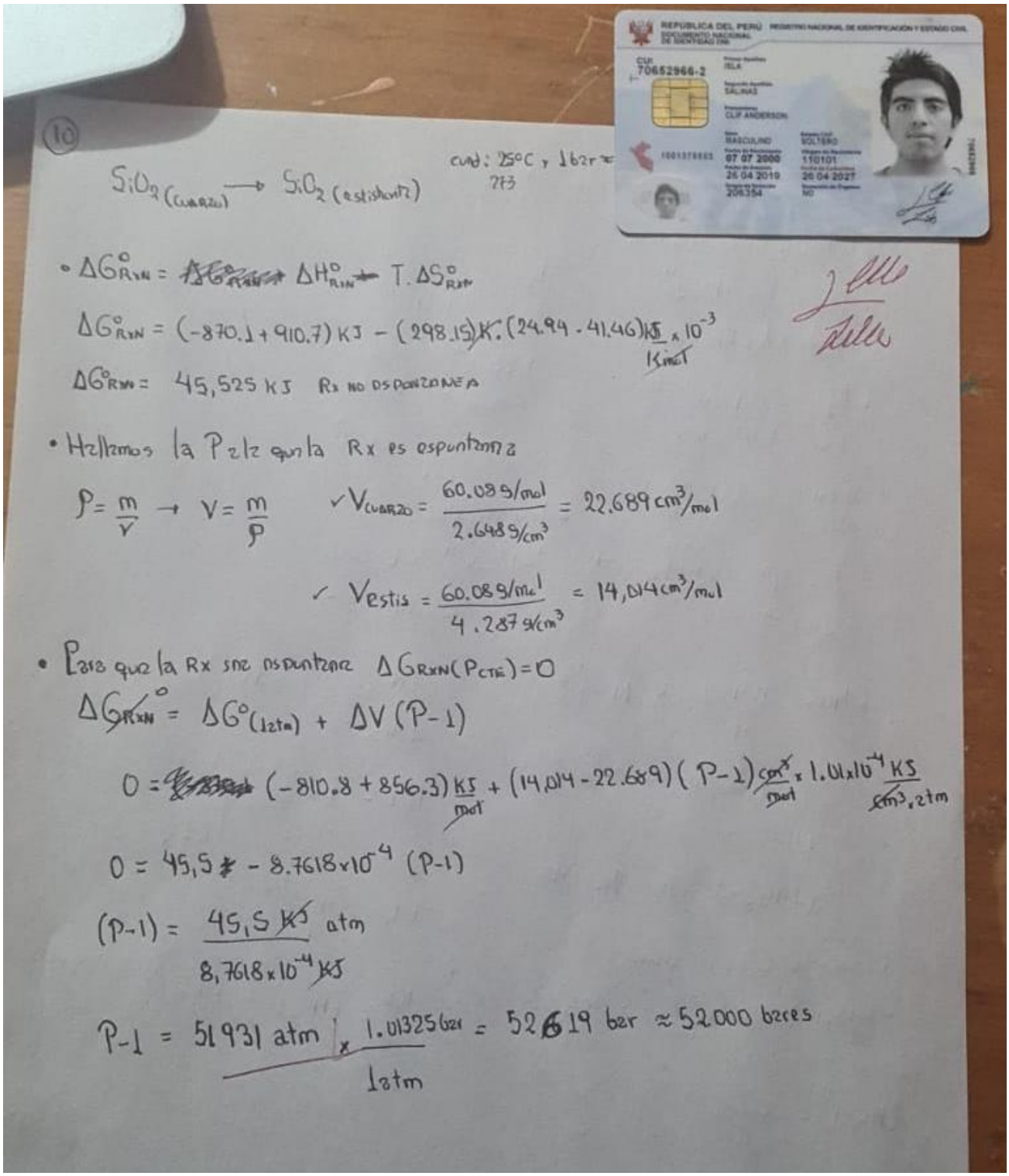
CLIF ANDERSON ISLA SALINAS



10

$SiO_{2(cuarzo)} \longrightarrow SiO_{2(estishovita)}$ cuad: 25°C, 1 bar = 273

- $\Delta G^\circ_{RXN} = \Delta H^\circ_{RXN} - T.\Delta S^\circ_{RXN}$

$\Delta G^\circ_{RXN} = (-870.1 + 910.7)\,KJ - (298.15\,K)(24.94 - 41.46)\frac{KJ}{1\,kmol} \times 10^{-3}$

