SHOW ALL WORK TO RECEIVE CREDIT.
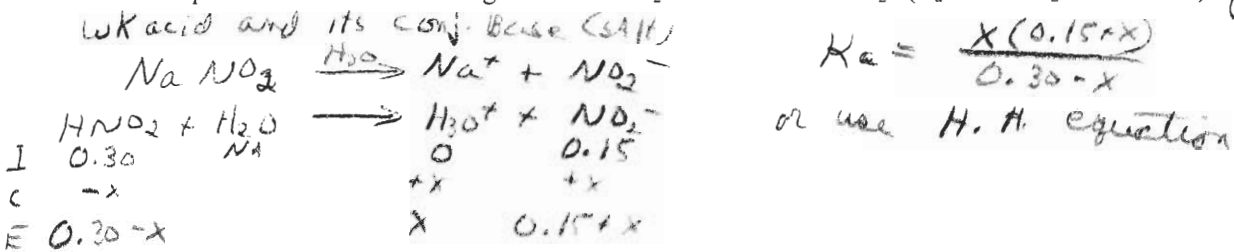**DUE Tuesday. October 25th   AT THE BEGINNING OF CLASS**
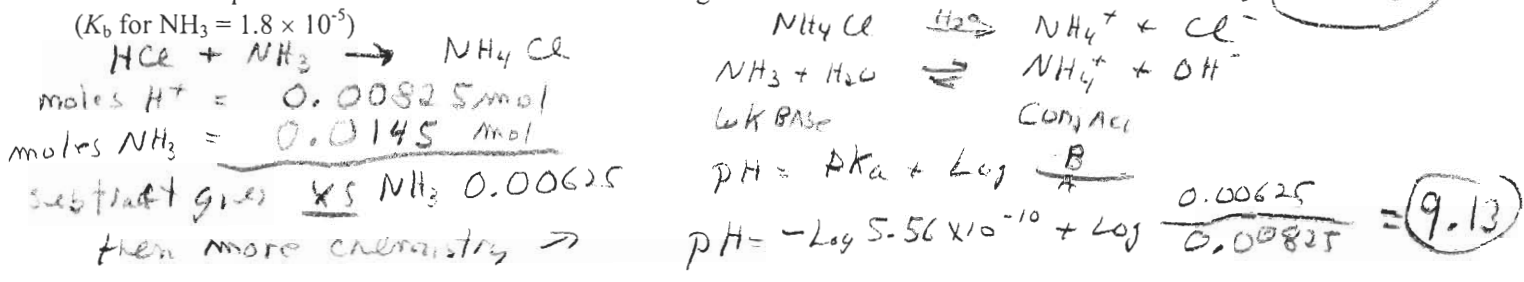
1. What is the pH of a mixture containing 0.30 M HNO_2 and 0.15 M $NaNO_2$? (K_a for HNO_2 = 4.5 × 10^{-4})   **3.05**

wk acid and its conj. base (salt)

$Na NO_2 \xrightarrow{H_2O} Na^+ + NO_2^-$

$HNO_2 + H_2O \longrightarrow H_3O^+ + NO_2^-$

	0.30	NA	0	0.15
I				
C	-x		+x	+x
E	0.30-x		x	0.15+x

$Ka = \dfrac{x(0.15+x)}{0.30-x}$

or use H. H. equation

2. What is the pH of the solution that results from adding 25 mL of 0.33 M HCl to 25 mL of 0.58 M NH_3?   **9.13**
(K_b for NH_3 = 1.8 × 10^{-5})

$HCl + NH_3 \longrightarrow NH_4Cl$

moles H^+ = 0.00825 mol
moles NH_3 = 0.0145 mol

subtract gives XS NH_3 0.00625

then more chemistry ⟶

$NH_4 Cl \xrightarrow{H_2O} NH_4^+ + Cl^-$

$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$

wk base   conj Aci

$pH = pKa + Log \dfrac{B}{A}$

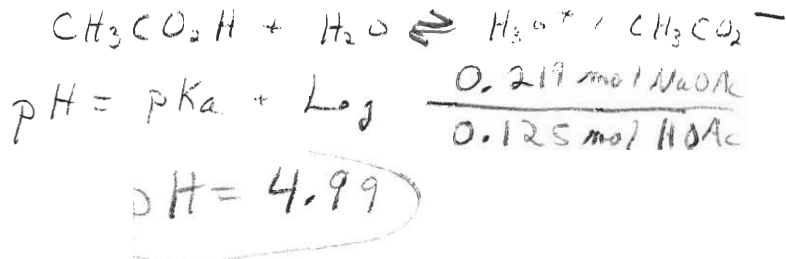$pH = -Log\ 5.56 \times 10^{-10} + Log \dfrac{0.00625}{0.00825} = 9.13$

