

Data Tables

Table 1. Indicators, pH, and Reaction with Carbonates

	HCl	CH ₃ CO ₂ H	NaOH	NH ₄ OH	NaHCO ₃	H ₂ O
Color of red litmus						
Color of blue litmus						
Color with phenolphthalein						
Acidic, basic or neutral?						
Color with pH paper						
Color with universal indicator						
Numerical pH value						
Reaction with carbonates						

Table 2. Reactions of Acids and Bases with Metals

	HCl	CH ₃ CO ₂ H	NaOH
Zinc (Zn)			
Magnesium (Mg)			
Copper (Cu)			

Table 3. Results of Burning Splint Test

	Observations with burning splint
Zn + HCl	
Mg + HCl	
Cu + HCl	

Questions and Analysis of Data

Refer to the data in your tables to answer the following questions.

Part A. Acids, Bases, and Indicators

1. a. Which of the solutions tested are acidic? _____
b. What evidence do you have for this? _____
2. a. Which of the solutions tested are basic? _____
b. What evidence do you have for this? _____
3. a. Were any of the solutions neutral (neither acidic nor basic)? Which one(s)? _____
b. How do you know this? _____
4. Look at your results with the litmus test paper. What color is litmus paper in acids? in bases? _____

5. Look at your results with the phenolphthalein indicator. What color is phenolphthalein in acids? in bases? _____

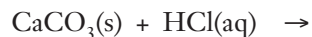
Part B. Acids, Bases, and pH

6. Look at the data for the solutions which you labeled as acids.
 - a. What color(s) were these acids with the pH test paper?
 - b. What color(s) were these acids with the universal indicator?
 - c. What pH values can be assigned to acids?
7. Look at the data for the solutions which you labeled as bases.
 - a. What color(s) were these bases with the pH test paper?
 - b. What color(s) were these bases with the universal indicator?
 - c. What pH values can be assigned to bases?
8. Look at the data for the solutions which you labeled as neutral.
 - a. What color(s) were these neutral solution(s) with the pH test paper?
 - b. What color(s) were these neutral solution(s) with the universal indicator?
 - c. What pH values can be assigned to neutral solution(s)?
9. Relate pH to acid or base strength.
 - a. Using the numerical pH values for the acids, rank the acids from strongest to weakest.
 - b. Using the numerical pH values for the bases, rank the bases from strongest to weakest.
10. a. What would be some benefits of using universal indicator rather than phenolphthalein? _____

- b. When would phenolphthalein be sufficient as an indicator?

Part C. Reactions of Acids and Bases with Carbonates

11. Which solutions reacted with the calcium carbonate? _____
12. Write a balanced chemical equation for each reaction with the CaCO_3 . Show all states of matter using s = solid, l = liquid, g = gas, and aq = aqueous. Write "No Reaction" (NR) on the product side for the combinations that produced no reaction. The first equation is started below



13. a. What gas is released in the reaction of acids with carbonates? _____
- b. What would you expect to happen if you conducted a burning wood splint test on the products of the reactions in question 12?

Part D. Reactions of Acids and Bases with Metals

14. Rank the three metals tested from most reactive to least reactive. _____
15. Look at your results from Part D. Among the acids and bases which were tested (HCl , $\text{HC}_2\text{H}_3\text{O}_2$, and NaOH), which showed a positive reaction with any of the metals? _____
16. Write a balanced equation for each reaction in Part D. Show all states of matter using s = solid, l = liquid, g = gas, and aq = aqueous. Write "No Reaction" (NR) on the product side for the combinations that produced no reaction. The first equation is started below



Part E, Test for Release of a Gas

17. Which metals, when reacted with HCl , showed a positive test with the burning wood splint? _____
18. What gas was released when the metals reacted with HCl ? _____
19. Write the balanced chemical equation for the combustion of this gas.
- _____

Summary Questions

20. Match each of the following characteristics with the appropriate choice by using the following letters

A = Acid only

B = Base only

C = Both acid and base

D = Neither acid nor base

- a. ____ OH^- is characteristic group
- b. ____ Corrodes (reacts with) metals
- c. ____ Changes color of pH paper
- d. ____ Turns red litmus blue
- e. ____ pH lower than 7
- f. ____ Turns phenolphthalein colorless
- g. ____ Turns blue litmus red
- h. ____ pH equal to 7
- i. ____ Reacts with calcium carbonate
- j. ____ Turns phenolphthalein pink
- k. ____ pH higher than 7
- l. ____ H^+ is characteristic group

21. Use your textbook and your laboratory data to complete the following acid/base summary table

Category	Acids	Bases
Examples		
Taste		
Feel		
Effect on litmus		
Effect on phenolphthalein		
pH range		
Reaction with metals		
Reaction with carbonates		
Electrical conductivity		

Extension Questions

22. Describe what may be occurring in the following situation: Upon adding two drops of phenolphthalein indicator solution to an uncapped solution of unknown pH, the solution turns a faint pink color. However, within a few minutes, the pink color slowly fades and the solution becomes colorless.