

# Unit 9: Acids and Bases

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Prep Chemistry

**Unit Learning Objectives:** By the end of the unit students will be able to...

- (1) Define and give examples of acids and bases.
- (2) Give the common properties of acids and bases including colors seen when each is combined with indicators such as phenolphthalein, bromothymol blue, and cabbage juice.
- (3) Calculate pH, pOH,  $[H^+]$ , and  $[OH^-]$  for acids and bases.
- (4) Classify a solution as acidic, basic, or neutral from the pH.
- (5) Write a balanced neutralization equation for the reaction of an acid and base to produce a salt and water.

Monday	Tuesday	Wednesday	Thursday	Friday
Feb. 22 Unit 8 Test	23 Properties of Acids and Bases	24 Calculating pH and pOH	25 Calculating pH and pOH	26 Acid Base Stoichiometry and Lab: Classifying Household substances
29 Partner Quiz Lab: Classifying Household substances continued.	Mar 1 Neutralization Reactions	2 Neutralization Reactions	3 Unit 9 Review For Test	4 Unit 9 Test Part 1
7 Unit 9 Test Part 2 HW packet Due				

## Acids and Bases

Acid:

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Base:

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Properties of Acids and Bases:

Acid	Base
pH < 7.0	pH > 7.0
taste sour	taste bitter
react with metals to produce hydrogen gas	feel slippery
pH paper turns red	pH paper turns blue
phenolphthalein is colourless	phenolphthalein turns pink
bromothymol blue turns yellow	bromothymol blue stays blue
cabbage juice turns pink	cabbage juice turns blue/green
an acid in solution will conduct electricity	a base in solution will conduct electricity

pH and pOH

pH:

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pOH:

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[H <sup>+</sup> ]														
pH														
1.0	1.0x10 <sup>1</sup>	1.0x10 <sup>2</sup>	1.0x10 <sup>3</sup>	1.0x10 <sup>4</sup>	1.0x10 <sup>5</sup>	1.0x10 <sup>6</sup>	1.0x10 <sup>7</sup>	1.0x10 <sup>8</sup>	1.0x10 <sup>9</sup>	1.0x10 <sup>10</sup>	1.0x10 <sup>11</sup>	1.0x10 <sup>12</sup>	1.0x10 <sup>13</sup>	1.0x10 <sup>14</sup>
0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
<b>ACID</b>							<b>BASE</b>							
14.0	13.0	12.0	11.0	10.0	9.0	8.0	7.0	6.0	5.0	4.0	3.0	2.0	1.0	0
1.0x10 <sup>14</sup>	1.0x10 <sup>13</sup>	1.0x10 <sup>12</sup>	1.0x10 <sup>11</sup>	1.0x10 <sup>10</sup>	1.0x10 <sup>9</sup>	1.0x10 <sup>8</sup>	1.0x10 <sup>7</sup>	1.0x10 <sup>6</sup>	1.0x10 <sup>5</sup>	1.0x10 <sup>4</sup>	1.0x10 <sup>3</sup>	1.0x10 <sup>2</sup>	1.0x10 <sup>1</sup>	1.0
pOH														
[OH <sup>-</sup> ]														

The pH scale is a base-10 logarithmic scale, which means that every change of one unit on the pH scale represents a change in the acidity by a factor of 10. More specifically, every decrease of one unit of the pH scale is equivalent to a tenfold increase in the hydrogen ion concentration.

Ex. A solution with a pH of one is \_\_\_\_\_ times more acidic than a solution with a pH of two.

Ex. A solution with a pH of one is \_\_\_\_\_ times more acidic that a solution with a pH of three.

**Sample pH Scale**

<b>pH</b>	<b>Substance</b>
0	1.0 M HCl
1	Stomach Acid, Battery Acid
2	Lemons, Limes, Plums
3	Grapes, Apples, Pickles, Oranges, Peaches
4	Vinegar, Cherries, Tomatoes
5	Banana, Asparagus, Turnips, Pumpkin
6	Milk, Tuna Fish, Peas, Salmon
7	Water
8	Egg, Sea Water
9	Baking Soda
10	Soap, Antacid
11	Ammonia, Windex
12	Laundry Detergent
13	Drain Cleaner, Bleach
14	1.0 M NaOH

Acid Base Calculations:

Important Formulas:

Note about significant figures:

- For pH and pOH only the digits after the decimal place are significant.
- Ie. pH=10.20 has two significant figures since there are two numbers after the decimal place.
- Ie. pOH- 1.384 has three significant figures since there are three numbers after the decimal place.

Ex. Calculate the pH if  $[H^+] = 0.015 \text{ M}$

Ex. Calculate  $[H^+]$  if pH= 1.22

Ex. Calculate pOH if  $[OH^-] = 3.8 \times 10^{-4} \text{ M}$

Calculate  $[\text{OH}^-]$  if  $\text{pOH}=9.76$

Calculate  $\text{pOH}$  if  $\text{pH}=12.50$

Calculate the  $[\text{H}^+]$  if  $[\text{OH}^-]=2.0 \times 10^{-10} \text{ M}$

Calculate the  $[\text{OH}^-]$ ,  $\text{pOH}$ ,  $\text{pH}$ , and  $[\text{H}^+]$  of  $0.020 \text{ M Sr}(\text{OH})_2$

## Neutralization Reactions

### Review:

### What happens in a neutralization reaction?

Ex. Write the balanced neutralization reaction for each of the following.

a.  $\text{HF}$  and  $\text{RbOH}$

b.  $\text{HNO}_3$  and  $\text{Ba}(\text{OH})_2$

Ex. Write the balanced neutralization between the acid and the base that produced from the salt  $\text{MgCl}_2$