

Assume all solutions are aqueous at 25°C.  $K_w = 1.0 \times 10^{-14}$

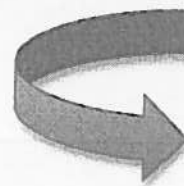
1. A 0.10M solution of  $H_2SO_4$  will have a pH (circle your choice): (5 pts)

- a) equal to 1.00
- b) equal to .70
- c) slightly greater than 1.00
- d) slightly less than 1.00

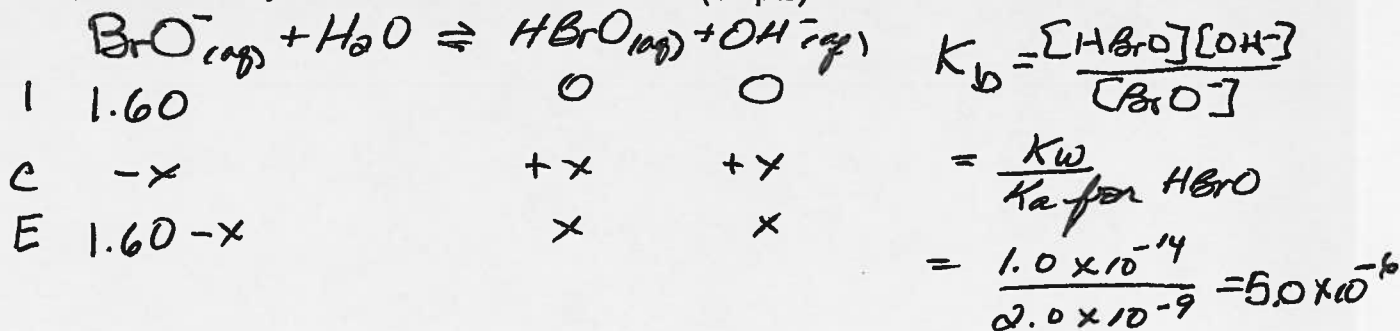
diprotic  $K_{a1}$  very large  
 $K_{a2}$  } weak acid  $\sim 10^{-2}$

2. Consider aqueous solutions of each of the following salts. Indicate if they will be acidic, basic or neutral. For each non-neutral solution, write the net-ionic chemical reaction that affects the pH. Be sure to include physical states (l, aq, etc.), any charges on ions, and double or single arrows as needed. (15 pts)

	<u>Acidic, basic or neutral</u>	<u>Chemical reaction, if non-neutral</u>
a) $NH_4Cl$	<u>acidic</u>	<u><math>NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)</math></u>
b) $NaF$	<u>basic</u>	<u><math>F^-(aq) + H_2O(l) \rightleftharpoons HF(aq) + OH^-(aq)</math></u>
c) $LiI$	<u>neutral</u>	<u>_____</u>



3. Calculate the pH of a 1.60 M KBrO solution.  $K_a$  for hypobromous acid, HBrO, is  $2.0 \times 10^{-9}$ . Be sure to include a chemical reaction, ICE table, equilibrium constant expression and your method to receive credit. (10 pts)



$$\frac{(x)(x)}{1.60-x} = 5.0 \times 10^{-6}$$

*assume x is small  
bc K is small*

$$x^2 = 5.0 \times 10^{-6} (1.60) = 8.0 \times 10^{-6}$$

$$x = 2.8 \times 10^{-3}$$

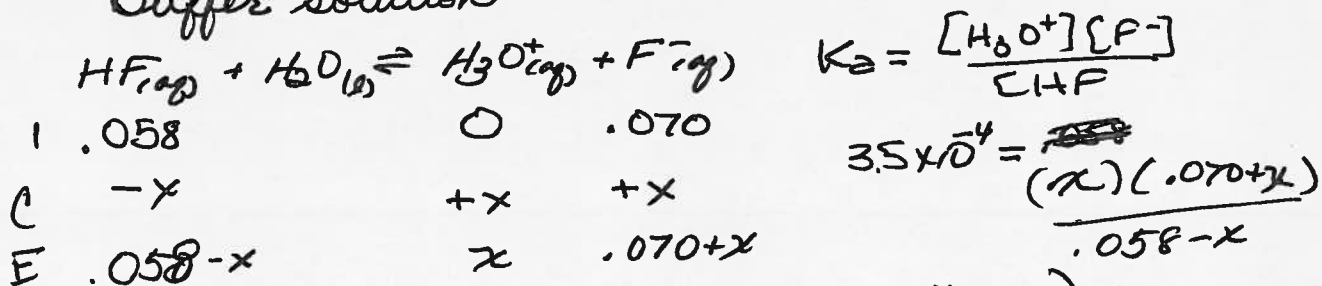
$1.60 - 2.8 \times 10^{-3} = 1.60$

$$[\text{OH}^-] = 2.8 \times 10^{-3}$$

$$\text{pOH} = 2.55; \text{pH} = 14.00 - 2.55 \quad \text{Ans. pH} = \underline{11.45}$$

4. Calculate the pH of a solution that contains 0.058 M HF and 0.070 M LiF. The  $K_a$  for HF is  $3.5 \times 10^{-4}$ . Clearly show your method, (including chemical reactions, an ICE table, etc. or a clear method) for partial credit. (10 pts)

*buffer solution*



*Assume x will be small,  $.070+x \approx .070$   
 $.058-x \approx .058$*

$$3.5 \times 10^{-4} = \frac{(x)(.070)}{.058}$$

$$x = \frac{3.5 \times 10^{-4} (.058)}{.070} = 2.9 \times 10^{-4}$$

$$x = [\text{H}_3\text{O}^+] = 2.9 \times 10^{-4}, \text{pH} = -\log [\text{H}_3\text{O}^+] = 3.54$$

*Henderson-Hasselbalch Alternate method*

$$\text{pH} = \text{p}K_a + \log \frac{[\text{F}^-]}{[\text{HF}]}$$

$$= -\log 3.5 \times 10^{-4} + \log \frac{.070}{.058}$$

$$= 3.456 + .0817 = 3.538 = 3.54$$

$$\text{Ans. pH} = \underline{3.54}$$