3. Which of the following combinations would be the best to buffer the pH to 7.0? **You must show a calculations to support your answer.**
    a. H_3PO_4 and $H_2PO_4^-$, K_a = 7.5 × 10^{-3}
    b. HNO_2 and NO_2^-, K_a = 4.5 × 10^{-4}
    c. CH_3CO_2H and CH_3COO^-, K_a = 18 × 10^{-5}
    d. $H_2PO_4^-$ and HPO_4^{2-}, K_a = 6.2 × 10^{-8}
    e. NH_4^+ and NH_3, K_a = 5.7 × 10^{-10}

(d circled)

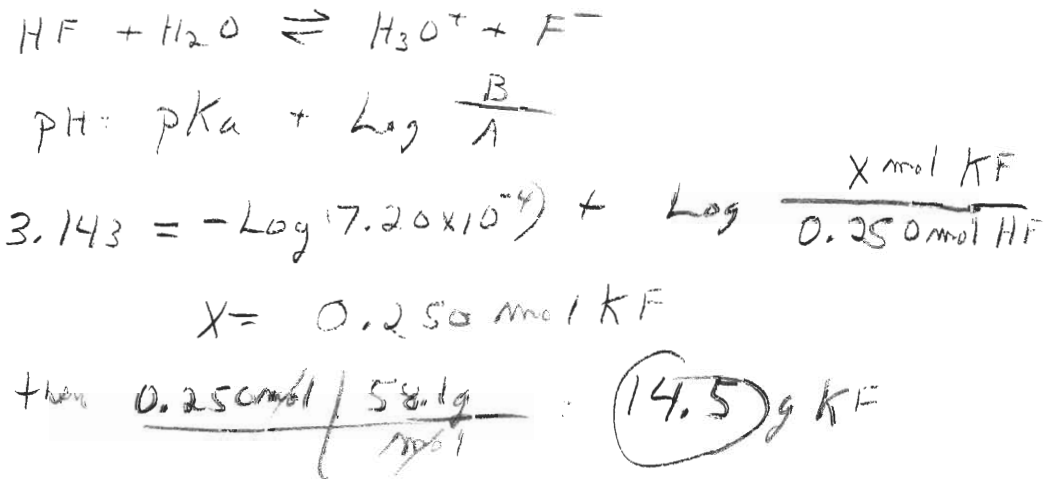$-Log\ Ka = 7.2$ ⟸ closest to **7**

4. What is the pH of the buffer that results when 18.0 g of $NaCH_3CO_2$ is mixed with 125 mL of 1.00 M CH_3CO_2H and diluted with water to 1.00 L? (K_a for CH_3CO_2H = 1.8 × 10^{-5})   **4.99**

$CH_3CO_2H + H_2O \rightleftharpoons H_3O^+ + CH_3CO_2^-$

$pH = pKa + Log \dfrac{0.219\ mol\ NaOAc}{0.125\ mol\ HOAc}$

$pH = 4.99$

5. How many grams of solid KF (molar mass = 58.1 g/mol) should be added to 1.00 L of 0.250 M HF to make a buffer of pH = 3.143? (K_a for HF = 7.20 × 10^{-4})   **14.5**
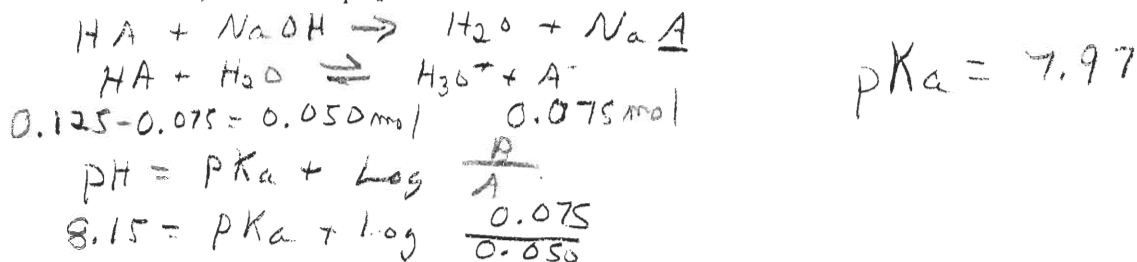
$HF + H_2O \rightleftharpoons H_3O^+ + F^-$

