Beth "Key"

Equilibrium: Weak and Strong Acids

Part I: What do you remember?

Answer the following True/False questions for yourself. Then check in with your lab partner(s). You don't all have to agree—just get a sense of what others are thinking. You will re-evaluate your answers at the end of this activity, so it's okay to be unsure at this point.

My response: Always True (Always False) Sometimes True ***My group's response:*** Always True Always False Sometimes True ***Response after completing the activity:*** Always True Always False Sometimes True	**1a.** Strong acids completely (dissociate) in water. IONIZE If ionize were here, I would say always true.
My response: Always True Always False (Sometimes True) ***My group's response:*** Always True Always False Sometimes True ***Response after completing the activity:*** Always True Always False Sometimes True	**1b.** Strong acids have lower pH's than weak acids. When molarity is equal, Strong acids have a lower pH than weak acids
My response: Always True (Always False) Sometimes True ***My group's response:*** Always True Always False Sometimes True ***Response after completing the activity:*** Always True Always False Sometimes True	**1c.** A ten-fold *dilution* of a strong acidic solution will *decrease* the pH by 1. Fewer H^+ ions / unit volume. pH will ↑
My response: Always True Always False (Sometimes True) ***My group's response:*** Always True Always False Sometimes True ***Response after completing the activity:*** Always True Always False Sometimes True	**1d.** A solution with $[H_3O^+] = 0.01$ M contains a stronger acid than a solution with $[H_3O^+] = 0.001$ M.
My response: Always True Always False (Sometimes True) ***My group's response:*** Always True Always False Sometimes True ***Response after completing the activity:*** Always True Always False Sometimes True	**1e.** A solution whose pH is 2.00 contains a stronger acid than a solution whose pH is 3.00.

Part II: Acids & Bases

Log into Mrs. Bethke's Webpage. Open the Acid-Base Folder in IB/Chem 2.
Click on PHET Acids & Bases.

Part 1: Procedure

1. The lab has 2 tools that allow you to test for pH values: A probe, and pH paper. Use each one by dipping it into the solution to be tested. Try all the given types of solutions and fill in the Data Chart with the pH value 0-14.

2. The circuit with a battery and bulb as shown: is the tool used to test for conduction of a solution. By dipping the wire leads into the solution, the bulb with either **remain unlit**, be **dimly lit**, be **somewhat bright** or **very bright**. Test each solution and record your observation for the bulbs brightness in the chart below.

Part 1: Data	pH Value from Probe	Color & pH Value from pH Paper	Observations from Circuit Tool Describe the brightness
Water (H_2O)	7.00	Yellow 7	Dimly Lit
Strong Acid (*HA*)	2.00	Red 2	Very Bright
Weak Acid (*A*)	4.50	Orange 4-6	Somewhat Bright
Strong Base (*MOH*)	12.00	Blue 12-13	Very Bright
Weak Base (*B*)	9.50	Blue-Green 9-10	Somewhat Bright

Part 1: Analysis

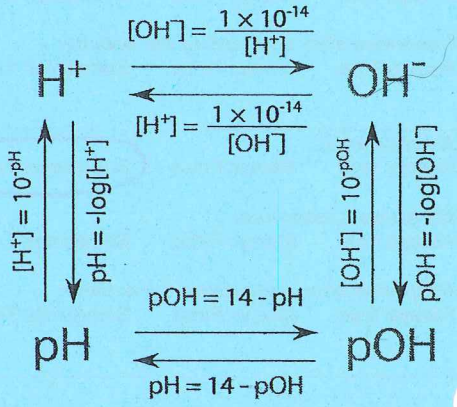
1. What pH value range is observed: a. for acids? < 7.00 b. for bases? > 7.00

2. *Why* are some solutions better conductors of electricity?

They produce more ions in solution.

