

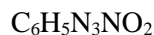
## Acid-Base and Buffers Conceptual Questions

Concentration (M)	pH of Acid 1	pH of Acid 2	pH of Acid 3	pH of Acid 4
0.010	3.44	2.00	2.92	2.20
0.050	3.09	1.30	2.58	1.73
0.10	2.94	1.00	2.42	1.55
0.50	2.69	0.30	2.08	1.16
1.00	2.44	0.00	1.92	0.98

- The table above shows the acids of, in no order, chlorous, hydrochloric, lactic, and propanoic acid.
  - Which acid would have the smallest  $K_a$ ?
  - Which of the four acids listed is Hydrochloric Acid?
  - In the dissociation of 1.0 M solution of acid 1, what species is the most concentrated at equilibrium?
  - If equal volumes of the acids at a concentration of 1.00 M are titrated with a strong base, which will require the greatest volume of base to reach the equivalence point?

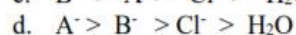
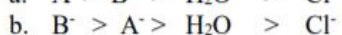
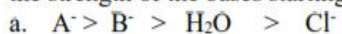
- As the concentration of a weak acid increases, its percent dissociation (increases/decreases/stays the same) and the pH (increases/decreases/stays the same)
- Which of the following ions will act as a weak base in water?
  - $\text{ClO}^-$
  - $\text{Cl}^-$
  - $\text{NO}_3^-$
  - $\text{OH}^-$

- Will the following salts form a solution that is acidic, basic, or pH-neutral?

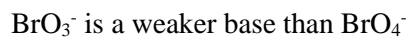


- Rank by strength of acid:  $\text{NaCl}$ ,  $\text{NaHCO}_3$ ,  $\text{NH}_4\text{Cl}$ ,  $\text{NH}_4\text{ClO}$ ,  $\text{NaOH}$ ,  $\text{KOH}$
- James adds some solid sodium acetate,  $\text{NaC}_2\text{H}_3\text{O}_2$ , to aqueous  $\text{HC}_2\text{H}_3\text{O}_2$ . What will happen to the pH?

HA and HB are both weak acids in water, and HA is a stronger acid than HB. Which of the following correctly ranks the strength of the bases starting with the strongest?



- True or False:

an aqueous solution of  $\text{CH}_3\text{NH}_3\text{Cl}$  is acidican aqueous solution of  $\text{Cu}(\text{ClO}_4)_2$  is basican aqueous solution of  $(\text{CH}_3)_3\text{NHNO}_2$  is acidic

- Which is a stronger base?  $\text{S}^{2-}$  vs  $\text{Se}^{2-}$  and  $\text{PO}_4^{3-}$  vs  $\text{AsO}_4^{3-}$

- Which of the anions below would be the strongest base?



## General Chemistry 233 Quiz 2

10) Alex wants to create a buffer for NaF. Which will be the best choice for a buffer solution for this compound?

NaF                      HCl                       $K(C_2H_3O_2)$                        $NH_3$                       NaOH

11) Given equal volumes of 0.10M HCl and another compound, which will produce a buffer solution?

0.05M NaOH    0.05M  $NH_4Cl$     0.20M NaCl    0.10M  $NH_3$     0.20M  $CH_3COOH$

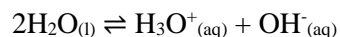
12) James has a phosphate buffer ( $H_2PO_4^-/HPO_4^{2-}$ ) and records a pH of 8.3. Which of the following will cause the pH of this buffer to increase?

- I. Adding a small amount of dilute hydrochloric acid, HCl
- II. Adding a small amount of dilute phosphoric acid,  $H_3PO_4$
- III. Dissolving a small amount of disodium phosphate,  $Na_2HPO_4$
- IV. Dissolving a small amount of monosodium phosphate,  $NaH_2PO_4$
- V. Making it more concentrated by removing some water

13) James is having acid reflux, and so Parker suggests he ingests bleach to neutralize stomach acid. If concentrated chlorine bleach has a pH of 13, what is the ratio of concentration of hydronium ions of bleach to that of pure water at room temperature?

14) Phosphate,  $H_3PO_4$  is present in cells. What is the predominant form of phosphate in cells if at a physiological pH of 7.0?                       $pK_{a1}=2.1$                        $pK_{a2}=7.21$                        $pK_{a3}= 12.87$

15) Water goes through autoionization as shown below



The temperature is raised, and a data table is listed below:

Temperature (C)	$pK_w$
0	14.9
10	14.5
20	14.2
30	13.8
40	13.5

- 1) Based on the information, which of the following statements must be true?
  - a) The dissociation of water is an exothermic process
  - b) The pH of pure water is 7.00 at any given temperature
  - c) As the temperature increases the pH of pure water increases
  - d) As the temperature increases, the pH of pure water decreases

## General Chemistry 233 Quiz 2

### Acid-Base and Buffers Calculations

(some values may need to be looked up)

- 1) After an experiment, Marky finds the concentration of  $\text{CO}_3^{2-}(\text{aq})$  to be 0.150M.  $K_a$  is  $5.6 \times 10^{-11}$

Find the pH and pOH

- 2) A 25.00 mL sample of 0.320 M NaOH analyte was titrated with 0.750 M HI at 25 C.

a). Calculate the initial pH before any titrant was added.

b). Calculate the pH of the solution after 5.00 mL of the titrant was added.

- 3) Is a pH with a solution of 7.00 acidic, basic, or neutral for a neutral aqueous solution at 37 degrees C given that the  $K_w$  for water at this temperature is  $2.4 \times 10^{-14}$ ?

- 4) Determine the pH of a solution that is 0.250 M in  $\text{HCO}_3^-$

- 5) Determine the pH of 0.20 M  $\text{NaCHO}_2$  solution

- 6) What is the pH of 2.5 M KI in solution?

## General Chemistry 233 Quiz 2

7) What concentration of salt should be used to create a buffer with pH of 10.24 that uses 0.8M methylamine?  
 $\text{CH}_3\text{NH}_2$

8) 80.0 mL of a buffer solution contains 0.169 M  $\text{NH}_3$  and 0.183 M  $\text{NH}_4\text{Cl}$ . If you add 10.0 mL of 0.100 M HCl, what will be the pH?  $K_b = 1.81 \times 10^{-5}$ . Assume additive volumes.

9) Blood is buffered by carbonic acid,  $\text{H}_2\text{CO}_3$  ( $\text{pK}_a = 6.1$ ). Assuming that the volume of blood in an adult is 5 liters, what mass of HCl can be neutralized by the buffer before the system reaches a fatal pH of below 7.0?

10) What mass of ammonium chloride should be added to 2.55 L of 0.155 M  $\text{NH}_3$  to obtain a buffer with pH of 9.55?

11) A 1.0 liter 1.0M buffer solution ( $\text{pH} = 4.7$ ) using Jamesonnum acid (JH) is mixed with another Jamesonnum buffer solution ( $\text{pH} = 4.55$ ) that is 0.50 liter and 0.5 M. What is the pH of this mixture after 1.0 liter of 0.1M HA strong acid is added?  $K_a$  of Jamesonnum is  $1.58 \times 10^{-5}$