

Getting to Know the pH Scale

Name _____

Date _____

Period _____

Classifying Acids and Bases

The pH of a solution is a number which tells how acidic or basic a solution is. pH values can range from 0-14. Determine whether the brief statements below describe an acid, a base, or a neutral solution. On the blank in front of the statement, write acid, base, or neutral. You may need to review your notes.

- _____ 1. Blue litmus paper turns red.
- _____ 2. Red litmus paper doesn't change color.
- _____ 3. Contains more H⁺ ions than water.
- _____ 4. pH of 4.
- _____ 5. pH of 7.
- _____ 6. Vinegar.
- _____ 7. Contains less H⁺ ions than water.
- _____ 8. Drain cleaner.
- _____ 9. Household ammonia.
- _____ 10. Lemon juice.

11. On the pH scale below, label the pH ranges for a strong acid, weak acid, strong base, weak base and a neutral solution.

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Measuring the pH of a Solution

12. Each pH increment on the pH scale represents a ten-fold change in H^+ ion concentration. For example, a solution that has a pH of 6 is 100 times more acidic than a solution that has a pH of 8.
- a. How much more acidic is a solution that has a pH of 3 than a solution that has a pH of 4?
- _____
- b. A solution with a pH of 8 has how much more H^+ ions than a solution with a pH of 12?
- _____
- c. A solution with a pH of 12 is how much more basic than a solution with a pH of 7?
- _____
13. Litmus paper can be used to determine if a solution is an acid or a base. There are two types of litmus paper. Red litmus paper will turn *blue* in the presence of a base. Blue litmus paper will turn *red* in the presence of an acid. Read the descriptions of the following solutions and **predict** what the litmus paper results should be. Then **conclude** as to whether it is an acid, base or neutral solution. Write your answers below in the table.

Table 1. Predicted Results of Litmus paper tests on Different Solutions.			
Solution	Red litmus Result	Blue litmus Result	Acid, Base, or Neutral
a) Solution with a pH of 4			
b) Solution has equal amounts of H^+ ions and OH^- ions			
c) Seawater, pH 8.5			
d) Distilled water (pure water)			
e) Coffee, pH 5.2			
f) Solution with a pH of 7.0			
g) Solution with a high concentration of H^+ ions			
h) Solution with a pH of 11			
i) Lime juice, pH 3.3			
j) Solution with less H^+ ions than OH^- ions			

Interpreting the Data

14. Table 2 has a list of results that a student recorded from her investigation of pH. She used both red and blue litmus paper and pH paper to test a number of different solutions. She neglected to follow directions and did not test each solution with all three pH indicators so some data is missing. Use the results she did collect to determine if each solution is an acid, base, or a neutral solution. Write your conclusion provided in table 2.

Solution	Red litmus Result	Blue litmus Result	pH paper	Acid, Base, or Neutral
A	Red		7	
B	Red	Red		
C		Blue	11	
D	Blue	Blue	8	
E	Red		4	
F			12	
G	Red	Blue		

Use table 3 to answer the following questions.

Substance	pH
Hydrochloric acid (HCl)	1.0
Sulfuric acid (H ₂ SO ₄)	1.2
Tomatoes	4.2
Rainwater	6.2
Pure Water	7.0
Sea water	8.5
Ammonium chloride	11.1
Sodium hydroxide (NaOH)	13.0

15. What is the strongest acid listed in Table 3? _____
16. What is the pH of the weakest acid listed in Table 3? _____
17. What is the strongest base listed in Table 3? _____
18. According to the pH values of Table 3, does a solution with a hydrogen ion concentration less than that of pure water have a pH greater or less than 7? _____