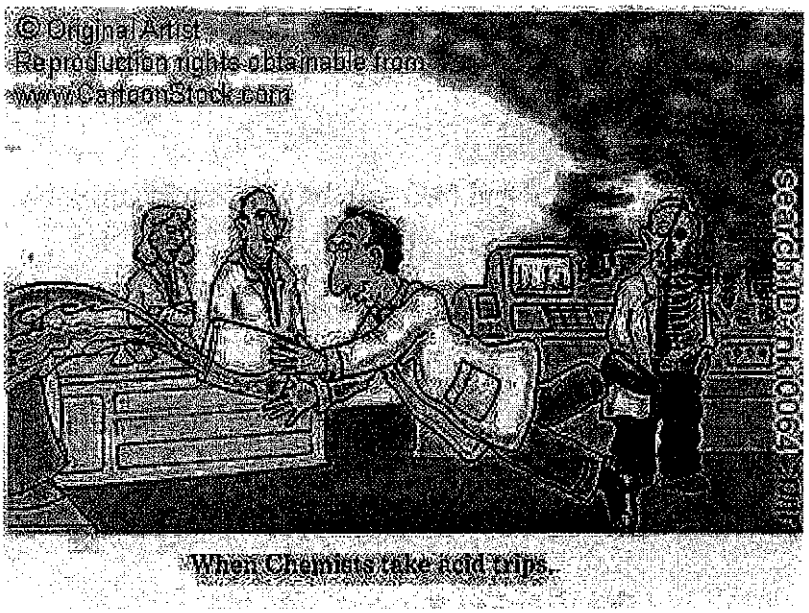
6.1 Introduction to Acids & Bases

In your years of studying chemistry, you probably have heard of a few common acids and bases; ie. hydrochloric acid, sodium hydroxide, ammonia ,sulfuric acid, nitric acid, etc. Acids and bases are classified according to various definitions that have been created throughout the years; we will be reviewing these definitions today.

Based on the textbook reading (Matter and Change; pages 595 ~~-599~~ 600) and the handout provided complete the following questions:



1. List 3 common *household* acids and 3 common *household* bases.

   acids: vinegar, oranges, lemons, pop, etc

   bases: soaps, antacid tablets, windex.

2. In the t-chart below, list 5 physical and/or chemical characteristics of acids and of bases to help determine the **operational definition** of acids and bases.

Acids	Bases
• sour taste • react w/ metals to produce H_2 gas. • form electrolytic solutions b/c they produce ions • turns litmus paper red • neutralized by bases	• bitter taste • no noticeable rxn with metals. • form electrolytic solutions b/c they produce ions. • turns litmus paper blue • slippery feeling • neutralized by acids.

3. Briefly explain the process of self-ionization.

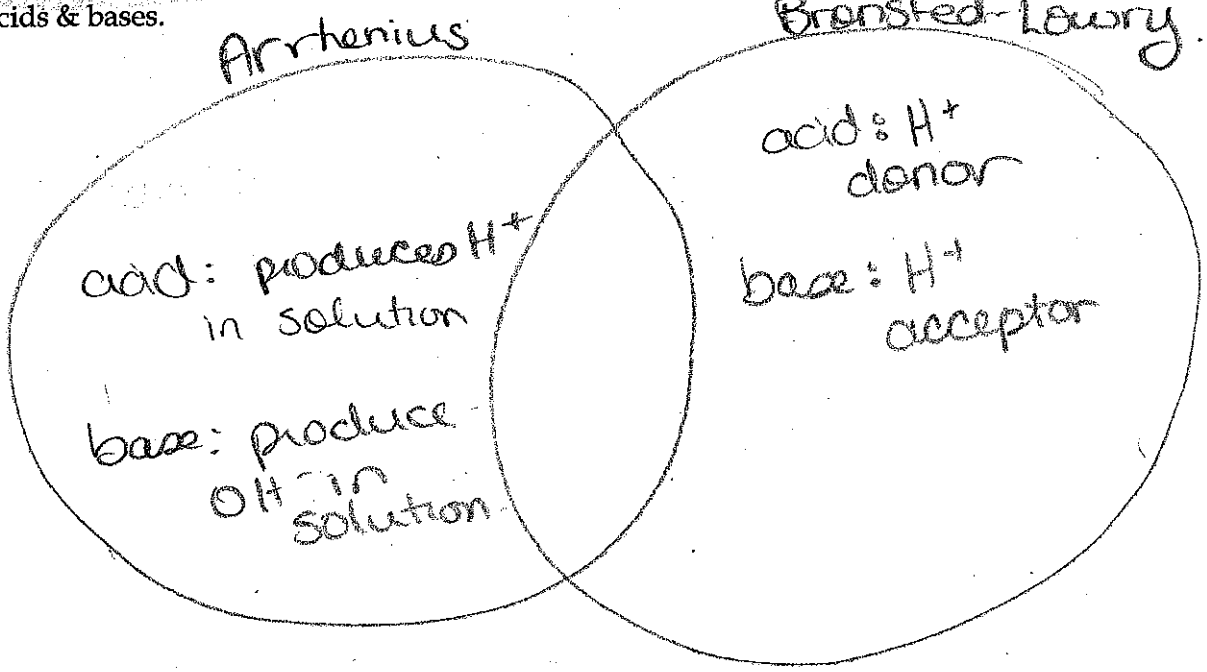
two water molecules react to form as H_3O^+ and OH^-

$$H_2O_{(l)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + OH^-_{(aq)} \text{ (neutral)}$$

