Unit 9: Acids and Bases

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Honors 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) Perform stoichiometric calculations involving pH and pOH for a neutralization reaction
(6) Use data from a titration experiment to perform stoichiometric calculations.

Monday	Tuesday	Wednesday	Thursday	Friday
Feb. 22 Introduction to Acids and Bases and pH	**23** Calculating pH and pOH	**24** Acid Base Stoichiometry	**25** Acid Base Stoichiometry and Lab: Classifying Household substances	**26** Lab: Classifying Household substances continued.
29 Acid Base Stoichiometry and Titration Problems	**Mar 1** Lab: Acid/Base Titration	**2** Lab: Acid/Base Titration	**3** **Unit 9 Review For Test**	**4** **Unit 9 Test** **HW packet Due**

Acids and Bases

Acid:

Base:

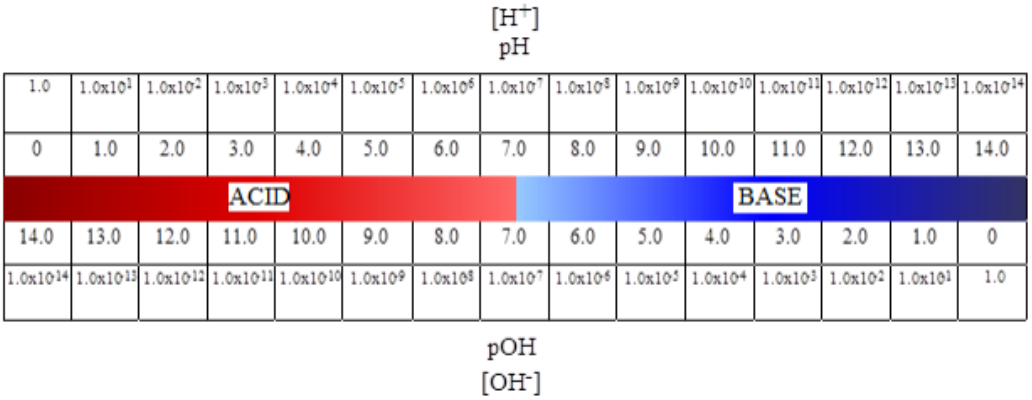
Properties of Acids and Bases:

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:

pOH:



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

pH	Substance
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 $[H^+] = 0.015$ M

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

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

Calculate $[OH^-]$ if pOH=9.76

Calculate pOH if pH=12.50

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

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

Acid Base Stoichiometry and Titration Calculations

Titration:

_____

_____

Acid Base Titration involve neutralization reactions.

Recall, acids and bases react to form salt and water (ex. HCl + NaOH → NaCl + H_2O). For an experiment the objective is to determine the volume of a solution with known concentration.

Ex. A titration experiment is carried out between HCl and NaOH. In the experiment, an average volume of 20.00 mL of 0.150 M NaOH is required to titrate 25.00 mL of HCl solution. Determine the concentration and the pH of the HCl solution. Determine the mass of the salt produced in the reaction.

Ex. A titration experiment is carried out between strontium hydroxide and phosphoric acid. The following data is collected:

Volume of H_3PO_4= 20.00 mL
Concentration of $Sr(OH)_2$= 2.00 M

Trial 1 Volume of $Sr(OH)_2$ required= 15.06 mL
Trial 2 Volume of $Sr(OH)_2$ required= 14.98 mL
Trial 3 Volume of $Sr(OH)_2$ required= 14.96 mL

a. Give the balanced chemical equation for this reaction.

b. Calculate the average volume of strontium hydroxide required in the titration experiment.

c. Determine the concentration of phosphoric acid solution.

d. Determine the mass of phosphoric acid contained in the solution (mass of solute)

e. From the volume of phosphoric acid used and the density of phosphoric acid (1.06 g/mL), determine the mass of the phosphoric acid solution (mass of solution).

f. Calculate the percent concentration of phosphoric acid in the solution.

$$Percent\ Concentration = \frac{mass\ of\ solute}{mass\ of\ solution}\ x\ 100\%$$