$[H_3O^+] = 10^{-5.9} = 1.26 \times 10^{-6} = X$

3) If a 0.05 M solution of a weak acid produces a pH of 5.9, What is $K_a$ for this weak acid?

$HA_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + A^-_{(aq)}$ $K_a = \frac{[A^-][H_3O^+]}{[HA]}$

| | HA | $H_3O^+$ | $A^-$ |
|---|---|---|---|
| I | 0.05 | 0 | 0 |
| C | −x | +x | +x |
| E | ↓ | x= $1.26 \times 10^{-6}$ | x= $1.26 \times 10^{-6}$ |

$0.05 - 1.26 \times 10^{-6} \approx 0.05$

$K_a = \frac{[1.26 \times 10^{-6}][1.26 \times 10^{-6}]}{[0.05]} = \boxed{3.2 \times 10^{-11}}$

Exam3

7) Calculate the molar solubility of barium fluoride ($BaF_2$) in water. $BaF_{2(s)} \xrightarrow{H_2O} Ba^{2+}_{(aq)} + 2F^-_{(aq)}$
$K_{sp} = 1.6 \times 10^{-6}$.
Calculate the molar solubility of this compound in an aqueous solution that is 0.2 M NaF (sodium fluoride). not on exam 2 This is ch 17 - exam 3

| | $BaF_2$ | $Ba^{2+}$ | $2F^-$ |
|---|---|---|---|
| I | solid | 0 | 0 |
| C | −x | +x | +2x |
| E | solid | x | 2x |

$K_{sp} = 1.6 \times 10^{-6} = [Ba^{2+}][F^-]^2 = [x][2x]^2 = 4x^3$

$\frac{1.6 \times 10^{-6}}{4} = \frac{4x^3}{4}$ $x^3 = 4 \times 10^{-7}$ $x = 7.4 \times 10^{-3}$ = How much $BaF_2$ dissolved

$\boxed{\text{molar solubility: } 7.4 \times 10^{-3} \text{ mol/L}}$

NaF complete dissociation

| | $BaF_2$ | $Ba^{2+}$ | $2F^-$ |
|---|---|---|---|
| I | solid | 0 | 0.2M |
| C | −x | +x | +2x |
| E | solid | +x | 0.2m+2x |

$K_{sp} = [x][0.2 + 2x]^2$, going to assume can ignore

$= x[0.2]^2$

$1.6 \times 10^{-6} = 0.04x$ $\boxed{x = 4.0 \times 10^{-5} = \text{molar solubility of } BaF_2 \text{ in } 0.2M \text{ NaF}}$

10) What is the pH of the following solutions?

a) 0.25 M $HNO_3$ strong acid

$[H_3O^+] = 0.25M$

$pH = -\log(0.25)$

$= \boxed{0.602}$

b) 0.17 M $Ba(OH)_2$ strong base

$[OH^-] = 0.17M \times 2 = 0.34M$

$pOH = -\log(0.34) = 0.47$

$pH = 14 - 0.47 = \boxed{13.53}$

Exam 3

(16) $CaCl_{2(aq)} + Na_2CO_{3(aq)} \rightarrow CaCO_{3(s)} + 2NaCl_{(aq)}$

$\frac{0.1\,mol}{L} \times 0.05L = 0.005mol$    $0.005mol$    $0.005mol$

$0.05L + 0.05L = 0.1L$

not on exam 2

ch 17

$CaCO_{3(s)} \rightleftharpoons Ca^{2+}_{(aq)} + CO_3^{2-}_{(aq)}$

| | $CaCO_3$ | $Ca^{2+}$ | $CO_3^{2-}$ |
|---|---|---|---|
| I | Solid | 0 | 0 |
| C | $-x$ | $+x$ | $+x$ |
| E | solid | x | x |

$K_{sp} = [Ca^{2+}][CO_3^{2-}]$

$3.8 \times 10^{-9} = (x)(x) = x^2$

$x = 6.2 \times 10^{-5}\,mol/L$

$\boxed{\text{Dissolved } Ca^{2+} = 6.2 \times 10^{-5}\,\frac{mol}{L}}$

16) What is the concentration of $Ca^{2+}$ ion remaining after $CaCO_3$ precipitates when 50.0 ml of 0.10 M $CaCl_2$ is added to 50.0 ml of 0.10 M $Na_2CO_3$? $K_{sp}$ for $CaCO_3$ is $3.8 \times 10^{-9}$. not on exam 2

What is the pH of a 0.15 M solution of $NH_3$? Kb = $1.78 \times 10^{-5}$ ← weak base

$NH_{3(aq)} + H_2O_{(l)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$

| | $NH_3$ | $NH_4^+$ | $OH$ |
|---|---|---|---|
| I | 0.15 | 0 | 0 |
| C | $-x$ | $+x$ | $+x$ |
| E | $0.15-x$ | x | x |

$1.78 \times 10^{-5} = \frac{(x)(x)}{(0.15-\cancel{x})} = \frac{x^2}{0.15}$ ignore

$x^2 = 2.67 \times 10^{-6}$

$x = 1.634 \times 10^{-3} = [OH^-]$

$pOH = -\log(1.634 \times 10^{-3}) = 2.79$

$pH = 14 - 2.79 = \boxed{11.21}$

What is the PH of a 0.15 M solution of $NH_4^+$?

$NH_4^+{}_{(aq)} + H_2O_{(l)} \rightleftharpoons NH_{3(aq)} + H_3O^+$

$NH_4$ is conjugate acid of $NH_3$, so $K_a = \frac{1 \times 10^{-14}}{K_b} = \frac{1 \times 10^{-14}}{1.78 \times 10^{-5}} = 5.62 \times 10^{-10}$

| | $NH_4^+$ | $NH_3$ | $H_3O^+$ |
|---|---|---|---|
| I | 0.15 | 0 | 0 |
| C | $-x$ | $+x$ | $+x$ |
| E | $0.15-x$ | x | x |

$5.62 \times 10^{-10} = \frac{[x][x]}{[0.15-\cancel{x}]} = \frac{x^2}{0.15}$ ignore

$x^2 = 8.43 \times 10^{-11}$

$x = 9.18 \times 10^{-6} = [H_3O^+]$

$pH = -\log[9.18 \times 10^{-6}] = \boxed{5.04}$