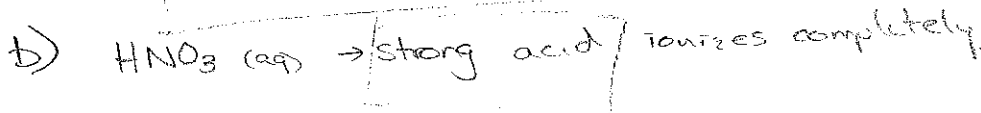
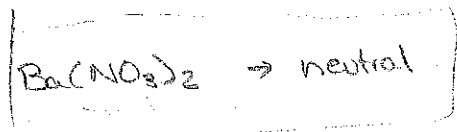




\downarrow
 cation of Group 2 metal does not cause a hydrolysis rxn
 \downarrow
 anion of strong acid does not cause a hydrolysis rxn



\downarrow
 cation of weak base acts as conjugate acid producing $\text{H}_3\text{O}^{+}(\text{aq})$
 \downarrow
 anion of strong acid does not cause a hydrolysis rxn



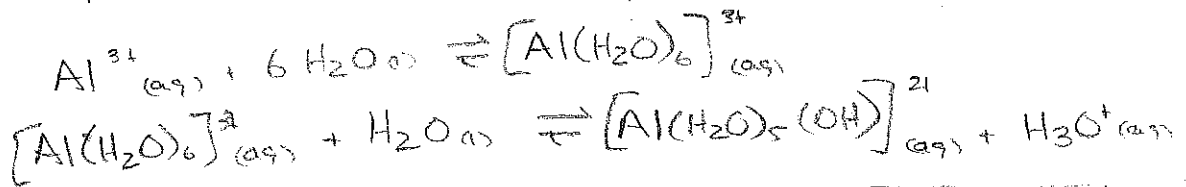
$$K_A = \frac{K_W}{K_B \text{ for } \text{NH}_3}$$

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

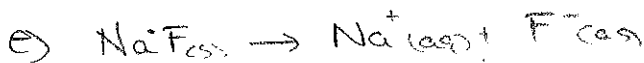
$K_A = 5.5 \times 10^{-10}$



\downarrow
 forms $\text{H}_3\text{O}^{+}(\text{aq})$
 bcz large ve core density
 \downarrow
 anion of strong acid does not affect pH



$K_A = 9.8 \times 10^{-6}$



\downarrow
 cation of Group 1 metal, no hydrolysis rxn
 \downarrow
 anion of weak acid acts as conjugate base causing a hydrolysis rxn

$$K_B = \frac{K_W}{K_A \text{ for HF}}$$



$$= \frac{1 \times 10^{-14}}{6.6 \times 10^{-4}}$$

$K_B = 1.5 \times 10^{-9}$

HNO_3
strong acid

$\text{Al}(\text{NO}_3)_3$
 $K_A = 9.8 \times 10^{-6}$

NH_4NO_3
 5.5×10^{-10}

$\text{Ba}(\text{NO}_3)_2$
neutral

NaF
produces base
high pH



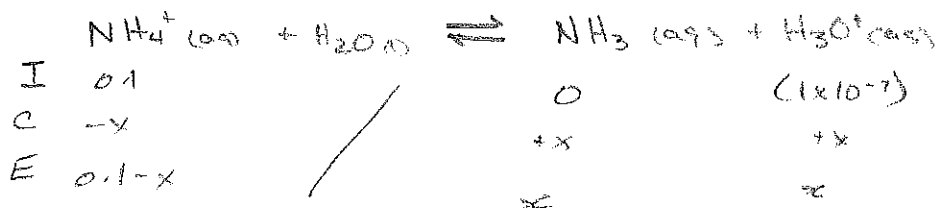
↙
 cation of weak base
 acts as conjugate acid

