

- How many moles of H_3O^+ ions will be required to exactly neutralize 34 grams of OH^- ions?
 - 1.0
 - 2.0
 - 0.5
 - 4.0
- Which saturated solution at 25 degree C. Has the highest pH?
 - $\text{Ba}(\text{OH})_2$ ($K_{\text{sp}} = 5.0 \times 10^{-3}$)
 - $\text{Ca}(\text{OH})_2$ ($K_{\text{sp}} = 1.3 \times 10^{-6}$)
 - $\text{Mg}(\text{OH})_2$ ($K_{\text{sp}} = 4.2 \times 10^{-15}$)
 - $\text{Pb}(\text{OH})_2$ ($K_{\text{sp}} = 8.9 \times 10^{-12}$)
- Which water solution has the highest concentration of H_3O^+ ions?
 - 1 M H_2SO_4
 - 1 M H_2CO_3
 - 1 M NH_3
 - 1 M NaOH
- A solution at 25 degree C with a pH of 7 contains
 - more H_3O^+ ions than OH^- ions
 - fewer H_3O^+ ions than OH^- ions
 - an equal number of H_3O^+ ions and OH^- ions
 - no H_3O^+ ions or OH^- ions
- The correct name for H_2SO_4 is
 - persulfuric acid
 - sulfurous acid
 - sulfuric acid
 - hydrosulfuric acid
- Which expression best represents the ionization constant (K_a) for the reaction $\text{CH}_3\text{COOH}(\text{aq}) = \text{H}^+(\text{aq}) + \text{CH}_3\text{COO}^-(\text{aq})$?
 - $K_a = [\text{H}^+][\text{CH}_3\text{COO}^-]/[\text{CH}_3\text{COOH}]$
 - $K_a = [\text{H}^+]/[\text{CH}_3\text{COO}^-]$
 - $K_a = [\text{CH}_3\text{COOH}]/[\text{H}^+][\text{CH}_3\text{COO}^-]$
 - $K_a = [\text{H}^+][\text{CH}_3\text{COO}^-]$
- What is the pH of a 0.010 M solution of HCl ?
 - 1.0
 - 2.0
 - 3.0
 - 12
- In the reaction $\text{NH}_4^+ + \text{H}_2\text{O} = \text{NH}_3 + \text{H}_3\text{O}^+$, the two Bronsted acids are
 - NH_4^+ and NH_3
 - H_2O and NH_3
 - H_2O and H_3O^+
 - NH_4^+ and H_3O^+
- According to the Bronsted-Lowry theory, the hydronium ion is the conjugate acid of
 - H_2O
 - NH_3
 - OH^-
 - NH_2^-
- Phenolphthalein will be pink in a solution whose H_3O^+ ion concentration in moles per liter is
 - 1×10^{-1}
 - 1×10^{-3}
 - 1×10^{-6}
 - 1×10^{-9}

21. Which would form the best electrolyte when added to one liter of water?
1. one mole of sulfuric acid
 2. one mole of phosphoric acid
 3. one mole of carbonic acid
 4. one mole of acetic acid
22. If the H_3O^+ ion concentration of a solution is $1 \times 10^{-3} M$, the pH of the solution is
1. 1
 2. 3
 3. -1
 4. -3
23. As hydrochloric acid is added to a solution of NaOH, the pH of the solution
1. decreases
 2. increases
 3. remains the same
24. As conjugate acid strength decreases, the strength of conjugate bases
1. decreases
 2. increases
 3. remains the same
25. One liter of a 1 M HCl solution is reacted with 1 liter of a 1 M NaOH solution according to the following reaction:
- $$HCl + NaOH \rightarrow NaCl + H_2O$$
- the two spectator ions in this reaction are
1. Na^+ and Cl^-
 2. H^+ and OH^-
 3. H^+ and Cl^-
 4. Na^+ and OH^-
26. In the reaction $H_2O + HNO_3 = H_3O^+ + NO_3^-$, the strongest Bronsted acid is
1. H_2O
 2. HNO_3
 3. H_3O^+
 4. NO_3^-
27. Which expression represents the ionization constant of water?
1. $K_w = [H^+][OH^-]$
 2. $K_w = [H^+]/[OH^-]$
 3. $K_w = [OH^-]/[H^+]$
 4. $K_w = [H^+]^2[O^{2-}]$
28. The volume of an acid required to neutralize exactly 15.00 ml of a base could be measured most precisely if it were added to the base solution from a
1. 100 ml graduate
 2. 125 Erlenmeyer flask
 3. 50 ml buret
 4. 50 ml beaker
29. The correct name for H_2SO_3 is
1. sulfuric acid
 2. hydrosulfuric acid
 3. sulfurous acid
 4. persulfuric acid
30. If 50 ml of a 0.20 M solution of NaOH are required to titrate 10 ml of an acid solution, what is the concentration of the acid solution?
1. 1.0 M
 2. 2.5 M
 3. 0.10 M
 4. 0.50 M

