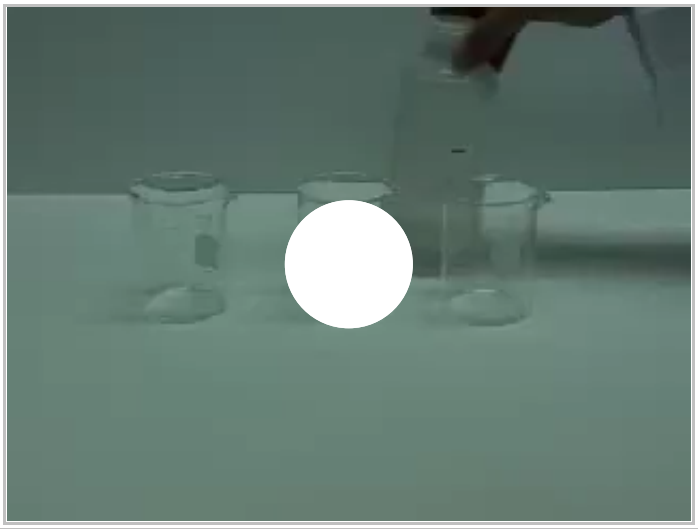
This is BCE#24.

I recommend you print out this page and bring it to class. Click here to show a set of five BCE24 student responses randomly selected from all of the student responses thus far in a new window.

John , here are your responses to the BCE and the Expert's response.

In the BCE you will view a series of videos depicting the behavior of a buffer solution. Alka-Seltzer contains several different compounds that have buffer capacity. The compounds are sodium bicarbonate, $NaHCO_3$ and citric acid/sodium citrate, $H_3C_6H_5O_7$. In the series of videos you will see what happens when a strong acid and a strong base are added to water in the presence of a mixture of indicators, and what happens when Alka-Seltzer is added to a solution of a strong acid and a solution of a strong base.

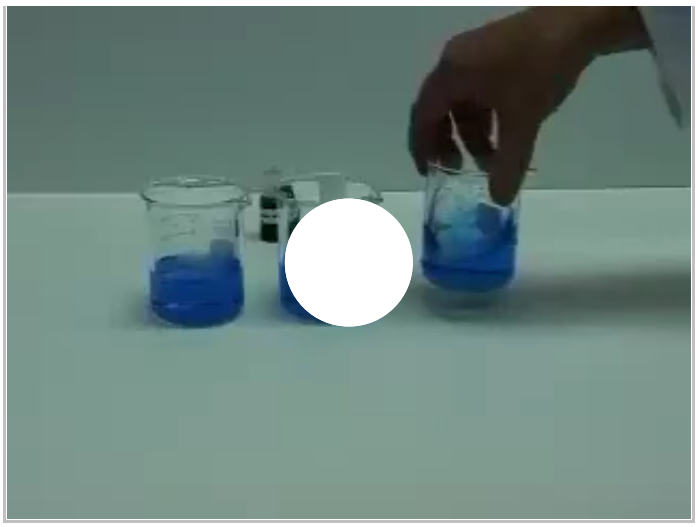


In the first video two indicators are added each of three beakers. The two indicators are bromocresol green and phenolphthalein.

1. What color is the the indicator mixture (bromocresol green and phenolphthalein) in water?

blue 100%

The color appears to be blue after adding both indicators to the beaker on the left.



In the second video 10 drops of 0.100 M HCl is added to the beaker of indicator solution on the left.

2a. What color does the indicator mixture change to after addition of 10 drops of 0.100 M HCl?

a yellowish-green ✓

The color appears to be yellow (with some greenish color) after adding 10 drops of 0.100 M HCl to the beaker on the left.

