Chemistry 12

Lab Simulation: Strengths of Acids & Bases

Name: Key

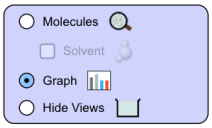
Block:

1. Go to: https://phet.colorado.edu/en/simulations/acid-base-solutions
2. Click the arrow to launch the simulation.
3. Select "Introduction". 

4. On the bottom right, select the light bulb tool. 
5. Complete the following table:

Solution	**Reaction**	**Light Bulb** **(select one of the following)**
Water (H_2O)	$2H_2O \rightleftharpoons H_3O^+ + OH^-$	Dim // Bright // Very Bright
Strong Acid (HA)	$HA + H_2O \rightarrow A^- + H_3O^+$	Dim // Bright // Very Bright
Weak Acid (HA)	$HA + H_2O \rightleftharpoons A^- + H_3O^+$	Dim // Bright // Very Bright
Strong Base (MOH)	$MOH \rightarrow M^+ + OH^-$	Dim // Bright // Very Bright
Weak Base (B)	$B + H_2O \rightleftharpoons BH^+ + OH^-$	Dim // Bright // Very Bright

6. Provide an explanation of the differences in light bulb brightness:
   SA / SB completely ionizes
   ↳ ions conduct electricity
7. At the very bottom of your screen, select "My Solution". 

8. Under "Views" select "Graph". 

9. Your reaction is: $HA + H_2O \rightleftharpoons A^- + H_3O^+$
10. Your K_a expression is: $K_a = \dfrac{[A^-][H_3O^+]}{[HA]}$

11. Ensure that the "Initial Concentration is 0.010 M and that you haven't moved the parameters on "Strength". (If you did, you can simply hit the refresh button.)

12. Given these parameters, calculate the value of K_a and identify the acid based on your Acids-Bases table.

Calculation:

$$K_a = \frac{(3.16\times10^{-5})(3.16\times10^{-5})}{(9.97\times10^{-3})} = 1.0\times10^{-7}$$

Acid: HSO_3

13. Fill out the following table by adjusting "Initial Concentration (mol/L)":
****do not adjust the "strength" parameters***

Initial Concentration (mol/L)	**[HA]**	**[A-]**	**[H_3O^+]**	**K_a (calculation)**	**Identify the Acid**	**pH**
0.001M	9.90×10^{-4} M	9.95×10^{-6} M	9.95×10^{-6} M	1.0×10^{-7}	HSO_3	5.00
0.008 M	7.97×10^{-3} M	2.82×10^{-5} M	2.82×10^{-5} M	1.0×10^{-7}	HSO_3	4.55
0.237 M	2.37×10^{-1} M	1.54×10^{-4} M	1.54×10^{-4} M	1.0×10^{-7}	HSO_3	3.81
0.400 M	4.00×10^{-1} M	2.00×10^{-4} M	2.00×10^{-4} M	1.0×10^{-7}	HSO_3	3.70
0.701M	7.01×10^{-1} M	2.65×10^{-4} M	2.65×10^{-4} M	1.0×10^{-7}	HSO_3	3.58

14. Complete the following with "increases", "decreases" or "stays the same".

a. If pH increases, [H_3O^+] decreases.

b. If pH decreases, [H_3O^+] increases.

c. If pH increases, [OH^-] increases.

d. If pH decreases, [OH^-] decreases.

e. As initial concentration of an acid increases, pH decreases.

f. As initial concentration of an acid increases, K_a stays the same.

g. As strength of the acid increases, K_a increases.