

## AP Chemistry: 14.5-14.6 Classwork

**Directions:** Calculate the following on your own paper. Write your final answer on the line and staple your work to the back.

1. What is the pH of a 0.25 M solution of HF if the  $K_a = 6.8 \times 10^{-4}$ ? 1.89
  
2. If the pH of  $\text{HC}_3\text{H}_5\text{O}_2$  is 4.2 and the  $K_a = 1.34 \times 10^{-5}$ 
  - a. What is the equilibrium concentration of  $\text{HC}_3\text{H}_5\text{O}_2$ ?  $2.97 \times 10^{-4} \text{ M}$
  - b. What was the initial concentration of  $\text{HC}_3\text{H}_5\text{O}_2$  before dissociation?  $3.6 \times 10^{-4} \text{ M}$

$[H^+] = 10^{-4.2} + (2.97 \times 10^{-4}) = \rightarrow$
  
3. If the pH is 12.2 what was the initial concentration of the base? /
  
4. 0.50 M  $\text{NH}_3$  has a  $K_b = 1.8 \times 10^{-5}$ 
  - a. What is the concentration of  $\text{OH}^-$  at equilibrium? 0.0030 M
  - b. What is the pOH of this solution? 2.52
  - c. What is the pH of this solution? 11.48
  
5. If the pH of a weak base solution is 9.5 and the original concentration of base was 0.30 M
  - a. What is the pOH? 4.5
  - b. What is the concentration of  $\text{OH}^-$ ?  $3.16 \times 10^{-5} \text{ M}$
  - c. What is the equilibrium concentration of the base? 0.30 M
  - d. What is the  $K_b$  of the base?  $3.3 \times 10^{-9}$
  
6. If the pH is equal to 8.7 and the  $K_b = 9.6 \times 10^{-7}$ .  
 What was the original concentration of the base?  $3.1 \times 10^{-5}$

$$\text{pOH} = 5.3$$

$$[\text{OH}^-] = 5.0 \times 10^{-6} \text{ M}$$

$$9.6 \times 10^{-7} = \frac{(5.0 \times 10^{-6})^2}{x}$$

$$x = 2.6 \times 10^{-5} \text{ M}$$

add

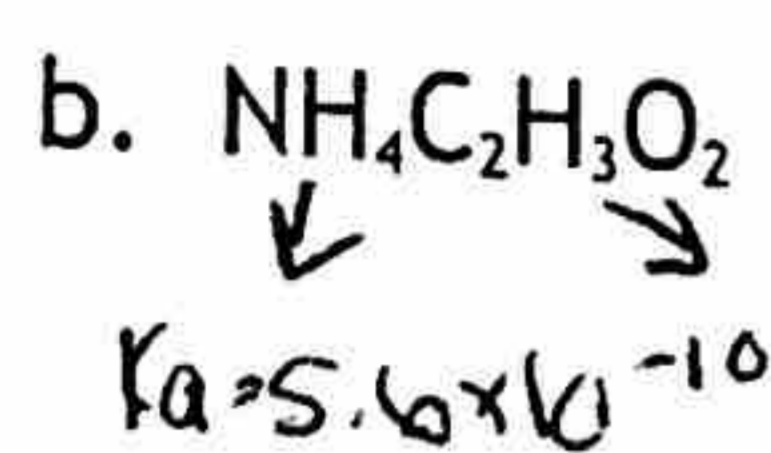
AP Chemistry: Acid-Base Properties of Salts Classwork

1. A salt is basic if the anion is the conjugate base of a weak acid
2. A salt is acidic if the cation is the conjugate acid of a weak base, highly charged cation
3. A salt is neutral if cation of strong base + anion of strong acid

4. Are solutions of the following salts acidic, basic, or neutral?

a. KCl

neutral

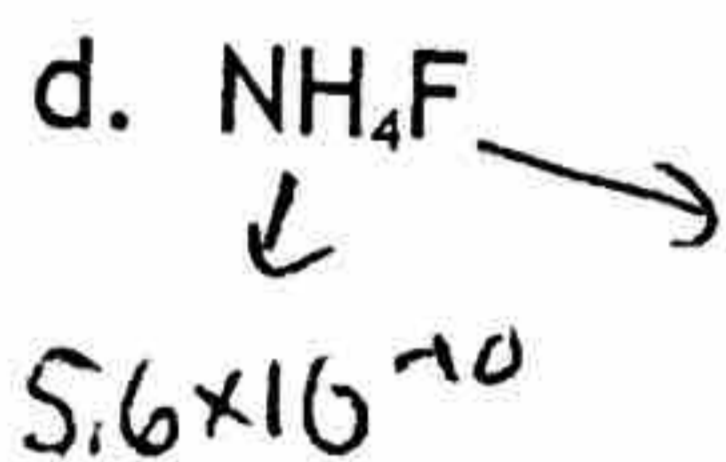


$K_b = \frac{1.0 \times 10^{-14}}{1.8 \times 10^{-5}} = 5.6 \times 10^{-10}$   
 $K_a = K_b$