$pH = pKa + Log \dfrac{B}{A}$

$3.143 = -Log(7.20 \times 10^{-4}) + Log \dfrac{X\ mol\ KF}{0.250\ mol\ HF}$

$X = 0.250\ mol\ KF$

then $0.25\ mol \cdot \dfrac{58.1g}{mol} = $ **14.5** g KF

6. The K_a for hypochlorous acid, HClO, is 3.5×10^{-8}. To make a buffer of pH = 7.20 using this acid, what [ClO⁻]/[HClO] **0.55** ratio is necessary?

$$pH = pKa + Log \frac{B}{A}$$

$$7.20 = -Log\ 3.5 \times 10^{-8} + Loy\ \frac{B}{A}$$

$$\frac{B}{A} = 0.55$$

7. A buffer is prepared by adding 250 mL of 0.300 M NaOH to 250 mL of 0.500 M weak acid, HA. If the pH of the buffer is 8.15, what is the pK_a of the acid? **7.97**

$$HA + NaOH \rightarrow H_2O + Na\underline{A}$$
$$HA + H_2O \rightleftharpoons H_3O^+ + A^-$$
$$0.125 - 0.075 = 0.050\ mol \qquad 0.075\ mol$$

$$pH = pKa + Log\ \frac{B}{A}$$

$$8.15 = pKa + Log\ \frac{0.075}{0.050}$$

$$pKa = 7.97$$

8. A buffer is composed of 0.250 mol $H_2PO_4^-$ and 0.250 mol HPO_4^{2-} diluted with water to a volume of 1.00 L. The pH of the buffer is 7.208. How many moles of HCl must be added to reduce the pH to 6.208? **0.205**
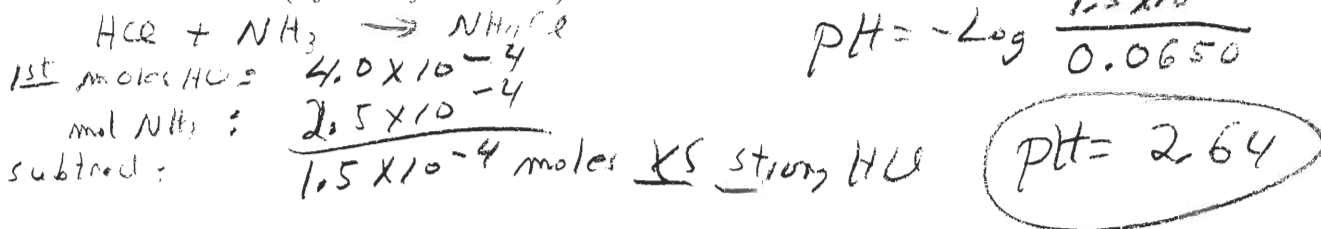
Initially: $7.208 = pKa + Log\ \frac{0.250}{0.250}$

$pKa = 7.208$

then since pH dropped: HCl must react with the C.BASE $(HPO_4^{2-} + H^+ \rightleftharpoons H_2PO_4^-)$

So: $6.208 = 7.208 + Log\ \frac{0.250 - X}{0.250 + X}$

$$X = 0.205\ mol$$

9. Hydrochloric acid is used to titrate 25.0 mL of 0.0100 M NH_3. What is the pH after the addition of 40.0 mL of 0.0100 M HCl? (K_b for $NH_3 = 1.8 \times 10^{-5}$) **2.64**

$$HCl + NH_3 \rightarrow NH_4Cl$$

1st moles HCl: 4.0×10^{-4}

mol NH_3: 2.5×10^{-4}

subtract: 1.5×10^{-4} moles XS strong HCl

$$pH = -Log\ \frac{1.5 \times 10^{-4}}{0.0650}$$

$$pH = 2.64$$

10. Hyperventilation can cause your blood pH to rise. One way to lower your blood pH is to breath into a paper bag, thus recycling the air you exhale. Why does this procedure lower your blood pH?

recycled air increases the CO_2 intake. The CO_2 reacts with the water in your blood to form H_2CO_3 (carbonic acid) and thus lower the pH.