Name Key Honors Acad /70 /47 Date Period

Acid Bases PhET WebLab for Chromebooks BE SURE TO USE HTML 5 Version

https://phet.colorado.edu/en/simulation/acid-base-solutions Click **<Introduction>** to begin.

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 20pts	pH Value from Probe (1pt ea)	Color & pH Value from pH Paper (2pts ea)	Observations from Circuit Tool Describe the brightness (1pt ea)
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

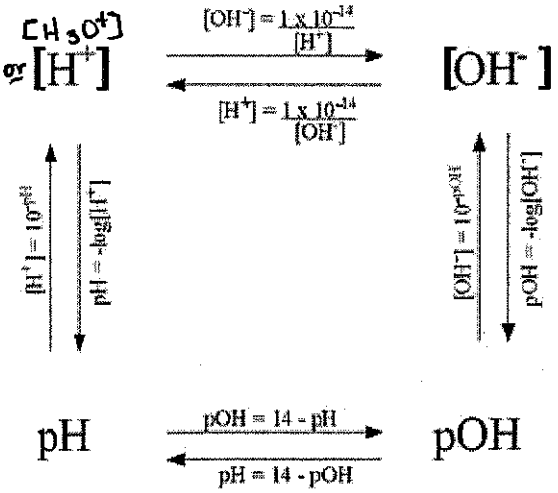
Part 1: Analysis

2pts 1. What pH value range is observed: a. for acids? Approx. 2-6 b. for bases? Approx. 9-12

2pts 2. *Why* are some solutions better conductors of electricity?
Because they ionize more completely

Part 2 Procedure, Data & Analysis:

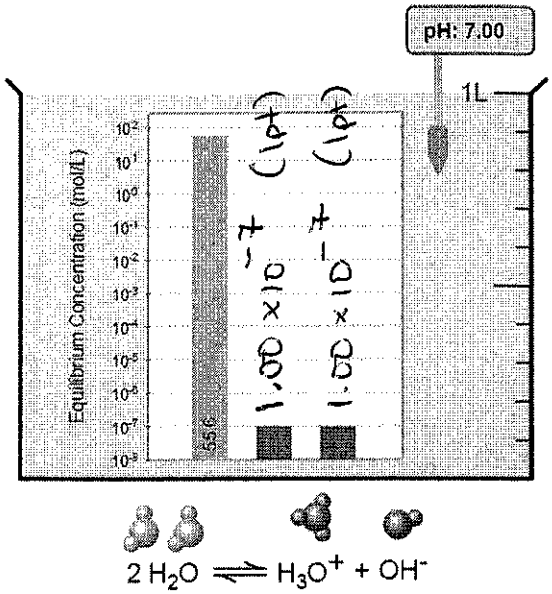
Recall: The amount of ionization or dissociation of ions determines the strength of an acid or base. The concentration of $[H_3O^+]$, hydronium and $[OH^-]$, hydroxide ions can be used to calculate pH and pOH as shown on the diagram here:
Note: we use $[H_3O^+]$ and $[H^+]$ interchangeably.



1. Click on Water Solution, Graph View, Probe Tool. Insert the probe in the water. Notice that the initial

/24 pts

concentration of the solution is given before any ionization or dissociation takes place.



2. Fill in the missing concentration values for the hydronium and hydroxide ions on the chart here: Use the concentration (2pts) *value for $[H_3O^+]$* to calculate the pH. Show work:

1pts $pH = -\log(1.00\times10^{-7}) = 7$ (4pts)

3. Use the concentration *value for $[OH^-]$* to calculate the pOH. Show work:

4pts $pOH = -\log(1.00\times10^{-7}) = 7$ (4pts)

1pt 4. Did your answer to #2 match the pH given in the simulation? yes (1pt)

3pts 5. Is the answer to #3 equal to: (14 - pH)? yes (1pt) Show work: 14 - 7 = 7 (2pts)

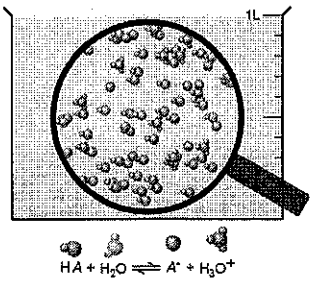
1pt 6. Is the solution an **acid**, a **base** or **neutral**, based upon the calculated pH? Neutral (1pt)

HONORS ONLY: Attach notebook paper to show calculations for the pH and pOH for the other solutions. (24pts) See Attached

