Reactions of Acids & Bases

http://oceanoptics.com/measurementtechnique/ph-sensing/ph-scale/

Outcomes:

1-04 Write balanced neutralization reactions involving strong acids and bases.

1-05 Perform a lab to demonstrate the stoichiometry of a neutralization reaction.

Acid & Base Review…

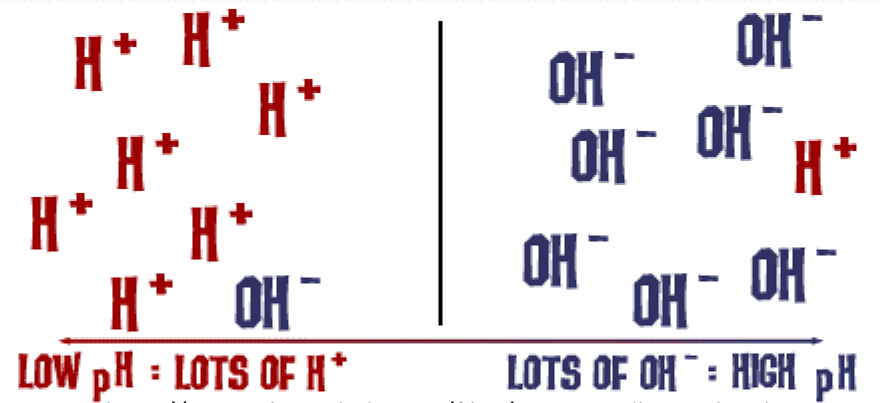
Recall From Science 20F

Properties of acids: (H^+)

- TASTE SOUR
- TURN BLUE LITMUS RED (BRA)
- NEUTRALIZE BASES
- REACT WITH CARBONATES TO PRODUCE CO2
- ARE CORROSIVE TO METALS
- ARE ELECTROLYTES
- BURN WHEN TOUCHING THE SKIN

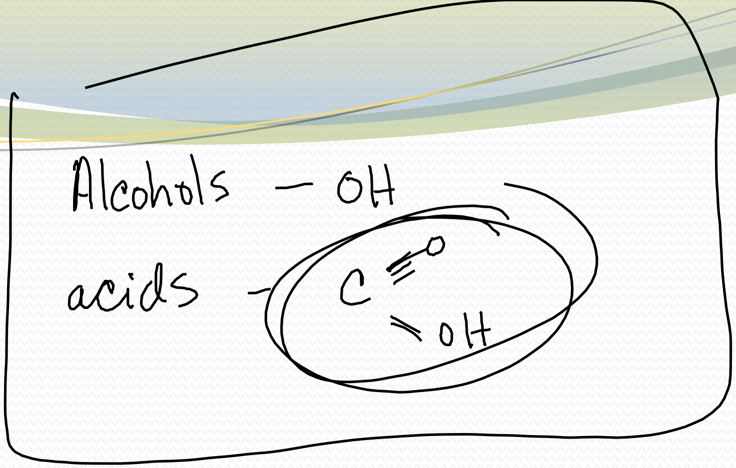
Properties of Bases: (OH^-)

- TASTE BITTER
- FEEL SLIPPERY
- TURN RED LITMUS BLUE
- NEUTRALIZE ACIDS
- ARE ALSO ELECTROLYTES
- ARE CAUSTIC (DISSOLVE ORGANIC MATERIAL)



http://www.chem4kids.com/files/react_acidbase2.html

Common Acids & Bases



You should be able to recognize the following common acids and bases…

Common Acids:

- HNO_3 – **NITRIC ACID**
- HNO_2 – **NITROUS ACID**
- H_2SO_4 – **SULFURIC ACID**
- H_2SO_3 – **SULFUROUS ACID**
- CH_3COOH – **ACETIC ACID** ($HC_2H_3O_2$)
- HCl – **HYDROCHLORIC ACID**
- $HClO$ – **HYPOCHLOROUS ACID**
- H_2CO_3 – **CARBONIC ACID**
- H_3PO_4 – **PHOSPHORIC ACID**

Common Bases:

- $Mg(OH)_2$ – **MAGNESIUM HYDROXIDE**
- NH_3 – **AMMONIA**
- $Ca(OH)_2$ – **CALCIUM HYDROXIDE**
- $Na(OH)$ – **SODIUM HYDROXIDE**
- KOH – **POTASSIUM HYDROXIDE**
- $Al(OH)_3$ – **ALUMINUM HYDROXIDE**

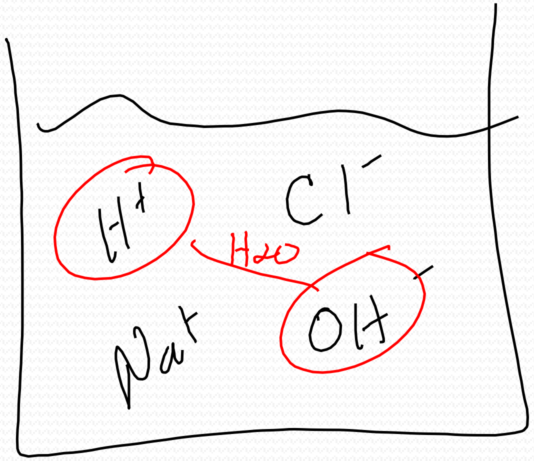
Keep in mind that you have an acid chart in your data booklet that you can use to identify any acids you may not know…

Arrhenius Definition of Acids & Bases

Acids:

An acid is a substance that releases H^+ ions in water.