2b. What is the pH of a solution of 0.100 M HCl?

pH = 1 93%

The pH of 0.100 M HCl is

pH = -log[H^+] = -log[0.100 M] = 1.00

2c. Assuming 10 drops is approximately 0.500 mL, calculate the pH of the solution when 10 drops of 0.100 M HCl is added to 100 mL of water? (assume that adding 10 drops to 100 mLs of water does not change the volume of the new solution.). Calculate the pH of the solution in the beaker on the left.

pH = 3.30 53%

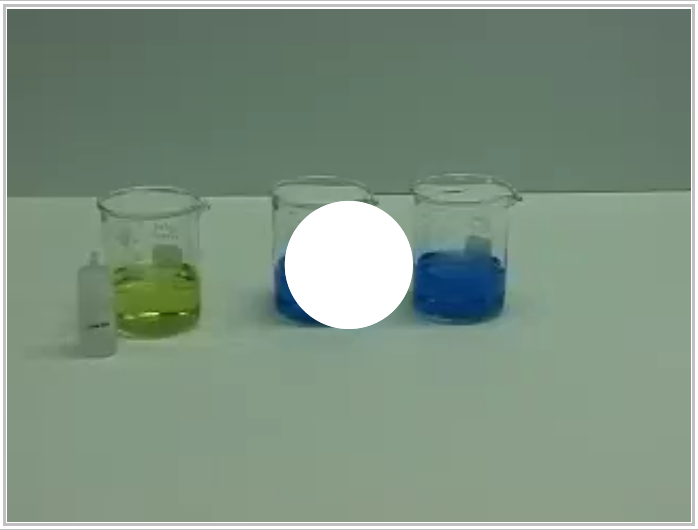
This is a simple dilution where 0.500 mL (0.00050 L) of 0.100 M HCl is diluted to 100 mL (0.100 L). So we can use the dilution relationship ($M_CV_C = M_DV_D$) to calculate the molarity upon dilution;

$M_D = M_CV_C/V_D$ = (0.00050 L * 0.100 M)/0.100 L = 0.00050 M HCl

The pH of 0.00050 M HCl is

pH = -log[H^+] = -log[0.00050 M] = 3.30

So following the addition of the 10 drops of 0.100 M HCl the pH of the solution in the beaker has changed by 2.30 pH units.



In the third video 10 drops of 0.100 M NaOH is added to the beaker of indicator solution on the right.

3a. What color does the indicator mixture change to after addition of 10 drops of 0.100 M NaOH?

dark blue to purple ✓

The color appears to be darker blue (purple?) after adding 10 drops of 0.100 M NaOH to the beaker on the left.

3b. What is the pH of a solution of 0.100 M NaOH?

pH = 13 97%

The pH of 0.100 M NaOH is

pH = -log[H^+]

For this solution we know the [OH^-] is 0.100 M,

so the [H^+] = 1 x10^{-14} / 0.100 M = 1.00 x 10^{-13} M

pH = -log[1.00 x 10^{-13} M] = 13.0

3c. Assuming 10 drops is approximately 0.500 mL, calculate the pH of the solution when 10 drops of 0.100 M NaOH is added to 100 mL of water? (assume that adding 10 drops to 100 mLs of water does not change the volume of the new solution.). Calculate the pH of the solution in the beaker on the left.

pH = 10.70 56%

This is a simple dilution where 0.500 mL (0.00050 L) of 0.100 M NaOH is diluted to 100 mL (0.100 L). So we can use the dilution relationship ($M_C V_C = M_D V_D$) to calculate the molarity upon dilution;

$M_D = M_C V_C / V_D$ = (0.00050 L * 0.100 M)/0.100 L = 0.00050 M NaOH

The pH of 0.00050 M NaOH is

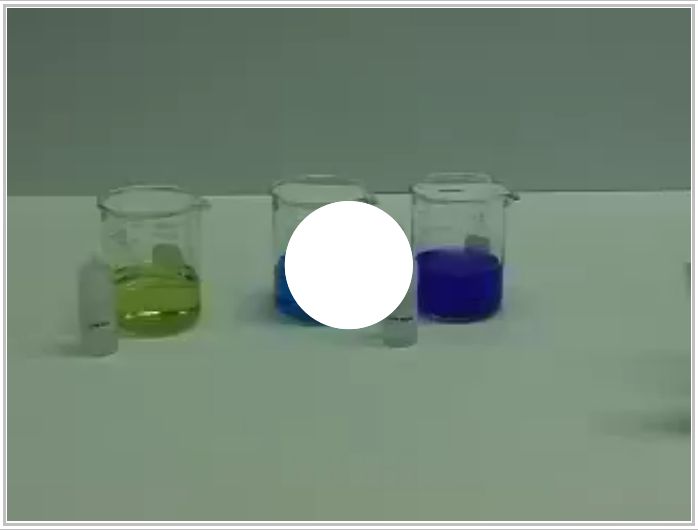
pH = -log[H^+]

