Aim: How do we explain the behavior of acids?

1. Table K **COMMON ACIDS**

ionization

$HCl_{(aq)} = H^+_{(aq)} + Cl^-_{(aq)}$

$H_2SO_{4(aq)} = 2H^+_{(aq)} + SO_4^{-2}{}_{(aq)}$

$H_3PO_{4(aq)} = 3H^+_{(aq)} + PO_4^{-3}{}_{(aq)}$

Ionization – when a covalent compound reacts with water to form ions.

According to **Arrhenius**, acids are substances that produce hydrogen ions in water.

$\{\text{Acids} \xrightarrow{H_2O} H^+_{(aq)}\}$

$H^+_{(aq)}$ ions are responsible for acidic properties = sour taste, caustic, corrosive, turn litmus red, neutralize bases, etc...

2. The strongest acids in Table K are HCl, HNO_3 & H_2SO_4; the rest are weaker.
(Note: It's not just the # of H's that determines the strength of an acid.)

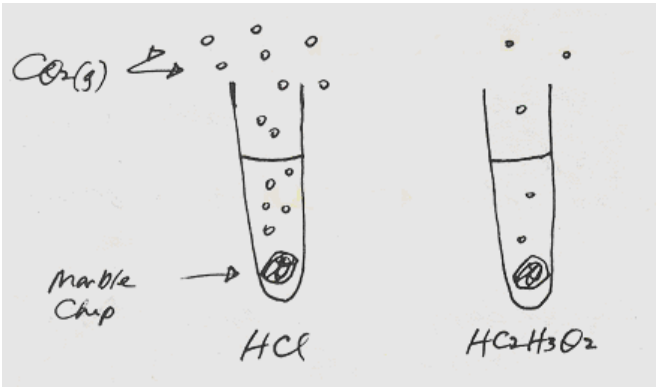
3. How can you tell which acid is stronger experimentally? HCl vs. $HC_2H_3O_2$

A. Test electrical conductivity.

DEMO: conductivity apparatus
Results: {stronger acid, greater conductivity, brighter light}

B. Test reactivity with a metal or stone.

DEMO: reaction with marble chips ($CaCO_3$)
Results: {stronger acid, faster rate of reaction, more bubbles}



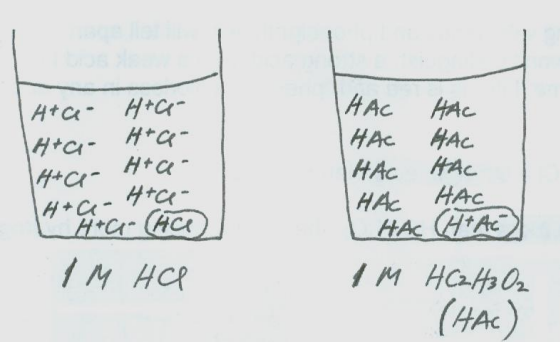
C. Test pH.

DEMO: pH meter or paper
Results:{stronger acid, lower pH}
(We will discuss this in depth in a future lesson.)

P.S. Testing with litmus and phenolphthalein will tell apart an acid from a base, but won't distinguish a strong acid from a weak acid b/c the results are the same. Litmus is red and "pheno" is colorless in any acid.

4. Why is HCl a stronger acid than $HC_2H_3O_2$?

HCl ionizes much more than $HC_2H_3O_2$ and thereby produces more hydrogen ions.

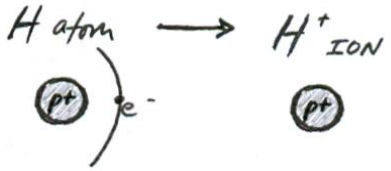


(Actually, the difference is greater than what is depicted. HCl is almost 100% ionized, $HC_2H_3O_2$ is less than 10%)

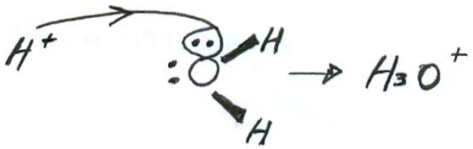
{stronger acid, higher %ionization, greater $[H^+]$}

5. What is a H^+ ion?

Actually, it's a **proton** that is desperately seeking 2 electrons.



And, technically, $\mathbf{H^+_{(aq)} = H_3O^+}$. That is, a hydrogen ion in water turns into a hydronium ion.



The bond formed with water is called a **coordinate** covalent bond b/c one atom is providing both electrons that are shared.

IF TIME PERMITS,

A Closer Look : $CO_{2(aq)} = H_2CO_{3(aq)}$

Carbon dioxide dissolved in water turns into carbonic acid. That's why seltzer has a tart taste.

DEMO: blowing CO_2 into water with a straw
Result: pH decreases

Also, NO_2, SO_2, P_2O_5…That is, **non**metal oxides are **acidic**.