4. Explain why H^+ and H_3O^+ can be used interchangeably.

H_3O^+ = hydrated H^+ ion

5. Using a Venn Diagram compare and contrast The Arrhenius and the Bronsted-Lowry models of acids & bases.



6. Describe which model is better used to describe why NH_3 is a base and why using a balanced chemical equation.

$$NH_{3(aq)} + H_2O_{(l)} \rightleftharpoons NH_4^+_{(aq)} + OH^-_{(aq)}$$

base (H^+ acceptor) (donates H^+) acid

* Bronsted-Lowry is used to explain why NH_3 is a base (H^+ acceptor)

7. Define & give an example for: an acid, a base, electrolyte (strong and weak).

acid: donates a H^+ ion in solution ie) HCl

base: accepts H^+ or produces OH^- in solution
ex) NaOH, NH_3

electrolyte: an aqueous solution that conducts electricity (strong = many ions; weak = less ions)

8. Explain why a single arrow is used in a strong electrolyte reaction equation and a double arrow is used in a weak electrolyte reaction equation.

strong electrolyte = complete dissociation

weak electrolyte = incomplete dissociation
(reverse reaction happening as well)
↳ equil is reached

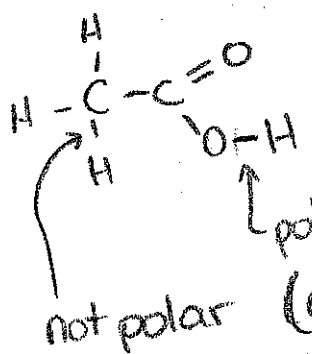
9. Define amphiprotic (sometimes referred to as amphoteric) substances. Use examples to help in your explanation.

amphiprotic = can act as both acids + bases.

ex) H_2O, HCO_3^-

10. Explain why CH_3COOH is not considered a polyprotic acid.

* only one ionizable H ion.



polar bond ∴ ionizable

not polar (C and H has basically the same electronegativities ∴ non-ionizable)

6.1 Introduction to Acids and Bases Assignment

1. Write the balanced ionization or dissociation reaction for the following acids and bases. (Don't worry about the states of the **reactants**.)

   a. Nitric acid $HNO_3 \rightleftharpoons H^+_{(aq)} + NO_3^-{}_{(aq)}$

   b. Chloric acid $HClO_3 \rightleftharpoons H^+_{(aq)} + ClO_3^-{}_{(aq)}$

   c. Acetic acid $CH_3COOH \rightleftharpoons CH_3COO^-{}_{(aq)} + H^+_{(aq)}$

   d. Lithium hydroxide $LiOH_{(s)} \rightleftharpoons Li^+_{(aq)} + OH^-_{(aq)}$

   e. Sulfurous acid $H_2SO_3 \rightleftharpoons H^+_{(aq)} + HSO_3^-{}_{(aq)}$

2. Name each of the following acids.

   a. H_3PO_4 phosphoric acid

   b. H_3BO_3 boric acid

   c. HI hydroiodic acid

   d. CH_3COOH acetic acid

   e. HF hydrofluoric acid

3. Identify the hydrogen-ion donor(s) & acceptor(s) in each of the following reactions:

		H^+ donors (the acids)	**H^+ acceptors (the bases)**
a.	$HNO_3\ (l) + H_2O(l) \rightarrow H_3O^+\ (aq) + NO_3^-\ (aq)$	HNO_3	H_2O
b.	$C_2H_5NH_2\ (l) + H_2O(l) \rightarrow C_2H_5NH_3^+\ (aq) + OH^-(aq)$	H_2O	$C_2H_5NH_2$
c.	$CH_3CO_2H(l) + H_2O(l) \rightarrow CH_3CO_2^-(aq) + H_3O^+(aq)$	CH_3CO_2H	H_2O

4. Which of the following would you expect to act as Brønsted-Lowry bases. Why? Hint – think about charge!

a) Br^- b) Li^+ c) H_3PO_4 d) NH_4^+ e) H_2O f) NH_2^-

possibly
- depends what it is reacting with

5. Consider the following two reactions. In which reaction does $H_2PO_4^-$ act as a base? In which does it act as an acid?

		Is $H_2PO_4^-$ an acid or base?
a.	$H_2PO_4^-\ (aq) + H_2O(l) \rightarrow H_3PO_4(aq) + OH^-(aq)$	base (H^+ acceptor)
b.	$H_2PO_4^-(aq) + H_2O(l) \rightarrow HPO_4^{2-}(aq) + H_3O^+(aq)$	acid (H^+ donor)