

## Acids and Bases: Stoichiometry

1. The  $[\text{OH}^-(\text{aq})]$  in a solution made by mixing 50.0 mL of 0.100 mol/L  $\text{HCl}(\text{aq})$  with 200 mL of 0.300 mol/L  $\text{NaOH}(\text{aq})$  is \_\_\_\_\_ mol/L

|   |        |
|---|--------|
| a | 0.240  |
| b | 0.0400 |
| c | 0.275  |
| d | 0.220  |

2. When 100 mL of 1.00 mol/L  $\text{HCl}(\text{aq})$  is added to 100 mL of 2.00 mol/L  $\text{NaOH}(\text{aq})$ , the final mixture has \_\_\_\_\_.

|   |                                                                                  |
|---|----------------------------------------------------------------------------------|
| a | pH greater than 7                                                                |
| b | pH less than 6                                                                   |
| c | $[\text{OH}^-(\text{aq})]$ that is equal to $[\text{H}_3\text{O}^+(\text{aq})]$  |
| d | $[\text{OH}^-(\text{aq})]$ that is less than $[\text{H}_3\text{O}^+(\text{aq})]$ |

3. A 900 mL sample of 1.80 mol/L  $\text{HCl}(\text{aq})$  solution is added to 300 mL of 0.400 mol/L  $\text{NaOH}(\text{aq})$  solution. The resulting  $[\text{H}_3\text{O}^+(\text{aq})]$  is \_\_\_\_\_ mol/L

|   |       |
|---|-------|
| a | 1.25  |
| b | 0.925 |
| c | 0.300 |
| d | 0.120 |

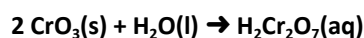
4. If 200 mL of 0.300 mol/L  $\text{HCl}(\text{aq})$  is added to 300 mL of 0.150 mol/L  $\text{NaOH}(\text{aq})$  then the equilibrium  $[\text{H}_3\text{O}^+(\text{aq})]$  is \_\_\_\_\_ mol/L.

|   |        |
|---|--------|
| a | 0.0150 |
| b | 0.0300 |
| c | 0.0500 |
| d | 0.0750 |

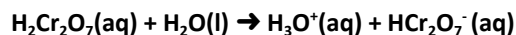
5. A 20.0 mL sample of 0.300 mol/L  $\text{NaOH}(\text{aq})$  is required to completely react with 30.0 mL of  $\text{HNO}_3(\text{aq})$ . The concentration of the nitric acid is \_\_\_\_\_ mol/L

|   |       |
|---|-------|
| a | 2.56  |
| b | 1.56  |
| c | 0.450 |
| d | 0.200 |

6. Chromium(VI) oxide is used to form the highly acidic "chromic acid" in chromium plating solution. Production of "chromic acid" is



The "chromic acid" ionizes completely in water according to the following reaction.



What is the pH in a chromium plating solution in a 1.00 kL tank when 24.0 g/L of  $\text{CrO}_3(\text{s})$  is dissolved?

|   |        |
|---|--------|
| a | 0.620  |
| b | 0.958  |
| c | -0.380 |
| d | 0.544  |

7. Which 50.0 mL solution requires the greatest volume of 0.100 mol/L  $\text{HCl}(\text{aq})$  to completely react with it?

|   |                                                 |
|---|-------------------------------------------------|
| a | 0.100 mol/L $\text{NaOH}(\text{aq})$            |
| b | 0.100 mol/L $\text{NH}_3(\text{aq})$            |
| c | 0.100 mol/L $\text{Ba}(\text{OH})_2(\text{aq})$ |
| d | 0.100 mol/L $\text{HOOC}\text{COOH}(\text{aq})$ |

8. A hydrochloric acid solution ( $\text{HCl}(\text{aq})$ ) is standardized using pure  $\text{Na}_2\text{CO}_3(\text{s})$  as the primary standard. If 30 mL of the acid is required to react completely with a 0.50 g sample of  $\text{Na}_2\text{CO}_3(\text{s})$ , what is the pH of the  $\text{HCl}(\text{aq})$ ?