$\Delta G^\circ_{RXN} = 45,525\,KJ$ Rx NO ESPONTANEA

- Hallamos la P a la que la Rx es espontanea

$\rho = \frac{m}{V} \rightarrow V = \frac{m}{\rho}$

$V_{CUARZO} = \frac{60.089\,g/mol}{2.648\,g/cm^3} = 22.689\,cm^3/mol$

$V_{estis} = \frac{60.089\,g/mol}{4.287\,g/cm^3} = 14,014\,cm^3/mol$

- Para que la Rx sea espontanea $\Delta G_{RXN(P_{CTE})} = 0$

$\Delta G^\circ_{RXN} = \Delta G^\circ_{(1atm)} + \Delta V(P-1)$

$0 = (-810.8 + 856.3)\frac{KJ}{mol} + (14.014 - 22.689)(P-1)\frac{cm^3}{mol} \times 1.01 \times 10^{-4}\frac{KJ}{cm^3 \cdot atm}$

$0 = 45,5 - 8.7618 \times 10^{-4}(P-1)$

$(P-1) = \frac{45,5\,KJ}{8,7618 \times 10^{-4}\,KJ}\,atm$

$P-1 = 51931\,atm \times \frac{1.01325\,bar}{1\,atm} = 52619\,bar \approx 52000\,bares$

⑤ Halla la ΔG°_{RXN}

$[Sr^{2+}] = 2.1\times10^{-6}\,M$

$[SO_4^{2-}] = 1.4\times10^{-4}\,M$

$SrSO_{4(s)} \rightarrow Sr^{2+}_{(ac)} + SO_4^{2-}{}_{(ac)}$

1) Hallemos la concentración activa $\{\ \}$

$\{Sr^{2+}\} = \gamma_{Sr^{2+}} \cdot 2,1\times10^{-6}$

$\{SO_4^{2-}\} = \gamma_{SO_4^{2-}} \times 1,4\times10^{-4}$

- $\{Sr^{2+}\} = 1,8102\times10^{-6}\,M$
- $\{SO_4^{2-}\} = 1,2068\times10^{-4}\,M$

$I = 0.001$ Usamos la ley extendida

- $\log\gamma_{Sr^{2+}} = -0.509\times(2)^2\times(10^{-3})^{1/2}$

$\gamma_{Sr^{2+}} = 0.862 = \gamma_{SO_4^{2-}}$

- $\log\gamma_{SO_4^{2-}} = -0.509\times(-2)^2\times(10^{-3})^{1/2}$

2) Hallemos la ΔG_{RXN}

$\Delta G_{RXN} = \Delta G^\circ_{RXN} + R.T.\ln K$

- $\Delta G^\circ_{RXN} = (-557.3 - 741.9) + 1335.8\ KJ/mol$

$\Delta G^\circ_{RXN} = 36,6\ KJ/mol$

$$\Delta G_{RXN} = 36.6\,KJ + 8,314\,\frac{J}{mol\cdot K}\times(25+273.15)K\cdot\ln\frac{\{Sr^{2+}\}\{SO_4^{2-}\}}{\{SrSO_4\}^{1}_{(s)}}$$

$$\Delta G_{RXN} = 36.6\,KJ + 8,314\times298,15\times10^{-3}\,KJ\times\ln(1,8102\times10^{-6}\times1,2068\times10^{-4})$$

$\Delta G_{RXN} = -18,540\,KJ$ Rx. ESPONTANEA

(2)

$NO_{2(g)} \rightarrow NO_{(g)} + O_{2(g)}$; $[NO_2] = 0.056M$

a) $[NO_2]$? después de 1 hora

$r_{Rx} = \frac{K.[NO_2]^n}{}$

Hallar la K y el orden (n)

- $\frac{r_2}{r_4} = \left(\frac{5,40 \times 10^{-5}}{1,35 \times 10^{-5}}\right)^n$

$\frac{0.010}{0.005} = \left(\frac{5,40}{1,35}\right)^n$

$2 = 4^n$

$2 = 2^{2n}$

orden $n = 1/2$ →

$\frac{r_2}{r_4} = \left(\frac{0.015}{0.010}\right)^n$

$\frac{1.22 \times 10^{-4}}{5.40 \times 10^{-5}} = \left(\frac{0.015}{0.010}\right)^n$

