

Acids and Bases – Basic Intro Worksheet

Organic Chemistry Tutor

1. The $[\text{H}_3\text{O}^+]$ concentration in a solution is 4.0×10^{-3} M. (a) What is the pH of the solution? (b) Calculate the pOH of the solution. (c) What is the $[\text{OH}^-]$ ion concentration of this solution?

3. If the $[\text{H}_3\text{O}^+]$ ion concentration in a solution is 2.5×10^{-5} M, what is the $[\text{OH}^-]$ concentration in the solution at 25°C ?

2. The $[\text{OH}^-]$ concentration in a solution is 5.3×10^{-4} M. (a) What is the pOH of the solution? (b) Calculate the pH of the solution. (c) What is the $[\text{H}_3\text{O}^+]$ ion concentration of this solution?

4. If the K_a of $\text{HC}_2\text{H}_3\text{O}_2$ is 1.8×10^{-5} , what is the $\text{p}K_a$ of the acid? (b) Calculate the $\text{p}K_b$ and K_b value of the conjugate base $\text{C}_2\text{H}_3\text{O}_2^-$.

5. Which of the following statements is false?

- A. Bases taste bitter and feel slippery.
- B. Acids taste sour and react with active metals to produce Hydrogen gas.
- C. HCl is a strong electrolyte.
- D. Acids turn red litmus paper blue.
- E. A 0.5 M NaOH solution can conduct an electric current.

6. Which of the following solutions will have the highest pH?

- A. 0.1 M HBr
- B. 0.1 M HF
- C. 0.1 M NaCl
- D. 0.1 M NH₃
- E. 0.1 M KOH

7. The K_a value for HF and HC₂H₃O₂ are 7.2×10^{-4} and 1.8×10^{-5} . (a) Which acid is stronger? HF or HC₂H₃O₂? (b) Which conjugate base is stronger? C₂H₃O₂⁻ or F⁻? (c) Which acid has the lower pK_a value?

8. Match each term with the correct letter.

- ___ 1. Arrhenius Acid
- ___ 2. Arrhenius Base
- ___ 3. Bronsted-Lowry Acid
- ___ 4. Bronsted-Lowry Base
- ___ 5. Lewis Acid
- ___ 6. Lewis Base

- A) Electron Pair Acceptor
- B) Proton Donor
- C) Releases H⁺ ions in solution
- D) Electron Pair Donor
- E) Releases OH⁻ ions in solution
- F) Proton Acceptor

9. Calculate the pH of the following solutions:

(a) 2×10^{-3} M HBr. (b) 5×10^{-11} M HBr

11. What is the pH of a solution consisting of 0.03 M HBr and 0.04 M HCl?

10. Calculate the pH of the following solutions:

(a) 0.05 M HCl. (b) 3×10^{-4} M NaOH. (c) 0.003 M Ba(OH)₂. (d) 4×10^{-9} M KOH.

12. What is the pH of a solution consisting of a mixture of 80 mL of 0.03 M HCl and 120 mL of 0.05 M HNO₃?

13. What mass of NaOH is necessary to prepare 250 mL of a solution having a pH of 10.8?

15. What is the pH of a 0.60 M $\text{HC}_2\text{H}_3\text{O}_2$ solution?
 $K_a = 1.8 \times 10^{-5}$.

14. 150 mg of KOH is dissolved in water to make a 500 mL solution. What is the pH of the solution?

16. What is the pH of a 0.40 M NH_3 solution?
 $K_b = 1.8 \times 10^{-5}$.

17. What is the pH of a solution consisting of 0.8 M HF and 0.50 M NaF? $K_a = 7.2 \times 10^{-4}$.

19. Identify the type of solution formed when each of the following substances is dissolved in water. Will it be an acidic, neutral, or a basic solution?

- I. NaCl
- II. NaF
- III. $AlBr_3$
- IV. NH_4Cl
- V. CaO
- VI. SO_2

18. Which of the following substances is not amphoteric?

- A. H_2O
- B. HSO_4^-
- C. OH^-
- D. NH_3
- E. PO_4^{3-}

Answers:

1a. $\text{pH} = 2.4$

1b. $\text{pOH} = 11.6$

1c. $[\text{OH}^-] = 2.5 \times 10^{-12} \text{ M}$

2a. $\text{pOH} = 3.28$

2b. $\text{pH} = 10.72$

2c. $[\text{H}_3\text{O}^+] = 1.9 \times 10^{-11} \text{ M}$

3. $[\text{OH}^-] = 4 \times 10^{-10} \text{ M}$

4a. $\text{pK}_a = 4.74$

4b. $\text{pK}_b = 9.26, \text{K}_b = 5.6 \times 10^{-10}$

5. D

6. E

7a. HF

7b. $\text{C}_2\text{H}_3\text{O}_2^-$

7c. HF

8.

1. Arrhenius Acid \rightarrow C

(Releases H^+ ions in solution)

2. Arrhenius Base \rightarrow E

(Releases OH^- ions in solution)

3. Bronsted-Lowry Acid \rightarrow B

(Proton Donor)

4. Bronsted-Lowry base \rightarrow F

(Proton Acceptor)

5. Lewis Acid \rightarrow A

(Electron Pair Acceptor)

6. Lewis Base \rightarrow D

(Electron Pair Donor)

9a. $\text{pH} = 2.7$

9b. $\text{pH} = 7.0$

10a. $\text{pH} = 1.3$

10b. $\text{pH} = 10.5$

10c. $\text{pH} = 11.8$

10d. $\text{pH} = 7.02$

11. $\text{pH} = 1.15$

12. $\text{pH} = 1.38$

13. 6.31 mg

14. $\text{pH} = 11.73$

15. pH = 2.48

16. pH = 11.4

17. pH = 2.94

18. PO_4^{3-}

19.

I. NaCl = Neutral

II. NaF = Basic

III. AlBr_3 = Acidic

IV. NH_4Cl = Acidic

V. CaO = Basic

VI. SO_2 = Acidic