq}) + \text{OH}^-(\text{aq})$   
 (C)  $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH}(\text{aq}) + \text{H}_2$   
 (D)  $\text{C} + \text{H}_2\text{O} \rightarrow \text{CO} + \text{H}_2$

\_\_\_ 10. Given the reaction:



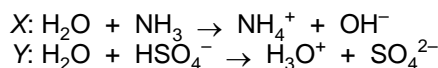
Which reactant acted as a Brønsted-Lowry acid?

- (A)  $\text{HCl(g)}$ , because it reacted with chloride ions  
 (B)  $\text{H}_2\text{O(l)}$ , because it produced hydronium ions  
 (C)  $\text{HCl(g)}$ , because it donated protons  
 (D)  $\text{H}_2\text{O(l)}$ , because it accepted protons

\_\_\_ 11. A compound that can act as an acid or a base is referred to as

- (A) a neutral substance  
 (B) an amphoteric substance  
 (C) a monomer  
 (D) an isomer

\_\_\_ 12. Given the reactions X and Y below:



Which statement describes the behavior of the  $\text{H}_2\text{O}$  in these reactions?

- (A) Water acts as an acid in both reactions.  
 (B) Water acts as a base in both reactions.  
 (C) Water acts as an acid in reaction X and as a base in reaction Y.  
 (D) Water acts as a base in reaction X and as an acid in reaction Y.

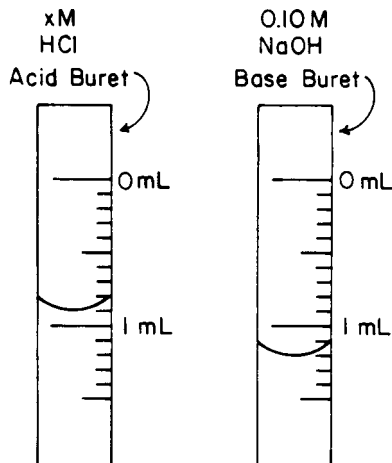
\_\_\_ 13. How many milliliters of 0.010 M NaOH are required to exactly neutralize 20.0 milliliters of 0.020 M HCl?

- (A) 10. mL (C) 30. mL  
 (B) 20. mL (D) 40. mL

\_\_\_ 14. If 50. milliliters of a 1.0 M NaOH solution is needed to exactly neutralize 10. milliliters of an HCl solution, the molarity of the HCl solution is

- (A) 1.0 M (C) 5.0 M  
 (B) 0.20 M (D) 10. M

15. A 30. milliliter sample of HCl is completely neutralized by 10. milliliters of a 1.5 M NaOH solution. What is the molarity of the HCl solution?
- (A) 0.25 (C) 1.5  
(B) 0.50 (D) 4.5
16. The diagram below represents the meniscus on an acid and a base buret at the endpoint of a titration in which 0.10 M NaOH was used to neutralize an unknown concentration of HCl.



If the solution level in each buret was 0.00 milliliter at the start of the titration, what is the molarity of the unknown HCl solution?

- (A) 1.2 M (C) 0.30 M  
(B) 0.13 M (D) 0.090 M
17. According to the Arrhenius theory, the acidic property of an aqueous solution is due to an excess of
- (A)  $H_2$   
(B)  $H^+$   
(C)  $H_2O$   
(D)  $OH^-$
18. A solution of a base differs from a solution of an acid in that the solution of a base
- (A) is able to conduct electricity  
(B) is able to cause an indicator color change  
(C) has a greater  $[H_3O^+]$   
(D) has a greater  $[OH^-]$
19. According to Arrhenius theory, which species does an acid produce in aqueous solution?
- (A) hydrogen ions (C) sodium ions  
(B) hydroxide ions (D) chloride ions
20. Which substance can act as an Arrhenius base in an aqueous solution?
- (A) LiCl  
(B)  $LiNO_3$   
(C) LiBr  
(D) LiOH
21. Which pH change represents a hundredfold increase in the concentration of  $H_3O^+$ ?
- (A) pH 5 to pH 7 (C) pH 3 to pH 1  
(B) pH 13 to pH 14 (D) pH 4 to pH 3
22. Which pH indicates a basic solution?
- (A) 1 (C) 7  
(B) 5 (D) 12
23. Given the following solutions:
- Solution A: pH of 10  
Solution B: pH of 7  
Solution C: pH of 5
- Which list has the solutions placed in order of increasing  $H^+$  concentration?
- (A) A, B, C (C) C, A, B  
(B) B, A, C (D) C, B, A
24. As an aqueous solution becomes more acidic, the hydroxide ion concentration
- (A) decreases (C) remains the same  
(B) increases
25. Which relationship is present in a solution that has a pH of 7?
- (A)  $[H^+] = [OH^-]$  (C)  $[H^+] < [OH^-]$   
(B)  $[H^+] > [OH^-]$  (D)  $[H^+] + [OH^-] = 7$
26. A solution at  $25^\circ C$  with a pH of 7 contains
- (A) more  $H_3O^+$  ions than  $OH^-$  ions  
(B) fewer  $H_3O^+$  ions than  $OH^-$  ions  
(C) an equal number of  $H_3O^+$  ions and  $OH^-$  ions  
(D) no  $H_3O^+$  ions or  $OH^-$  ions
27. The pH of a 0.001 M HCl solution is closest to
- (A) 1 (C) 3  
(B) 7 (D) 10
28. A solution has a hydroxide ion concentration of  $1 \times 10^{-5} M$ . What is the hydrogen ion concentration of the solution?
- (A)  $1 \times 10^{-1} M$  (C)  $1 \times 10^{-9} M$   
(B)  $1 \times 10^{-5} M$  (D)  $1 \times 10^{-14} M$
29. What is the pH of a 0.001 M KOH solution?
- (A) 14 (C) 3  
(B) 11 (D) 7
30. In an acid solution, the  $[H^+]$  ion is found to be  $1 \times 10^{-2}$  mole per liter. What is the  $[OH^-]$  ion in moles per liter?
- (A)  $1 \times 10^{-2}$  (C)  $1 \times 10^{-12}$   
(B)  $1 \times 10^{-7}$  (D)  $1 \times 10^{-14}$
31. Which concentration indicates a basic solution at 298 K?
- (A)  $[OH^-] > 1.0 \times 10^{-7}$   
(B)  $[OH^-] = 1.0 \times 10^{-7}$   
(C)  $[H_3O^+] > 1.0 \times 10^{-7}$   
(D)  $[H_3O^+] = 1.0 \times 10^{-7}$
32. What is the ionization constant for water at 298 K?
- (A)  $1.0 \times 10^{-14}$  (C)  $1.0 \times 10^7$   
(B)  $1.0 \times 10^{-7}$  (D)  $1.0 \times 10^{14}$
33. What is the pH of a 0.10 M solution of NaOH?
- (A) 1 (C) 13  
(B) 2 (D) 14

