WATER CHEMISTRY SOLUTIONS (PART 1)

1)

Temp=25C	a	b	c	d=b/c	e=100/2	f=a*e/d
Constituents	Concentration	Molecular	Ionic	Equivalent	Equivalent	mg/L as
Cations	mg/L	Weight	Charge	Weight Ion	Weight $CaCO_3$	$CaCO_3$
Ca	120	40.00	2	20.00	50	300.00
Mg	39	24.30	2	12.15	50	160.49
Na	12.8	22.99	1	22.99	50	27.84
K	3.4	39.10	1	39.10	50	4.35
Fe	6.2	55.85	2	27.93	50	11.10
Mn	0.3	54.94	2	27.47	50	0.55
Anions						
HCO3	422	61.00	1	61.00	50	345.90
SO4	101	96.10	2	48.05	50	105.10
Cl	32	35.50	1	35.50	50	45.07
CO3	1.2	60.00	2	30.00	50	2.00

2)

From the molecular equation $HCO3^- \rightarrow H^+ + CO3$ pKa=10.33

Table 3-3 gives ---> $Ka=10^{-10.33}$

Ka=[H+][CO3]/[HCO3] in molar concentrations only!

$[H+]=10^{-10.33}*[HCO3]/[CO3]$

$[HCO3]=422/61/1000=6.918*10^{-3}M$

$[CO3]=1.2/60/1000=2.0*10^{-5}M$

Therefore $[H+]=\underline{1.618*10^{-8}M}$

$[H+]=\underline{1.618*10^{-5}mg/L}$

$[H+]=\underline{8.09*10^{-4}mg/L\ as\ CaCO3}$

pH=-log $1.618*10^{-8}M=\underline{7.79}$

3)

$[OH]=10^{-14}/10^{-7.79}=\underline{10^{-6.21}M}$ $\underline{6.17*10^{-7}M}$

$pOH=\underline{6.21}$

$[OH]=\underline{1.048*10^{-2}\ mg/L}$

$[OH]=\underline{3.083*10^{-2}\ mg/L\ as\ CaCO3}$

4)

From above $[H+]=1.618*10^{-8}M$

$[HCO3]=6.918*10^{-3}M$

Assume [H2CO3]=[CO2]

Table 3-3 gives --> pKa=6.35

$Ka=10^{-6.35}$

From the molecular equation $H2CO3 <---> H^+ + HCO3$

Ka=[H+][HCO3]/[H2CO3] in molar concentrations only!

$[H2CO3[=[CO2]=(1.618*10^{-8})*(6.918*10^{-3})/10^{-6.35}= 2.51*10^{-4}M$

$[CO2]=\underline{11.02\ mg/L}=\underline{25.05\ mg/L\ as\ CaCO3}$

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