31. An acid-base conjugate pair for the reaction $\text{H}_3\text{BO}_3(\text{s}) + \text{H}_2\text{O}(\text{l}) = \text{H}_3\text{O}^+(\text{aq}) + \text{H}_2\text{BO}_3^-(\text{aq})$ is
1. H_3BO_3 and H_3O^+
 2. H_2O and H_2BO_3^-
 3. H_3BO_3 and H_2BO_3^-
 4. H_3O^+ and OH^-
32. What is the K_w of water at 25 degree C?
1. 1×10^{-14}
 2. 1×10^{-7}
 3. 1×10^{-2}
 4. 1×10^7
33. How many milliliters of 0.2 M KOH are needed to neutralize 20 milliliters of 0.1 M HCl?
1. 10
 2. 20
 3. 30
 4. 40
34. In the reaction $\text{NH}_3 + \text{H}_2\text{O} = \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$, which are the two Bronsted bases?
1. NH_4^+ and H_2O
 2. NH_4^+ and OH^-
 3. NH_3 and H_2O
 4. NH_3 and OH^-
35. An aqueous solution has a H_3O^+ concentration of 1×10^{-9} mol/l.
 $[K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 1 \times 10^{-14}$
the OH^- concentration of this solution is
1. 1×10^{-5} M
 2. 1×10^{-7} M
 3. 1×10^{-9} M
 4. 1×10^{-14} M
36. How many milliliters of 0.4 M HCl are required to completely neutralize 200 milliliters of 0.16 M potassium hydroxide?
1. 500
 2. 200
 3. 80
 4. 30
37. The pH of a 0.00001 M HCl solution is closest to
1. 1
 2. 7
 3. 5
 4. 10
38. According to the reaction $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$, when 4 moles of hydrogen ions react completely, what is the total number of moles of water formed?
1. 1
 2. 2
 3. 3
 4. 4
39. What are the Bronsted-Lowry bases in the reaction $\text{HI} + \text{H}_2\text{O} = \text{H}_3\text{O}^+ + \text{I}^-$?
1. HI and H_2O
 2. HI and I^-
 3. H_3O^+ and I^-
 4. H_2O and I^-
40. In which reaction does water act as a Bronsted acid?
1. $\text{NH}_3 + \text{H}_2\text{O} \rightarrow \text{NH}_4^+ + \text{OH}^-$
 2. $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$
 3. $\text{Ca}(\text{HCO}_3)_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2$
 4. $\text{CuSO}_4 + 5\text{H}_2\text{O} \rightarrow \text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

41. How many moles of OH^- ions would be needed to exactly neutralize 1 liter of 2 M HCl?
- 1
 - 2
 - 3
 - 0.5
42. When an acid forms its conjugate base, the acid
- loses a proton
 - loses a neutron
 - gains an electron
 - gains a hydronium ion
43. In the reaction $\text{HCO}_3^- + \text{H}_2\text{O} = \text{H}_2\text{CO}_3 + \text{OH}^-$, the HCO_3^- ion is the
- conjugate base of H_2CO_3
 - conjugate base of OH^-
 - conjugate acid of OH^-
 - conjugate acid of H_2O
44. Which solution is the strongest electrolyte?
- 1.0 M HCl(aq)
 - 1.0 M H_2CO_3 (aq)
 - 1.0 M NH_4OH (aq)
 - 1.0 M $\text{C}_2\text{H}_5\text{OH}$ (aq)
45. The ionization constant of water, K_w , is 1×10^{-14} . If the hydroxyl ion (OH^-) concentration is 1×10^{-3} , the hydrogen ion concentration is
- 1×10^{-17}
 - 1×10^{-11}
 - between 1×10^{-4} and 1×10^{-5}
 - 1×10^{11}
46. In the reaction $\text{S}^{2-} + \text{H}_2\text{O} = \text{HS}^- + \text{OH}^-$, the two acids are
- S^{2-} and H_2O
 - H_2O and OH^-
 - S^{2-} and HS^-
 - H_2O and HS^-
47. Phenolphthalein will be colorless in a solution whose H_3O^+ ion concentration in moles per liter is
- 1×10^{-1}
 - 1×10^{-14}
 - 1×10^{-11}
 - 1×10^{-9}
48. How many liters of 2.5 M HCl are required to exactly neutralize 1.5 liters of 5.0 M NaOH?
- 1.0
 - 2.0
 - 3.0
 - 4.0
49. The conjugate acid of a base is formed when the base
- accepts a proton
 - accepts an electron
 - donates a proton
 - donates an electron
50. The correct formula for nitric acid is
- HCN
 - HNO_3
 - HNO_2
 - NH_3
51. Which of the following acids has the strongest conjugate base?
- HCl
 - HNO_3
 - HSO_4^-
 - H_2O

