Dougherty Valley HS Chemistry - AP
Acid Base – Extra Practice

Worksheet #6*

Name: **Period:** **Seat#:**

Directions: Any worksheet that is labeled with an * means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website…and the entire internet! See me if you need help finding practice on a topic you are struggling with.

$$pK_a = -\log(K_a) \qquad K_a = \frac{[H^+][A^-]}{[HA]} \qquad [H^+] = \frac{K_a[A^-]}{[HA]}$$

$$pH = pK_a + log\left(\frac{[salt\ form]}{[acid\ form]}\right) \qquad pOH = pK_b + log\left(\frac{[salt\ form]}{[base\ form]}\right)$$

DESMOS ONLINE PRACTICE
Someone shared some online flashcards, card sorting, self grading practice for Acid Base topics with me in a website called Desmos. If you would like to use them please go to **student.desmos.com** The join code is: _____

CHEM COLLECTIVE ACID BASE PRACTICE
https://tinyurl.com/29x6yup8

Some Ka and Kb values to use for these problems
Remember the values can be slightly different so always use the ones given to you. Sometimes the values are even made up by random number generating function in the problem generator! Also remember these problems are annoying because a tiny bit of rounding somewhere can make your answer look pretty different!

Acetic acid	Ka = 1.8 x 10^{-5}	Ammonia	Kb = 1.77 x 10^{-5}
Anisic acid	Ka = 3.38 x 10^{-5}	Nicotine (a base)	Ka = 3.16 x 10^{-9}
Methylamine	Kb = 4.38 x 10^{-4}		

1) A buffer is prepared containing 0.800 M acetic acid and 1.00 M sodium acetate. What is its pH? *4.849*

2) A buffer is prepared containing 0.700 M anisic acid and 0.300 M sodium anisate. What is its pH? *4.103*

3) A buffer is prepared containing 1.00 M nicotine and 1.00 M nicotine hydrochloride. What is its pH? *8.50*

4) Aspirin has pKa of 3.4. What is the ratio of A^- to HA in:
- **a.** the blood (pH = 7.4) *10^4 = 10000 = $[A^-]/[HA]$*
- **b.** the stomach (pH = 1.4) *10^{-2} = 0.01 = $[A^-]/[HA]$*

***General comment about the solutions**: You have to find the ratio between A^- and HA so the concentrations are not needed*

5) Calculate pH of 50.00 mL of 0.1800 M NH_3 solution (K_b = 1.77 x 10^{-5}) is being titrated with 0.3600 M HCl.
- **a.** initially *11.252*
- **b.** After the addition of 5.00 mL of HCl *9.850*
- **c.** After the addition of a total volume of 12.50 mL HCl *9.248*
- **d.** After the addition of a total volume of 25.00 mL of HCl *5.084*
- **e.** After the addition of 26.00 mL of HCl *2.324*

6) Calculate the ratio of CH_3NH_2 to CH_3NH_3Cl required to create a buffer with pH = 10.14 *base/acid ratio = 0.313*

7) A buffer is prepared with 1.00 molar anisic acid and 1.00 molar sodium anisate. What is its pH? *4.471*

8) A buffer is prepared containing 0.800 M ammonia and 1.00 M ammonium chloride. What is its pH? *9.151*

9) A buffer is prepared containing 0.700 molar nicotine and 0.300 molar nicotine hydrochloride. What is its pH? *8.389*

10) You need to produce a buffer solution that has a pH of 5.27. You already have a solution that contains 10.0 mmol (millimoles) of acetic acid. How many millimoles of sodium acetate will you need to add to this solution? The pK_a of acetic acid is 4.75. *33.1 millimoles of sodium acetate*

11) 1.00 L of a sol'n containing 0.0500 mole of HAc and 0.100 mole of NaAc is prepared. Ignore the autoionization of water for the purposes of this Q - for part B only. The K_a of HAc equals 1.77 x 10^{-5}
- **a.** Calculate the reaction quotient, Q for the initial condition. *Q_a = 2.00 x 10^{-7}*
- **b.** Which way will the reaction shift?
- **c.** Calculate to 3 significant digits the pH of this solution *pH = 5.053*

12) Fifty percent of a weak acid is in an ionized form in a solution with pH of 5.000, what is the pKa value for the weak acid? *pH = pKa*

13) Which of the following are examples of buffer solutions? Select all that apply.
- **a.** 0.1M NaF, 0.15M HF
- **b.** 0.2M CH3COOH, 0.15M LiF
- **c.** 0.25M HCl, 0.25M KCl
- **d.** 0.1M $C_2H_5NH_2$, 0.15M $C_2H_5NH_3Br$

For Questions #14 – 19, 21, 23, 24 Which method best demonstrates how the pH could be determined for the following solution:
- **a.** Just weak acid, $K_a = x^2/[HA]$
- **b.** Just weak base, $K_b = x^2/[A^-]$
- **c.** Buffer, $K_a = [x][A^-]/[HA]$
- **d.** Strong acid dominant, $[H^+]$ = HX
- **e.** Strong base dominant, $[OH^-]$ = MOH

14) 0.100 M NaF and 0.150 M HF

15) 0.100 M NaF and 0.150 M KF

16) 0.100 M HCl and 0.150 M HF

17) 0.100M HNO_2

18) 0.100M $HONH_3Br$

19) 0.100M HF ($K_a = 7.2 \times 10^{-4}$)
and 0.150M H2S ($K_a = 1.0 \times 10^{-7}$)

20) Which of the following mixtures would result in a buffer? (*hint* Pay attention to whether the substances listed will a) react with one another, b) be in equilibrium with one another, or c) simply coexist in solution. Select all that apply.