Part 2 Procedure, Data & Analysis:

Recall: The amount of ionization or dissociation of ions determines the strength of an acid or base. The concentration of $[H_3O^+]$, hydronium and $[OH^-]$, hydroxide ions can be used to calculate pH and pOH as shown on the diagram here:
Note: we use $[H_3O^+]$ and $[H^+]$ interchangeably.

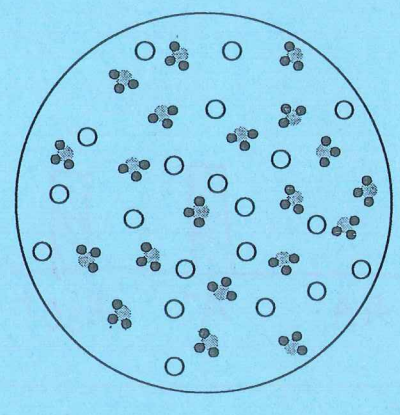


List ~~two ways~~ *strong* and *weak* acids **differ** below.

1. Strong acids are better electrical conductors than weak acids when molarity is the same.
2. Strong acids 100% ionize, weak acids establish an equilibrium in aqueous solution.

NOTE: In the representations below, HA denotes a generic acid, and the water molecules are not shown.

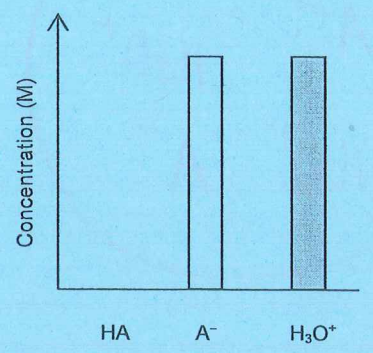
2a. This picture/graph depicts a **strong acid** solution.



O = HA

O = A^-

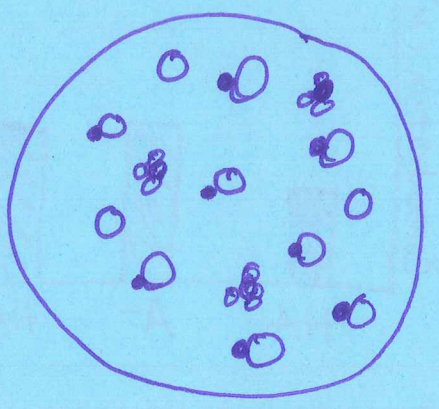
= H_3O^+



How would the picture/graph change for a **weak acid** solution? *How would the pH change?*

There would be HA present, pH would ↑

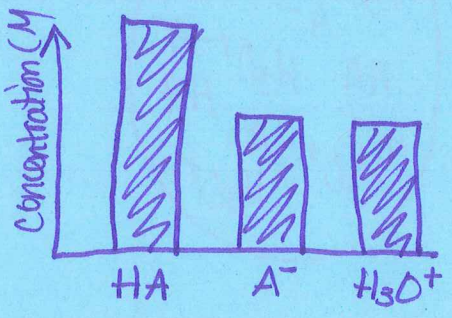
2b. Draw picture/graph that depicts a **weak acid** solution.