Ex) $HCl_{(aq)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$



Bases :

A base is a substance that releases OH^- ions in water.

Ex) $NaOH_{(aq)} \rightarrow Na^+_{(aq)} + OH^-_{(aq)}$

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

Given our definition of acids and bases, what do you think would result from the mixing of an acid and base solution ?

H_2O

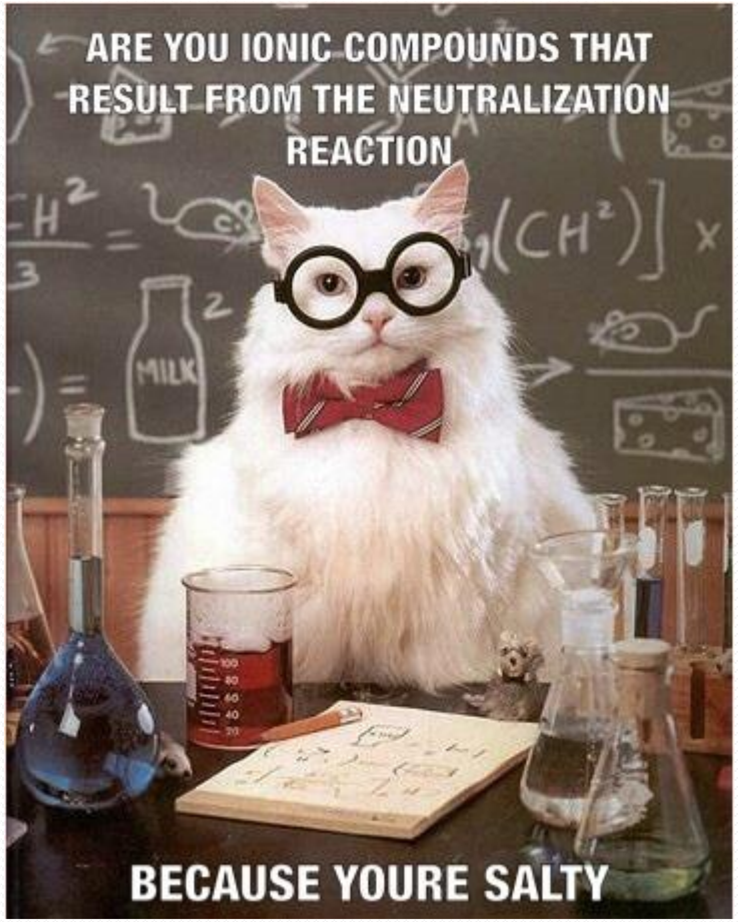
Neutralization Reactions

Are **DOUBLE DISPLACEMENT** reactions between an **ACID** and a **BASE** to produce a **SALT** and **WATER**.

- Acids and bases are **OPPOSITES**.
  - Acids contain **H^+** ions,
  - Bases contain **OH^-** ions,
  - When they are in **EQUAL PROPORTION**, they combine to form **H_2O** (**NEUTRAL**).
- Therefore, if: **$mol_H = mol_{OH}$** , we get **pH=7** (**NEUTRAL**).
- The resulting solution still **CONDUCTS ELECTRICITY**.

Ex) $NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$

Base Acid Salt Water



https://ifunny.co/tags/neutralization

Neutralization Reactions

We can write the molecular, ionic and net-ionic equations for this reaction:

Molecular:

$$NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$$

Total Ionic:

$$Na^+_{(aq)} + OH^-_{(aq)} + H^+_{(aq)} + Cl^-_{(aq)} \rightarrow Na^+_{(aq)} + Cl^-_{(aq)} + H_2O_{(l)}$$

Net-Ionic:

$$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$$

Neutralization Reactions

H^+ H^+ SO_4^{2-}

Try this one...

Write the balanced molecular, ionic and net-ionic equations for the neutralization of KOH with H_2SO_4.

Molecular:

$$2KOH_{(aq)} + H_2SO_{4(aq)} \rightarrow K_2SO_{4(aq)} + 2H_2O_{(l)}$$

Total Ionic:

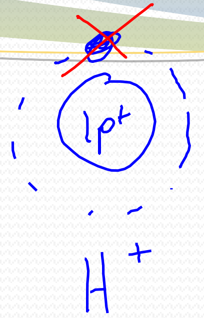
$$[2K^+_{(aq)} + 2OH^-_{(aq)}] + [2H^+_{(aq)} + SO^{2-}_{4(aq)}] \rightarrow [2K^+_{(aq)} + SO^{2-}_{4(aq)}] + 2H_2O_{(l)}$$

Net-Ionic:

$$2H^+_{(aq)} + 2OH^-_{(aq)} \rightarrow 2H_2O_{(l)}$$

$$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$$

Neutralization Reactions



Notice:

The net-ionic equation for **ANY** neutralization reaction is:

$$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$$

In order for **NEUTRALIZATION** to occur, the **MOLES** of **H^+** and moles of **OH^-** must be **EQUAL**.

As we have seen, not all neutralization reactions are between **MONOPROTIC ACIDS** (one proton or H+ ion) and **MONOHYDROTIC BASES** (one hydroxide).

(HCl, HBr)

(NaOH)

→ In these cases, we must ensure that the equation is **BALANCED**.