neutral

c. KF

basic



$K_b = \frac{1.0 \times 10^{-14}}{3.5 \times 10^{-4}} = 2.86 \times 10^{-11}$   
 $K_a > K_b$

acidic

5. Calculate the pH of 0.12M  $\text{KNO}_2$



I	.12	/	0	0
C	-x	/	+x	+x
E	.12-x	/	x	x

$K_a = 4.6 \times 10^{-4}$

$K_b = \frac{1.0 \times 10^{-14}}{4.6 \times 10^{-4}} = 2.17 \times 10^{-11} = \frac{x^2}{.12}$

$\text{pOH} = 5.79$

$\text{pH} = 8.21$

8.21

$x = 1.62 \times 10^{-6} \text{ M} = [\text{OH}^-]$

6. Calculate the pH of a 0.45M  $\text{NaOCl}$



I	.45	/	0	0
C	-x	/	+x	+x
E	.45-x	/	x	x

$K_a = 3.0 \times 10^{-8}$

$K_b = \frac{1.0 \times 10^{-14}}{3.0 \times 10^{-8}} = 3.3 \times 10^{-7}$

$3.3 \times 10^{-7} = \frac{x^2}{.45}$

$x = 3.87 \times 10^{-4} \text{ M} = [\text{OH}^-]$

$\text{pOH} = 3.41$

$\text{pH} = 10.59$

10.59

## 14.9 Classwork: Effect of Structure on the Properties of Acids & Bases

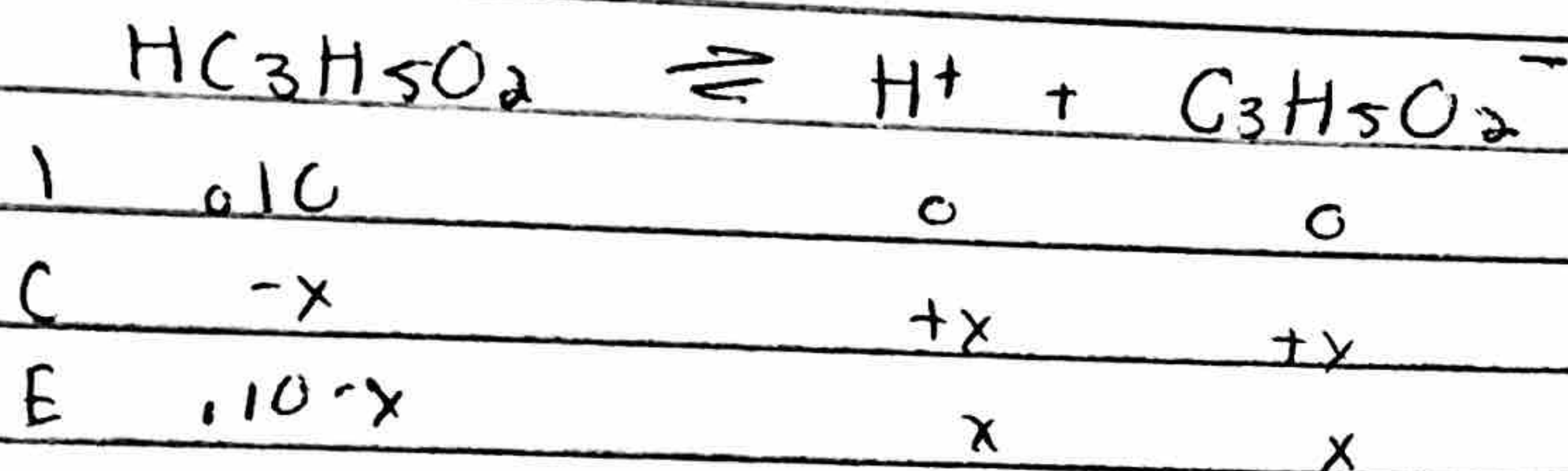
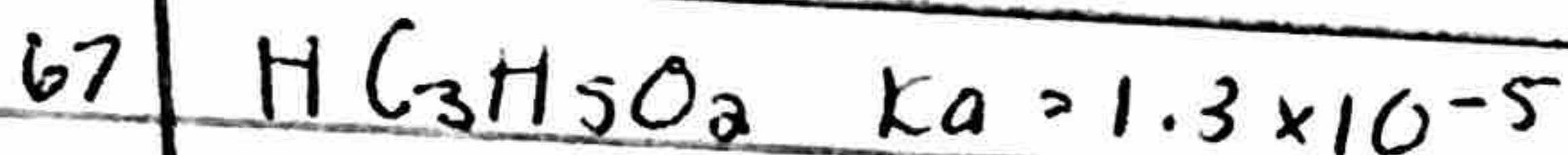
1. State which of following in each pair is the stronger acid. Justify your answer.