↘
 anion of a strong acid
 no effect on pH bcz does not cover
 hydrolysis rxn

$$[\text{NH}_4^+]_I = [\text{NH}_4\text{Cl}] \times \text{mol ratio}$$

$$= 0.100 \frac{\text{mol NH}_4\text{Cl}}{\text{L}} \times \frac{1 \text{ mol NH}_4^+}{1 \text{ mol NH}_4\text{Cl}}$$

$$= 0.100 \frac{\text{mol NH}_4^+}{\text{L}}$$



$$K_A = \frac{K_W}{K_B}$$

$$= \frac{1 \times 10^{-14}}{1.8 \times 10^{-5}}$$

$$= 5.56 \times 10^{-10}$$

check

$$\frac{C}{K_A} = \frac{0.1}{5.5 \times 10^{-10}} \gg 100$$

proof

$$\frac{x}{[]_I} \times 100\%$$

$$\frac{7.42 \times 10^{-6}}{0.100} \times 100\% = 0.00742\% \ll 5\%$$

$$5.5 \times 10^{-10} = \frac{(x)(x)}{0.1}$$

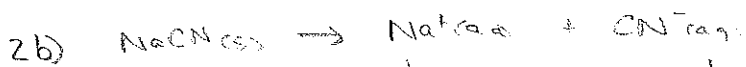
$$x = 7.42 \times 10^{-6}$$

$$[\text{H}_3\text{O}^+] = 7.42 \times 10^{-6}$$

$$\text{pH} = -\log[\text{H}_3\text{O}^+]$$

$$= -\log(7.42 \times 10^{-6})$$

$\text{pH} = 5.130$



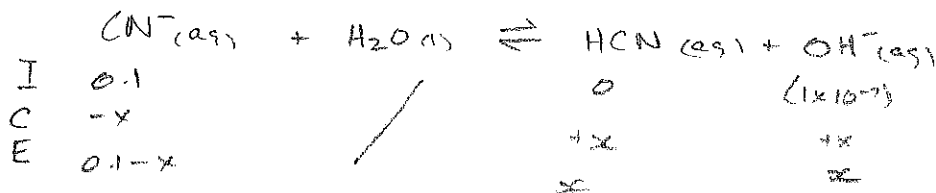
↓
 cation of Group 1 Metal
 does not cause a hydrolysis rxn

↘ anion of weak acid
 acts as conjugate base

$$[\text{CN}^-] = [\text{NaCN}] \times \text{mol ratio}$$

$$= \frac{0.1 \text{ mol NaCN}}{1 \text{ L}} \times \frac{1 \text{ mol CN}^-}{1 \text{ mol NaCN}}$$

$$= 0.100 \text{ mol CN}^-$$



$$K_B = \frac{K_w}{K_{\text{HCN}}}$$

$$= \frac{1 \times 10^{-14}}{6.2 \times 10^{-10}}$$

$$K_B = \frac{[\text{HCN}][\text{OH}^-]}{[\text{CN}^-]}$$

$$\frac{[\text{OH}^-]}{K_B} = \frac{0.1}{1.6 \times 10^{-5}} \gg 100$$

$$= 1.61 \times 10^{-5}$$

$$1.61 \times 10^{-5} = \frac{(x)(x)}{0.1}$$

$$x = 1.27 \times 10^{-3}$$

$$\frac{x}{[\text{CN}^-]} \times 100\% = \frac{1.27 \times 10^{-3}}{0.1} \times 100\%$$