- **a.** 0.1 mol HF, 0.1 mol NaF
- **b.** 0.2 mol HCl, 0.3 mol NaF
- **c.** 0.2 mol HCl, 0.1 mol NaF
- **d.** 0.2 mol HF, 0.1 mol NaOH
- **e.** 0.2 mol HF, 0.3 mol NaOH

21) 0.2 mol HCl, 0.1 mol NaF

22) Which of the following mixtures would result in a buffer? (*hint* Pay attention to whether the substances listed will a) react with one another, b) be in equilibrium with one another, or c) simply coexist in solution. Select all that apply.

- **a.** 0.1 mol HNO_2, 0.1 mol HCl
- **b.** 0.2 mol NaOH, 0.3 mol NaF
- **c.** 0.2 mol $NaNO_2$, 0.1 mol HNO_2
- **d.** 0.2 mol NaOH, 0.1 mol HNO_2
- **e.** 0.2 mol $NaNO_2$, 0.1 mol HCl

23) 0.2 mol $NaNO_2$, 0.1 mol HNO_2

24) 0.2 mol NaOH, 0.1 mol HNO_2

25) Which mixture would likely buffer at an acidic pH? (*hint* Think about calculating the pH of each mixture with an ICE table. What equations and what #'s would you use? What kind of pH would result if the amount of each are approximately equal?)

- **a.** HA ($K_a = 1.5 \times 10^{-3}$) and A^- ($K_b = 6.7 \times 10^{-10}$)
- **b.** HB ($K_a = 1.2 \times 10^{-7}$) and B^- ($K_b = 8.3 \times 10^{-8}$)
- **c.** HC ($K_a = 7.2 \times 10^{-11}$) and C^- ($K_b = 1.4 \times 10^{-4}$)

13) A, D
14) C
15) B
16) D
17) A
18) A
19) A
20) A, B, D
21) D
22) C, E
23) C
24) E
25) A

EVEN MORE PRACTICE! Hard work now during the chapter will set you up for success and save you time long term! Make smart, mature choices!

26) Consider doing some of the Honors Chem worksheets! *(You would be surprised how many AP Chem students miss points on exams for Honors level questions and not even the AP level questions! You will hear me all year long saying "don't lose points in AP Chem for Honors level material!")*
https://mychemistryclass.net/HCrainbowpacket14.html

27) Read, take notes, try some problems from your Tro online Textbook. *(Remember that the textbook often covers more material than we need for this class. If it isn't something I talked about in my lectures/handouts/ worksheets, then you can skip it! I won't officially assign reading or problems from the textbook because it isn't a very efficient way to teach this class, but some students might need to read the textbook sections, or do extra practice in order for things to "click" differently for them. That is ok! Not everyone is going to need the same amount or type of studying. A lot of this class is figuring out what you personally need to do in order to feel successful. You will have access to the textbook all year, don't forget about it!)*
Chapter 16: Acids and Bases
mlm.pearson.com/northamerica/masteringchemistry/

28) Don't forget that there is extra practice on the class website too! AP Chem Tab → Study Materials Link → Scroll to the chapter we are on → Extra Study Materials Link. *(I don't always have answer keys for the extra materials. If there is one, it will be in the folder!)*

29) Don't forget that there is extra practice on GoFormative too! www.goformative.com
(Another teacher made some assignments on GoFormative the year the school was Remote due to Covid. I have not proofread all the remote assignments, but I have published them so they are available for you to try if you would like!)

30) Don't forget that there is extra practice on AP Classroom too! https://myap.collegeboard.org
(AP Classroom is a bit clunky, doesn't allow me to easily post questions in the order we go, sometimes crashes, still has old material we no longer cover, etc. BUT it is a source of questions that we know came from College Board! You can use the "tags" I made to pull up practice that is just on the chapter you are interested in studying.)

31) ScienceGeek.net has some good online practice tests. I haven't checked all of them, but the ones I have checked are pretty good!
https://www.sciencegeek.net/APchemistry/APtaters/directory.shtml

32) Don't forget that you can sign up for my Access periods! You must sign up by Tuesday 8am of the week you want to attend. The links are on the front page of my class website and at the top of my Class Calendar.

33) Don't forget that our school has free peer tutoring available through the Academic Leadership class! The links are on the top of my Class Calendar