34. What is the  $\text{OH}^-$  ion concentration of an aqueous solution with a pH of 5?  
 (A)  $1 \times 10^{-5}$  M (C)  $1 \times 10^{-9}$  M  
 (B)  $1 \times 10^{-7}$  M (D)  $1 \times 10^{-14}$  M
35. What is the hydronium ion concentration of a solution that has a hydroxide ion concentration of  $1 \times 10^{-3}$  mole per liter at  $25^\circ\text{C}$ ?  
 (A)  $1 \times 10^{-3}$  mole per liter (C)  $1 \times 10^{-11}$  mole per liter  
 (B)  $1 \times 10^{-7}$  mole per liter (D)  $1 \times 10^{-14}$  mole per liter
36. Which equation correctly represents the  $K_w$  for water?  
 (A)  $K_w = [\text{H}^+] \div [\text{OH}^-]$   
 (B)  $K_w = [\text{H}^+][\text{OH}^-]$   
 (C)  $K_w = [\text{OH}^-] \div [\text{H}^+]$   
 (D)  $K_w = [\text{H}^+] - [\text{OH}^-]$
37. The  $\text{H}_3\text{O}^+$  ion concentration of a solution is  $1 \times 10^{-10}$  mole per liter. This solution is  
 (A) acidic and has a pH of 4  
 (B) acidic and has a pH of 10  
 (C) basic and has a pH of 4  
 (D) basic and has a pH of 10
38. As the hydrogen ion concentration of an aqueous solution increases, the hydroxide ion concentration of this solution will  
 (A) decrease (C) remain the same  
 (B) increase
39. What is the pH of a 0.01 M solution of  $\text{HNO}_3$ ?  
 (A) 1 (C) 13  
 (B) 2 (D) 14
40. The pH of a solution is 1. The hydrogen ion concentration of this solution, in moles per liter, is  
 (A) 1 (C) 0.01  
 (B) 10 (D) 0.1
41. The results of testing a colorless solution with three indicators are shown in the table below.

Indicator	Result
red litmus	blue
blue litmus	blue
phenolphthalein	pink

Which formula could represent the solution tested?

- (A)  $\text{NaOH}(\text{aq})$   
 (B)  $\text{HCl}(\text{aq})$   
 (C)  $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq})$   
 (D)  $\text{C}_{12}\text{H}_{22}\text{O}_{11}(\text{aq})$

42. A solution with a pH of 11 is first tested with phenolphthalein and then with litmus. What is the color of each indicator in this solution?  
 (A) Phenolphthalein is colorless and litmus is blue.  
 (B) Phenolphthalein is colorless and litmus is red.  
 (C) Phenolphthalein is pink and litmus is blue.  
 (D) Phenolphthalein is pink and litmus is red.
43. The table below was compiled from experimental laboratory data.

INDICATOR	CHANGE	pH RANGE AT WHICH CHANGE OCCURS
Bromthymol Blue	yellow $\rightarrow$ blue	6.2 – 7.6
Thymol Blue	red $\rightarrow$ yellow	1.2 – 2.8
Methyl Orange	red $\rightarrow$ yellow	3.1 – 4.4

At what pH would all three indicators appear as yellow?

- (A) 1.9 (C) 4.7  
 (B) 2.9 (D) 8.7
44. Which particle in a water solution of  $\text{NaOH}$  causes red litmus to turn blue?  
 (A)  $\text{Na}^+$   
 (B)  $\text{H}_3\text{O}^+$   
 (C)  $\text{OH}^-$   
 (D)  $\text{H}_2\text{O}$
45. In a 0.01 M solution of  $\text{HCl}$ , litmus will be  
 (A) blue and phenolphthalein will be colorless  
 (B) blue and phenolphthalein will be pink  
 (C) red and phenolphthalein will be colorless  
 (D) red and phenolphthalein will be pink

**Practice Test: Acids & Bases  
Answer Key**

1.   A
2.   A
3.   D
4.   C
5.   B
6.   C
7.   B
8.   D
9.   A
10.   C
11.   B
12.   C
13.   D
14.   C
15.   B
16.   B
17.   B
18.   D
19.   A
20.   D
21.   C
22.   D
23.   A
24.   A
25.   A
26.   C
27.   C
28.   C
29.   B
30.   C
31.   A

32.   A
33.   C
34.   C
35.   C
36.   B
37.   A
38.   A
39.   B
40.   D
41.   A
42.   C
43.   C
44.   C
45.   C