|   |      |
|---|------|
| a | 2.02 |
| b | 1.10 |
| c | 0.80 |
| d | 0.50 |

9. During a titration, a 25 mL sample of  $\text{HCl}(\text{aq})$  of unknown concentration was titrated with 0.20 mol/L  $\text{NaOH}(\text{aq})$ . The equivalence point was reached after 21 mL of  $\text{NaOH}(\text{aq})$  were added. The concentration of the  $\text{HCl}(\text{aq})$  was calculated and found to be \_\_\_\_\_ mol/L

|   |       |
|---|-------|
| a | 0.010 |
| b | 0.17  |
| c | 0.20  |
| d | 0.25  |

10. A 275 mL sample of 0.400 mol/L  $\text{HCl}$  was titrated with 100 mL of  $\text{KOH}(\text{aq})$  to reach the endpoint. The concentration of the  $\text{KOH}(\text{aq})$  was \_\_\_\_\_ mol/L

|   |       |
|---|-------|
| a | 0.400 |
| b | 0.800 |
| c | 1.10  |
| d | 2.20  |

11. A student titrates 10.0 mL of  $\text{H}_2\text{SO}_4(\text{aq})$  solution with 0.020 mol/L of  $\text{NaOH}(\text{aq})$  solution. If 30.0 mL of  $\text{NaOH}(\text{aq})$  are required to completely neutralize the solution, the concentration of the acid is \_\_\_\_ mol/L

|   |                      |
|---|----------------------|
| a | $6.0 \times 10^{-2}$ |
| b | $3.0 \times 10^{-2}$ |
| c | $6.0 \times 10^{-1}$ |
| d | $3.0 \times 10^{-1}$ |

12. The volume of 0.40 mol/L  $\text{KOH}(\text{aq})$  that is required to neutralize 0.080 L of 0.20 mol/L  $\text{HNO}_3(\text{aq})$  is \_\_\_\_ L

|   |       |
|---|-------|
| a | 0.202 |
| b | 0.040 |
| c | 0.080 |
| d | 0.16  |

13. A 0.409 g sample of impure methanoic acid ( $\text{HCOOH}(\text{aq})$ ) was titrated with a 0.100 mol/L  $\text{NaOH}(\text{aq})$ . It required 50.0 mL of the  $\text{NaOH}(\text{aq})$  solution to neutralize the acid. What percent (by mass) of the sample was methanoic acid?

|   |         |
|---|---------|
| a | 0.312 % |
| b | 0.642 % |
| c | 28.1 %  |
| d | 56.3 %  |

14. A volume of \_\_\_\_ mL of 2.00 mol/L  $\text{H}_2\text{SO}_4(\text{aq})$  would be needed to react completely with 4.20 g of  $\text{NaOH}(\text{s})$ .

|   |      |
|---|------|
| a | 26.3 |
| b | 52.2 |
| c | 105  |
| d | 420  |

15. The volume of 0.100 mol/L  $\text{NaOH}(\text{aq})$  required to neutralize 1.00 L of a strong monoprotic acid solution with a pH of 3.00 is \_\_\_\_\_ mL

|   |                    |
|---|--------------------|
| a | 10.0               |
| b | 333                |
| c | $1.00 \times 10^3$ |
| d | 100                |

16. The volume of 2.0 mol/L  $\text{HCl}(\text{aq})$  that will take 30 mL of 1.5 mol/L  $\text{K}_2\text{SO}_3(\text{aq})$  to completion is \_\_\_\_\_ mL

|   |    |
|---|----|
| a | 23 |
| b | 45 |
| c | 30 |
| d | 11 |

17. A 10 mL sample of  $\text{HCl(aq)}$  with a pH of 1.50 is reacted with 0.025 mol/L  $\text{Ba(OH)}_2\text{(aq)}$ . The volume of  $\text{Ba(OH)}_2\text{(aq)}$  needed to take the reaction to completion is \_\_\_\_ mL

|   |     |
|---|-----|
| a | 10  |
| b | 5.0 |
| c | 13  |
| d | 6.3 |

**Solutions:**

1. D
2. A
3. A
4. B
5. D
6. A
7. C
8. D
9. B
10. C
11. B
12. B
13. D
14. A
15. A
16. B
17. D