$(1.5)^n$

M/s M

- $r_{RXN} = K.[NO_2]$

$1.22 \times 10^{-4} = K.[0.015]$

$K = 8,1333 \times 10^{-3}\ s^{-1}$

- $r_{Rx} = -\frac{d[NO_2]}{dt} = K[NO_2]^{1/2}$

$\int \frac{d[NO_2]}{[NO_2]^{1/2}} = \int -K dt$

$-K.t = \frac{[NO_2]^{-1/2+1}}{-1/2+1} \Big|_{[\,]_0}^{[\,]_f}$

$-Kt = \frac{[NO_2]^{1/2}}{1/2} \Big|_0^f$

Hallemos la $[\,]_f$ en 1 hora

$-\frac{8,13 \times 10^{-3}}{2} \cdot 60 \text{ min} \times \frac{60 \text{ s}}{1 \text{ min}} \times s^{-1} = [NO_2]^{1/2} - 0.056^{1/2}$

$[NO_2]^{1/2} = 0.056^{1/2} - \frac{8,13 \times 10^{-3} \times 60^2}{2}$

$\frac{-Kt}{2} = [NO_2]^{1/2} - [NO_2]_0^{1/2}$ Ecuación

(7) Sol. $CO_3^{-2} + Na^+$ a 0.001M $Ka_1 = 10^{-6.3}$ pH=¿?

$NaCO_3$ $Ka_2 = 10^{-10.3}$ Alc=¿?

1) Identificamos especies:

CO_3^{-2}, Na^+, OH^-, H^+, HCO_3^-, H_2CO_3

H_2CO_3

exceso HCO_3^-

CO_3^{-2}, H_2O

OH^-

Profi

2) ~~Ecuaciones~~

~~$Ka_1 = \frac{[H^+][A^{++}]}{[HA^+]}$~~

• ECUACION PROTONES

NRP: $[OH^-] = [H^+] + [HCO_3^-] + 2[H_2CO_3]$

• Alcalinidad

$Alc = \underset{e^-}{Deficit} - \underset{e^-}{Exceso}$

$Alc = [OH^-] - ([H^+] + [HCO_3^-] + 2[H_2CO_3])$

* Para hallar el pH usamos el grafico, en la región del CO_3^{-2} (extremo derecho)

observamos en ese punto que: $[H^+]$ es baja ≈ 0

$[H_2CO_3]$ es baja ≈ 0

Entonces la Ecu de protones es: $[OH^-] = [HCO_3^-]$.

El pH se encuentra donde ambas curvas se cortan pH=10.5

Validamos la suposicion $[H^+] = 0$

$[H^+] = 10^{-10.5} = 3,16 \times 10^{-11}$ Concentraciones bajisimas

$[H_2CO_3] = 10^{-7.5} = 3.1623 \times 10^{-8} \approx 0$

* Para hallar la alcalinidad usamos la Ecu. de Alc

$Alc = [OH^-] - ([H^+] + [HCO_3^-] + 2[H_2CO_3])$

Usando la grafica de la alcalinidad en el pH=10.5, eliminamos Concentraciones bajisimas

$Alc = [OH^-] - [HCO_3^-] = 10^{-3.5} - 10^{-3} = -6.83 \times 10^{-4} \frac{eq}{L} \times \frac{50g}{eq} \times \frac{10^3 mg}{1g}$