O = HA

O = A^-

= H_3O^+



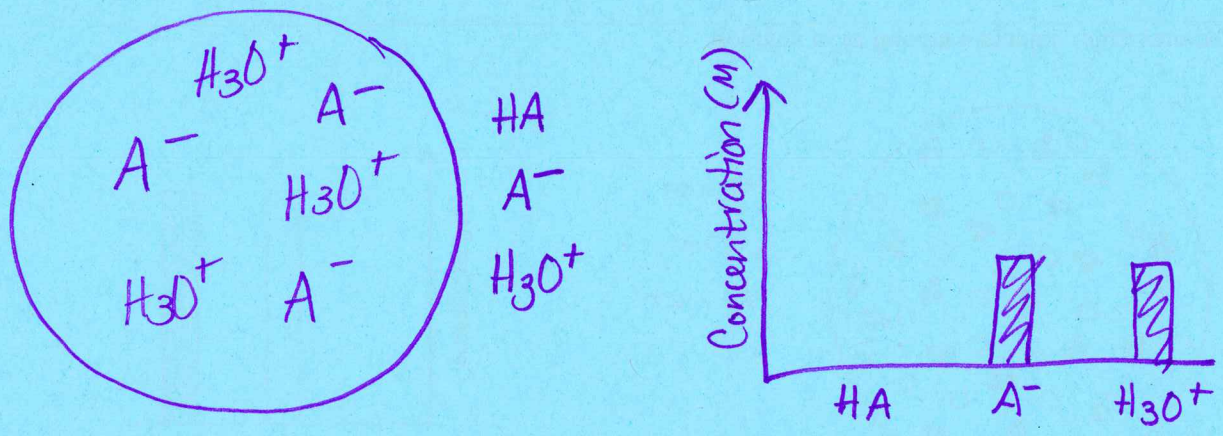
Use the 1st tab of the computer simulation to check your understanding.

Part III: Concentration and Strength

How would the picture/graph change for a more *dilute* **strong acid** solution? *How would the pH change?*

There would be fewer ions, H_3O^+ & A^-. pH ↑

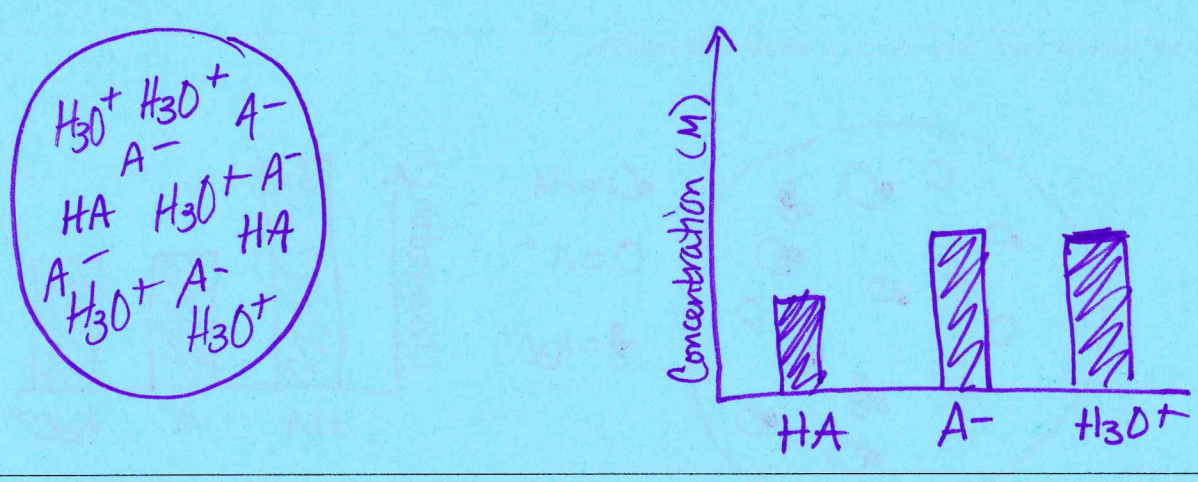
3a. Draw picture/graph that depicts a more *dilute* **strong acid** solution.



How would the picture/graph change for a *stronger* **weak acid** solution? *How would the pH change?*

HA would be present. pH could go up or down depending on the molarity.

3b. Draw picture/graph that depicts a *stronger* **weak acid** solution.



Use the 2nd tab of the simulation to explore the concepts of *strength* and *concentration*. How do they compare?

Strength represents % ionization/dissociation - Concentration describes amount of acid/ volume solution.

How can a *weak acid* solution have the **same pH** as a *strong acid* solution?

If you increase the strength or the molarity of the weak acid, PH will go down.

Return to page 1 of this activity and answer the questions for the last time!