52. The correct formula for nitrous acid is
1. HCN 2. HNO₃ 3. HNO₂ 4. NH₃
53. What is the pH of a 0.10 M solution of NaOH?
1. 1 2. 2 3. 13 4. 14
54. Beaker A contains 200 ml of 0.10 M HCl.
Beaker B contains 200 ml of 0.10 M NaOH. If the contents of beakers A and B were mixed, the pH of the resulting solution would be closest to
1. 1 2. 5 3. 7 4. 9
55. As sodium hydroxide is added to a solution of sulfuric acid, the hydrogen ion concentration of the solution
1. decreases 2. increases 3. remains the same
56. Which hydrogen ion concentration indicates the strongest acid solution?
1. 1.0×10^{-4} 3. 3.0×10^{-6}
2. 2.0×10^{-5} 4. 4.0×10^{-7}
57. If one mole of sulfuric acid reacts with an excess of sodium hydroxide, how many moles of water are formed?
1. 1 2. 2 3. 3 4. 4
58. The conjugate base of NH₄⁺ is
1. NH₃ 2. OH⁻ 3. H₂O 4. H₃O⁺
59. A reaction between equal volumes of a 1 molar solution of acetic acid and a 1 molar solution of sodium hydroxide will produce a solution that contains
1. an equal number of hydronium ions and hydroxide ions
2. more hydronium ions than hydroxide ions
3. fewer hydronium ions than hydroxide ions
4. neither hydronium ions nor hydroxide ions
60. Which acid has a pH that is closest to that of 0.1 M HCl?
1. 0.1 m HClO 3. 0.1 m CH₃COOH
2. 0.1 m H₂CO₃ 4. 0.1 m HNO₃
61. Which is the conjugate base of the H₃O⁺ ion?
1. H₂O 2. OH⁻ 3. H₂ 4. H⁺
62. The correct name for H₂CO₃ is
1. hypocarbonous acid 3. carbonic acid
2. carbonous acid 4. percarbonic acid

63. In the reaction $\text{NH}_3 + \text{H}_2\text{O} = \text{NH}_4^+ + \text{OH}^-$, the strongest acid is
1. NH_3 2. H_2O 3. NH_4^+ 4. OH^-
64. Neutralization of 15 milliliters of a 1.0-molar solution of KOH requires 5 milliliters of hydrochloric acid. What is the molarity of the HCl solution?
1. 1.0 2. 2.0 3. 3.0 4. 6.0
65. Which aqueous solution has the highest pH?
1. 0.1 M NaOH 3. 0.1 M $\text{C}_2\text{H}_5\text{OH}$
2. 0.1 M NH_4OH 4. 0.2 M CH_3COOH
66. In the neutralization reaction between hydrochloric acid and sodium hydroxide, the spectator ions are
1. H^+ and OH^- 3. Na^+ and H^+
2. Cl^- and OH^- 4. Na^+ and Cl^-
67. The correct formula for phosphoric acid is
1. H_3PO_2 2. H_3PO_3 3. H_3PO_4 4. NP_3
68. Which compound, in a water solution, would turn red litmus paper blue?
1. HNO_3 2. $\text{C}_2\text{H}_5\text{OH}$ 3. $\text{HC}_2\text{H}_3\text{O}_2$ 4. NaOH