For this solution we know the [OH^-] is 0.00050 M,

so the [H^+] = 1 x10^{-14} / 0.00050 M = 2.00 x 10^{-11} M

pH = -log[2.00 x 10^{-11} M] = 10.7

So following the addition of the 10 drops of 0.100 M NaOH the pH of the solution in the beaker has changed by 2.30 pH units (from 13 to 10.7).



In the fourth video half of a tablet of Alka-Seltzer is added to the beaker on the left.

4a. What color does the indicator mixture change to after addition of half of a tablet of Alka-Seltzer?

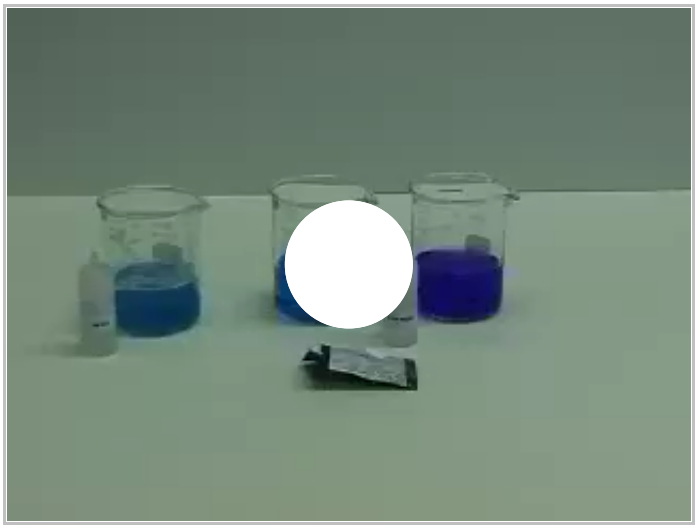
blue, similar to the beaker with indicator that has a pH close to 7

The solution in the left beaker after adding the half of a tablet of Alka-Seltzer appears to be the same as the color of the beaker in the center which only contains the indicator mixture and water. So could the pH of the solution in the beaker on the left now be close to 7?

4b. What do you think the pH of the solution in the left beaker is following the addition of half-tablet of Alka-Seltzer?

pH = close to 7 93%

The pH of the solution in the beaker on the left now appears to be be the same as the center beaker, which is close to 7.

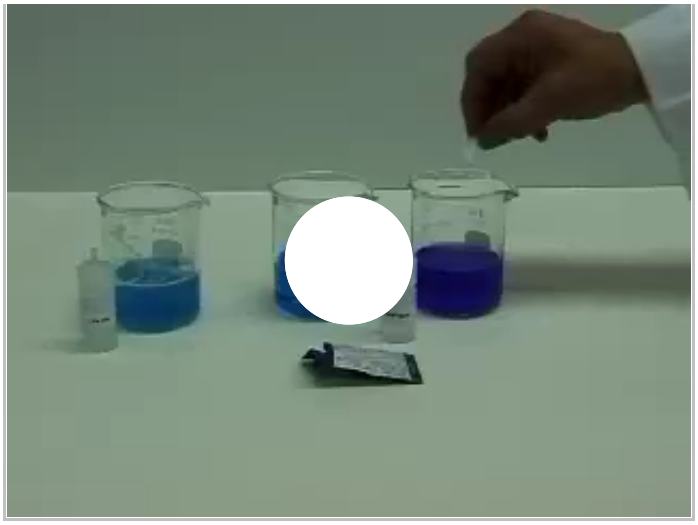


In the fifth video half of a tablet of Alka-Seltzer is going to be added to the beaker on the right.

5. Predict the color of the indicator mixture in the beaker on the right after addition of half of a tablet of Alka-Seltzer?

it will be blue like the other two solutions

Based on what happen to the beaker on the left, a reasonable prediction would be for the color of the beaker on the right to be the same as the center beaker after adding the half of a tablet of Alka-Seltzer.