- a)  $\text{HCl}$ ,  $\text{HBr}$  more polar bond  
b)  $\text{HCl}$ ,  $\text{H}_2\text{S}$  more polar bond  
c)  $\text{HClO}_3$ ,  $\text{HBrO}_3$  more polar bond  
d)  $\text{H}_3\text{PO}_4$ ,  $\text{H}_3\text{PO}_3$  more oxygens  
e)  $\text{HNO}_2$ ,  $\text{HNO}_3$  more oxygens  
f)  $\text{HOBr}$ ,  $\text{HOI}$  more polar bond  
g)  $\text{H}_2\text{CO}_3$ ,  $\text{H}_2\text{SiO}_3$  more polar bond  
h)  $\text{H}_3\text{AsO}_4$ ,  $\text{H}_3\text{AsO}_3$  more oxygens  
i)  $\text{H}_3\text{AsO}_4$ ,  $\text{H}_3\text{PO}_4$  more polar bond  
j)  $\text{H}_2\text{Te}$ ,  $\text{H}_2\text{Se}$  more polar bond

2. Will the following oxides give acidic or basic solutions?

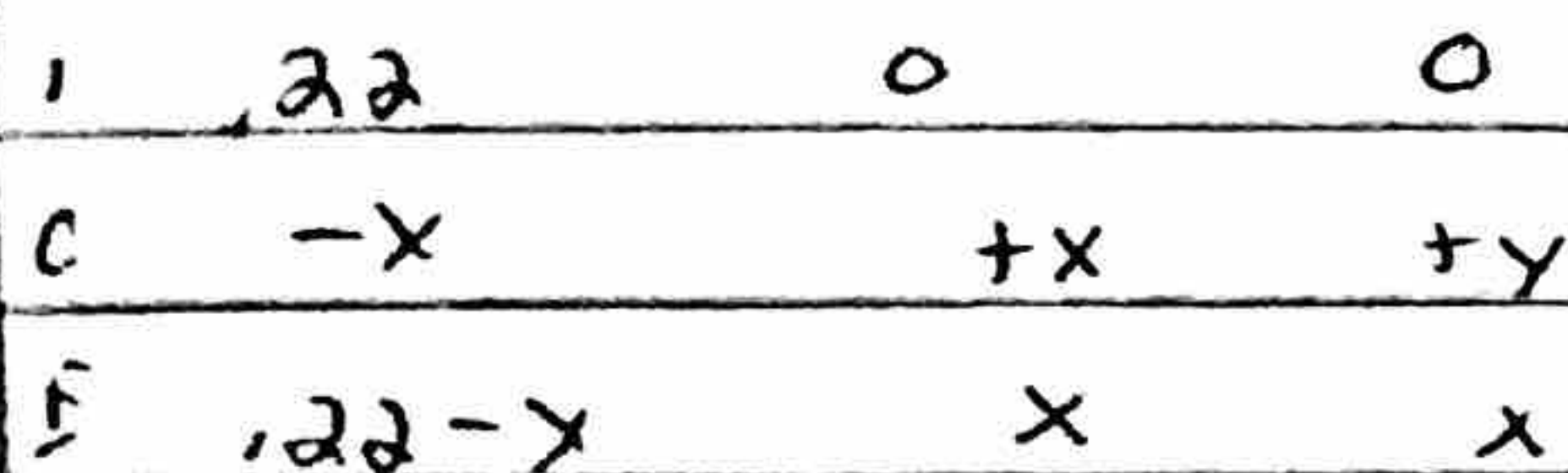
- a)  $\text{Li}_2\text{O}$  basic  
b)  $\text{CO}_2$  acidic  
c)  $\text{SrO}$  basic  
d)  $\text{SO}_2$  acidic  
e)  $\text{NO}_2$  acidic  
f)  $\text{BaO}$  basic

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$$1.3 \times 10^{-5} = \frac{x^2}{.10}$$

$x = .0011 \text{ M} = [\text{H}^+]$   
 $\text{pH} = -\log(.0011) = 2.94$   
 $\frac{.0011}{.1} \times 100 = 1.1\%$



$$1.2 \times 10^{-2} = \frac{x^2}{.22}$$

$x = .0514 \text{ M} = [\text{H}^+]$   
 $\text{pH} = -\log(.0514) = 1.29$   
 $\frac{.0514}{.22} \times 100 = 2.33\%$

69  $K_a = ?$

3.0% dissociated

.15 M solution

$$\frac{x}{.15} \times 100 = 3.0$$

$$x = .0045 \text{ M}$$

$K_a = \frac{(.0045)^2}{.15}$        $K_a = 1.35 \times 10^{-4}$