

Chemistry 105 B  
Exam 2  
7/21/08  
Dr. Jessica Parr

First Letter of  
last Name

PLEASE PRINT YOUR NAME IN BLOCK LETTERS

Name: \_\_\_\_\_

Last 4 Digits of USC ID: KEN

Lab TA's Name: \_\_\_\_\_

Question	Points	Score	Grader
1	20		
2	8		
3	18		
4	10		
5	16		
6	8		
7	10		
8	10		
<b>Total</b>	<b>100</b>		

**Please Sign Below:**

I certify that I have observed all the rules of Academic Integrity while taking this examination.

Signature: \_\_\_\_\_

**Instructions:**

1. You must show work to receive credit.
2. If necessary, please continue your solutions on the back of the preceding page (facing you).
3. YOU MUST use black or blue ink. (No pencil, no whiteout, no erasable ink.)
4. There are 9 problems on 9 pages. Please count them before you begin. A periodic table and some useful equations can be found on the last page.
5. Good luck!! =)

1. (20 pt) Answer the following multiple choice questions.

i. At  $0^\circ\text{C}$   $K_w$  is  $1.2 \times 10^{-15}$ . The pH of pure water at  $0^\circ\text{C}$  is:

- a. 7.00      b. 6.88      c. 7.56      d. 7.46

ii. Which of the following is not true for a solution at  $25^\circ\text{C}$  that has a hydroxide concentration of  $2.5 \times 10^{-6} \text{ M}$ ?

- a.  $K_w = 1 \times 10^{-14}$       b. The solution is acidic  
c. The solution is basic      d. The  $[\text{H}^+]$  is  $4 \times 10^{-9} \text{ M}$   
e. The  $K_w$  is independent of what the solution contains.

iii. Which of the following species, when dissolved in  $\text{H}_2\text{O}$ , will not produce a basic solution?

- a.  $\text{SO}_2$       b.  $\text{NH}_3$       c.  $\text{BaO}$       d.  $\text{Ba}(\text{OH})_2$       e. none of these

iv. If the  $K_a$  for  $\text{HCN}$  is  $6.2 \times 10^{-10}$ , what is  $K_b$  for  $\text{CN}^-$ ?

- a.  $6.2 \times 10^{-24}$       b.  $6.2 \times 10^4$       c.  $1.6 \times 10^{-5}$       d.  $1.6 \times 10^{23}$

v. Which of the following aqueous solutions will have the highest pH? For  $\text{NH}_3$ ,  $K_b = 1.8 \times 10^{-5}$ ; for  $\text{C}_2\text{H}_3\text{O}_2^-$ ,  $K_b = 5.6 \times 10^{-10}$ .

- a. 2.0 M  $\text{NaOH}$       b. 2.0 M  $\text{NH}_3$       c. 2.0 M  $\text{HC}_2\text{H}_3\text{O}_2$   
d. 2.0 M  $\text{HCl}$       e. all the same

vi. Calculate the pH of a 0.10 M solution of  $\text{Ca}(\text{OH})_2$ .

- a. 13.3      b. 13.0 M      c. 0.2      d. 0.1

vii. For the stepwise dissociation of aqueous  $\text{H}_3\text{PO}_4$ , which of the following is not a conjugate acid-base pair?



viii. The equilibrium constant for the reaction:  $\text{A}^-_{(\text{aq})} + \text{H}^+_{(\text{aq})} \leftrightarrow \text{HA}_{(\text{aq})}$  is defined as:

a.  $K_a$

b.  $K_b$

c.  $1/K_a$

d.  $K_w/K_b$

e.  $K_wK_a$

ix. The pH of a 1.0 M aqueous solution of NaCl is:

a. equal to 7.00

b. greater than 7.00

c. less than 7.00

d. not enough information provided

x. The pH of a 1.0 M aqueous solution of  $\text{NH}_4\text{Br}$  is:

a. equal to 7.00

b. greater than 7.00

c. less than 7.00

d. not enough information provided

2. (8 pt) The equilibrium constants ( $K_a$ ) for HCN, HF and HOBr in  $\text{H}_2\text{O}$  at 25 °C are  $6.2 \times 10^{-10}$ ,  $7.2 \times 10^{-4}$ , and  $2.5 \times 10^{-9}$ , respectively. Give the relative order of base strengths from least to greatest.