In the sixth video half the half tablet of Alka-Seltzer is added to the beaker on the right.

6. What do you think the pH of the solution in the right beaker is following the addition of half-tablet of Alka-Seltzer?

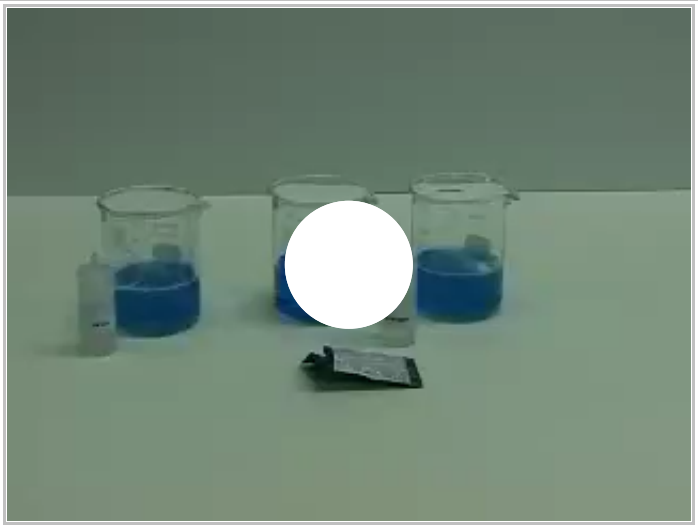
pH = 7

The pH of the solution in the beaker on the right now appears to be be the same as the center beaker, which is close to 7?

Before watching the next video, predict what you think will happen to the color of the indicator in the solution in the beaker on the left, if additional 0.100 M HCl is added.

it will remain blue for a while but eventually become yellowish green

If more HCl is added to the beaker on the left, one might expect that eventually the color of the solution will become yellow.



In the seventh video additional 0.100 M HCl is added to the beaker on the left.

7a. What happened to the color of the solution in the beaker on the left after adding more 0.100 M HCl?

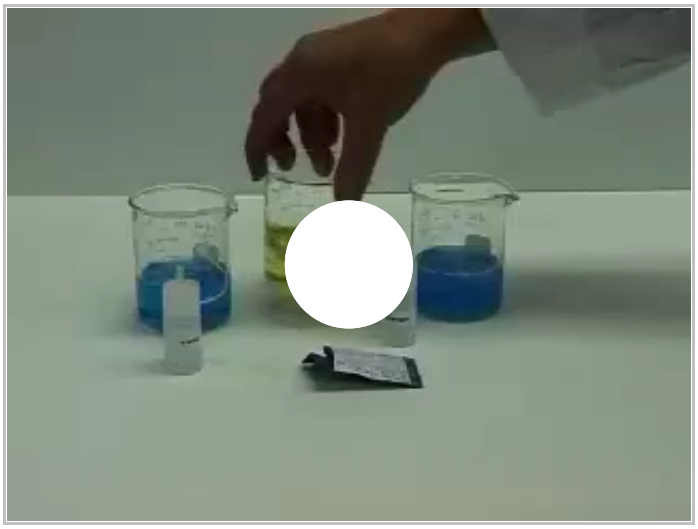
the color did not change much at all

The color of the solution did not change....it appears the pH of the solution, even after addition of much more HCl, is not changing as significantly as the initial change observed when adding HCl to pure water!

Before watching the next video, predict what you think will happen to the color of the indicator in the solution in the beaker on the right, if additional 0.100 M NaOH is added.

it will not change

Based on what happen in the case of further addition of HCl, a reasonable guess would be no color change will occur.



In the eighth video additional 0.100 M NaOH is added to the beaker on the right.

8a. What happened to the color of the solution in the beaker on the right after adding more 0.100 M NaOH?

No change in color

The color of the solution did not change....it appears the pH of the solution, even after addition of much more NaOH, is not changing as significantly as the initial change observed when adding NaOH to pure water!

9. Is there anything about the questions that you feel you do not understand? List your

concerns/questions.

nothing

10. If there is one question you would like to have answered in lecture, what would that question be?

nothing

why isn't the color changing when a sufficient amount of acid or base is added.