$$= 1.27\%$$

$$[\text{OH}^-] = 1.27 \times 10^{-3} \text{ mol/L}$$

$$\text{pOH} = -\log[\text{OH}^-]$$

$$= -\log(1.27 \times 10^{-3})$$

$$= 2.897$$

$$\text{pH} = 14 - \text{pOH}$$

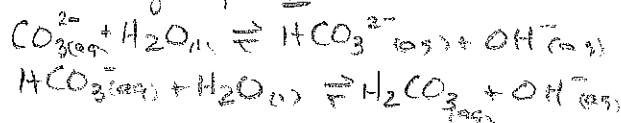
$$= 14 - 2.897$$

$$\text{pH} = 11.103$$



↓
cation of Group 1 metals
does not cause a hydrolysis rxn

↳ anion of a weak acid
causes a hydrolysis rxn



$$[\text{CO}_3^{2-}] = [\text{Li}_2\text{CO}_3] \times \text{molar ratio}$$

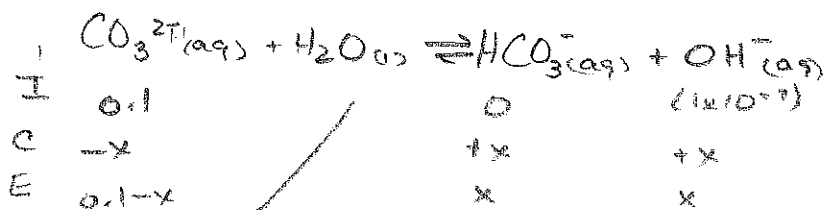
$$= 0.100 \frac{\text{mol Li}_2\text{CO}_3}{L} \times \frac{1 \text{ mol CO}_3^{2-}}{1 \text{ mol Li}_2\text{CO}_3}$$

$$= 0.100 \frac{\text{mol CO}_3^{2-}}{L}$$

$$K_B = \frac{K_w}{K_A \text{ for HCO}_3^-}$$

$$= \frac{1 \times 10^{-14}}{4.7 \times 10^{-4}}$$

$$= 2.13 \times 10^{-4}$$



$$K_B = \frac{[\text{HCO}_3^-][\text{OH}^-]}{[\text{CO}_3^{2-}]}$$

$$2.13 \times 10^{-4} = \frac{(x)(x)}{0.1}$$

$$x = 4.61 \times 10^{-3}$$

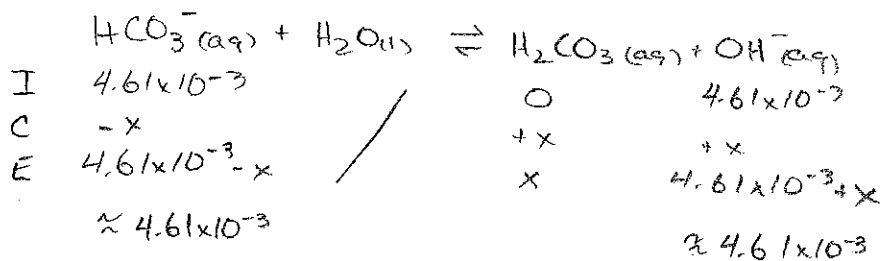
check

$$\frac{[x]}{K_B} = \frac{0.1}{2.3 \times 10^{-4}} \gg 100$$

proof

$$\frac{x}{[x]} \times 100\%$$

$$\frac{4.61 \times 10^{-3}}{0.1} \times 100\% = 4.61\%$$



$$K_B = \frac{K_w}{K_A \text{ for H}_2\text{CO}_3}$$

$$= \frac{1 \times 10^{-14}}{4.4 \times 10^{-7}}$$

$$= 2.27 \times 10^{-8}$$

$$K_B = \frac{[\text{H}_2\text{CO}_3][\text{OH}^-]}{[\text{HCO}_3^-]}$$

$$2.27 \times 10^{-8} = \frac{(4.61 \times 10^{-3})x}{(4.61 \times 10^{-3})}$$

$$x = 2.27 \times 10^{-8}$$

∴ no significant OH^-
produced in 2nd
rxn

$$\text{pOH} = -\log[\text{OH}^-]$$

$$= -\log(2.27 \times 10^{-8})$$

$$= 7.643$$

$$\text{pH} = 14 - \text{pOH}$$

$$= 14 - 7.643 = 6.357$$

check

$$\frac{[x]}{K_B} = \frac{4.61 \times 10^{-3}}{2.27 \times 10^{-8}} \gg 100$$

proof

$$\frac{x}{[x]} \times 100\%$$

$$\frac{2.27 \times 10^{-8}}{4.61 \times 10^{-3}} \times 100\%$$

$$= 4.92 \times 10^{-4} \%$$