HONORS ONLY: Part 3 Procedure, Analysis, Conclusion: My Solution

Across the bottom of the screen, click the 

button. The default setting shows a weak acid with a concentration of 0.010 M. Insert the pH probe to show an initial pH of 4.50. The beaker is shown below:



1. Slide the initial concentration bar to the right to increase the number of solute molecules and then slide it to the left.
What effect does changing the concentration have on the pH value? (Be specific)

2pts Increasing the concentration Lowers pH
(& decreasing concentration raises pH)

2. Return to your default setting and insert the probe. Now slide the strength to the right to make the acid stronger.

a. As you increase the strength, describe the change in the number of blue A^- ions, orange H_3O^+ ions and the original HA acid:

2pts more Blue A^- ions and orange H_3O^+ ions
Fewer HA molecules

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b. As you increase the strength, describe the change in the concentrations of both ions in the solution? Hint: Click <Graph> to see how the concentrations rise and fall.

(2pts) As strength increased, the concentrations of A^- and H_3O^+ both increased as well

(1pt) 3. Yes or No? Does the pH seem to depend upon the concentration of $[H_3O^+]$ ions?

4. We always assume that strong acids will 100% ionize in water. Click reset and move the slider to strength: strong. Insert the probe. Record pH. Observe the number of ions in the beaker and click <Graph> to observe the concentrations.

(4pts)
a. pH Value = 2.00 (1pt)
b. YES or NO? Did the beaker contain a particles that now has 0% concentration? If so, what particle seems missing? HA (1pt). Why is it likely missing?
(2pts) The HA molecule completely ionizes into A^- and H_3O^+ so there is none left

5. Click reset and change to a base. Repeat 1-4 above and answer the questions.

#1: What effect does changing the concentration of the base have on the pH? Be specific.

(2pts) Increasing initial concentration of MOH causes the pH to increase as well

#2: a. How do the # of OH^- and BH^+ and B change as you increase strength? Be specific.

(2pts) The # of OH^- and BH^+ ions increase
The # of B molecules decreases (more ionization)

b. How does the concentration of OH^- and BH^+ change as you increase strength? Be specific.

(2pts) A greater concentration of OH^- and BH^+ is noticible as the strength is increased (more ionization)

#3: (1pt) Yes or No? Does the pH seem to depend on the concentration of $[OH^-]$? Explain & Be specific:

(3pts) (2pts) A higher $[OH^-]$ causes a higher pH

#4: We always assume that strong bases will 100% ionize in water. Click reset and move the slider to strength: strong. Insert the probe. Record pH. Observe the number of ions in the beaker and click <Graph> to observe the concentrations.

(3pts) a. pH = 12.00 (1pt) b. Is there a particle missing? Yes (1pt) If so, what is it? MOH (1pt)

HONORS ONLY: Conclusions: If the answer is no, explain why not.

(8pts) (2 ea)
6. YES or NO? Can a weak acid be concentrated?
7. YES or NO? Can a strong acid be dilute?
8. YES or NO? For acids, can increasing the initial concentration increase the pH?
Inc. initial concentration decreases pH.
9. YES or NO? For Bases, can increasing the initial concentration increase the pH?

Extension: In <My Solution>, Try at least 4 combinations of initial concentration and strength, be sure to try a minimum of 2 acids and 2 bases. Click on <Graph> to find the ion concentration. Make a data chart to record ion concentration, initial concentration and strong/weak and acid/base. For each, use the concentration to calculate pH. Dip the probe to verify pH.

Honors

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2 pts - work
2 pts pH
2 pts pOH

Pt 2: Honors Only

6 pts ea
24 pts

Strong Acid $[H_3O^+] = 1.00 \times 10^{-2}\ m$

2 pts $pH = -\log(1.00 \times 10^{-2}) = 2$ (pH) 2 pts

$pOH = 14 - 2 = 12$ (pOH) 2 pts

Weak Acid $[H_3O^+] = 3.16 \times 10^{-5}\ m$

$pH = -\log(3.16 \times 10^{-5}) = 4.5$ (pH)

$pOH = 14 - 4.5 = 9.5$ (pOH)

Strong Base $[OH^-] = 1.00 \times 10^{-2}\ m$

$pOH = -\log(1.00 \times 10^{-2}\ m) = 2$ (pOH)

$pH = 14 - 2 = 12$ (pH)

Weak Base $[OH^-] = 3.16 \times 10^{-5}\ m$

$pOH = -\log(3.16 \times 10^{-5}\ m) = 4.5$ (pOH)

$pH = 14 - 4.5 = 9.5$ (pH)

note: The strong & weak have pH & pOH reversed.