

Name: _____

Period: _____

Seat#: _____

Purpose: Experimentally verify the predicted and calculated pH of different salts.

Background:

A salt is the product formed when a _____ reacts with a _____. When you put a salt into water the salt can make the solution acidic, basic, or neutral. It is possible to predict whether a salt is acidic, basic, or neutral. In order to do this you must first look to see which compound the salt ions originally came from. If the ion came from a:

Strong Acid then the salt ion will make the solution _____

Strong Base then the salt ion will make the solution _____

Weak Acid then the salt ion will make the solution _____

Weak Base then the salt ion will make the solution _____

Once you have identified the property of each salt ion, you must see how they will contribute to the pH when they are both present in the same solution

Acidic ion + Neutral ion will make the solution _____

Basic ion + Neutral ion will make the solution _____

Neutral ion + Neutral ion will make the solution _____

Acidic ion + Basic ion will require that you compare _____

in order to predict if solution is acidic/basic/neutral

When you have a combination of an acidic ion and a basic ion you will need to know how “strong” each one is by comparing their K values. Below is a chart that summarizes how you can predict if the salt is acidic/basic/neutral by comparing the K values.

$K_{\text{acid}} < K_{\text{base}}$ then the salt is acidic

$K_{\text{acid}} > K_{\text{base}}$ then the salt is basic

$K_{\text{acid}} = K_{\text{base}}$ then the salt is neutral

It is one thing to theoretically predict if a salt is acidic/basic/neutral, but if you know the concentrations and K values you can calculate the actual pH of the solution. In this activity you will predict if the salt is acidic/basic/neutral but then you will also do the math and calculate the theoretical pH of the salt solution. Then you will use pH paper to verify whether or not your calculated pH matches your experimental findings.

Remember:

You may need to use $K_w = K_a \times K_b$ to do your calculations. Also remember that K_w will vary depending on the temperature of the water! K_w is only 1×10^{-14} if the water is 25 °C. Below is a general range of K_w values based on temperature in case your water is not actually at 25 °C. Pick the K_w value that is closest to the temperature of the water you are using in the lab activity. (Yes, I know it is a big range, best chart we have right now 😊)

Temp. °C	0	10	20	25	30	40	50	100
K _w	0.114×10^{-14}	0.293×10^{-14}	0.681×10^{-14}	1.008×10^{-14}	1.471×10^{-14}	2.916×10^{-14}	5.476×10^{-14}	51.3×10^{-14}

Dougherty Valley HS Chemistry
Acids & Bases – pH of Salts Verification Lab Activity

Salt #1 – 0.10 M sodium acetate, K_a for acetic acid = 1.78×10^{-5}

- 1) Write the equation for the dissociation of the sodium acetate.
- 2) Using your dissociation reaction above, predict if the salt is acidic/basic/neutral. Justify your prediction!
- 3) Calculate the theoretical $[H_3O^+]$
- 4) Calculate the theoretical $[OH^-]$
- 5) Calculate the theoretical pOH
- 6) Calculate the theoretical pH
- 7) Using pH paper, test the pH of the 0.10 M sodium acetate solution. Record your observations below.
- 8) Discuss the difference between the theoretical pH calculation and the experimentally determined pH from the lab.

Dougherty Valley HS Chemistry
Acids & Bases – pH of Salts Verification Lab Activity

Salt #2 – 0.10 M sodium bicarbonate, K_a for carbonic acid = 4.30×10^{-7}

- 1) Write the equation for the dissociation of the sodium bicarbonate.
- 2) Using your dissociation reaction above, predict if the salt is acidic/basic/neutral. Justify your prediction!
- 3) Calculate the theoretical $[H_3O^+]$
- 4) Calculate the theoretical $[OH^-]$
- 5) Calculate the theoretical pOH
- 6) Calculate the theoretical pH
- 7) Using pH paper, test the pH of the 0.10 M sodium bicarbonate solution. Record your observations below.
- 8) Discuss the difference between the theoretical pH calculation and the experimentally determined pH from the lab.

Dougherty Valley HS Chemistry
Acids & Bases – pH of Salts Verification Lab Activity

Salt #3 – 0.10 M ammonium chloride, K_b for ammonia = 1.8×10^{-5}

- 1) Write the equation for the dissociation of the ammonium nitrate.
- 2) Using your dissociation reaction above, predict if the salt is acidic/basic/neutral. Justify your prediction!
- 3) Calculate the theoretical $[H_3O^+]$
- 4) Calculate the theoretical $[OH^-]$
- 5) Calculate the theoretical pOH
- 6) Calculate the theoretical pH
- 7) Using pH paper, test the pH of the 0.10 M sodium chloride solution. Record your observations below.
- 8) Discuss the difference between the theoretical pH calculation and the experimentally determined pH from the lab.