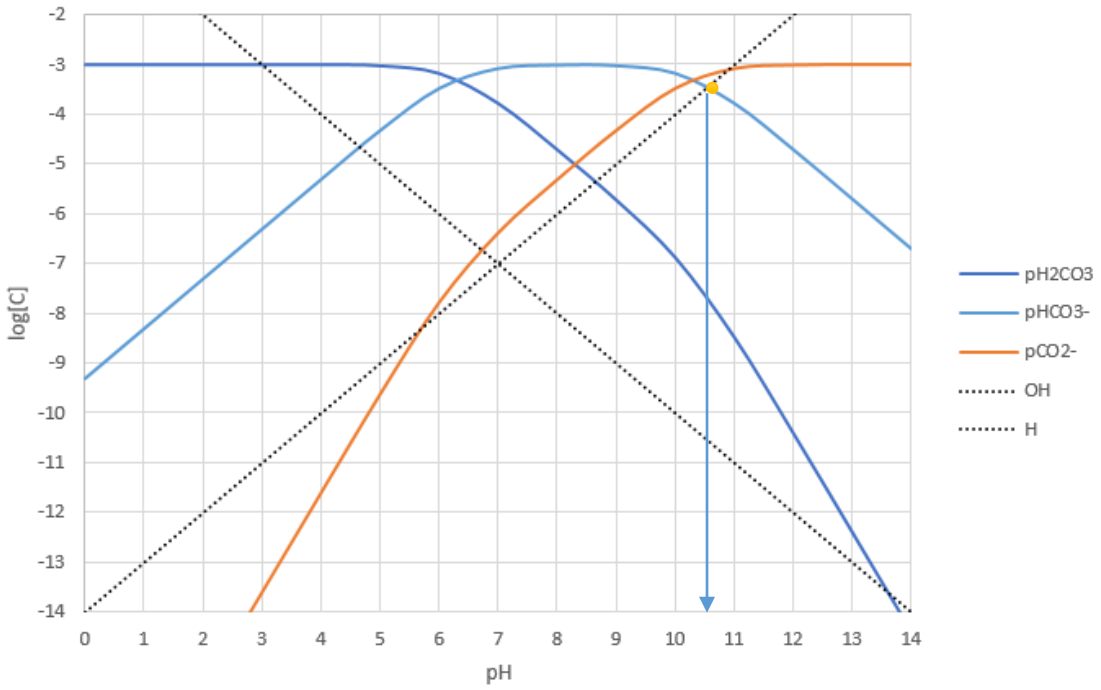
Si el pH = 10,5

pOH = 3,5

$[OH^-] = 10^{-3,5}$ M

$Alc = -34,15$ mg/L

Grafica de la pregunta 7



pH	[H*]	Denominador	a0	a1	a3	pH2CO3	pHCO3-	pCO2-	OH
0	1.00E+00	1.00E+00	1.00E+00	5.01E-07	2.51E-17	-3.00	-9.30	-19.60	-14
1	1.00E-01	1.00E-02	1.00E+00	5.01E-06	2.51E-15	-3.00	-8.30	-17.60	-13
2	1.00E-02	1.00E-04	1.00E+00	5.01E-05	2.51E-13	-3.00	-7.30	-15.60	-12
3	1.00E-03	1.00E-06	9.99E-01	5.01E-04	2.51E-11	-3.00	-6.30	-13.60	-11
4	1.00E-04	1.01E-08	9.95E-01	4.99E-03	2.50E-09	-3.00	-5.30	-11.60	-10
5	1.00E-05	1.05E-10	9.52E-01	4.77E-02	2.39E-07	-3.02	-4.32	-9.62	-9
6	1.00E-06	1.50E-12	6.66E-01	3.34E-01	1.67E-05	-3.18	-3.48	-7.78	-8
7	1.00E-07	6.01E-14	1.66E-01	8.33E-01	4.18E-04	-3.78	-3.08	-6.38	-7
8	1.00E-08	5.14E-15	1.95E-02	9.76E-01	4.89E-03	-4.71	-3.01	-5.31	-6
9	1.00E-09	5.27E-16	1.90E-03	9.50E-01	4.76E-02	-5.72	-3.02	-4.32	-5
10	1.00E-10	7.52E-17	1.33E-04	6.66E-01	3.34E-01	-6.88	-3.18	-3.48	-4
11	1.00E-11	3.01E-17	3.32E-06	1.66E-01	8.34E-01	-8.48	-3.78	-3.08	-3
12	1.00E-12	2.56E-17	3.90E-08	1.96E-02	9.80E-01	-10.41	-4.71	-3.01	-2
13	1.00E-13	2.52E-17	3.97E-10	1.99E-03	9.98E-01	-12.40	-5.70	-3.00	-1
14	1.00E-14	2.51E-17	3.98E-12	1.99E-04	1.00E+00	-14.40	-6.70	-3.00	0

Ka1	5.01E-07	pka1	6.35E+00
Ka2	5.01E-11	pka2	1.03E+01
Ka3			
Ct	0.001		