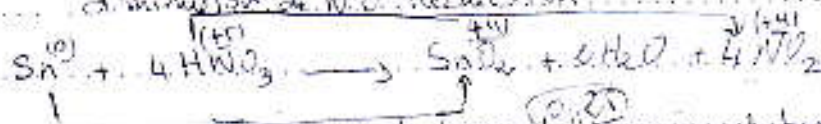


collège type: E.H.D. chimie des solutions
2ème GP

Ex. 1 (6 pts)

(0,25)

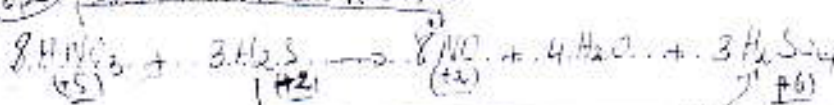
1) diminution de N.O. réduction



oxydant: HNO_3
réducteur: Sn

augmentation de N.O. oxydation

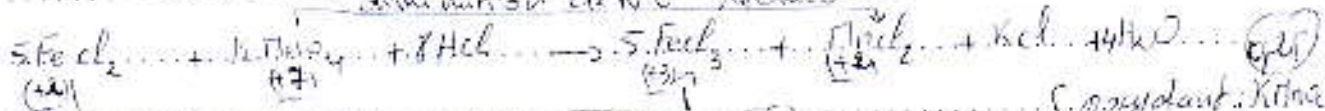
(0,25) diminution de N.O. réduction



HNO_3 oxydant (0,25)
 H_2S réducteur (0,25)

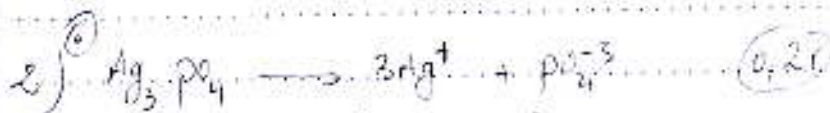
(0,25) augmentation de N.O. oxydation

diminution de N.O. réduction



augmentation de N.O. oxydation

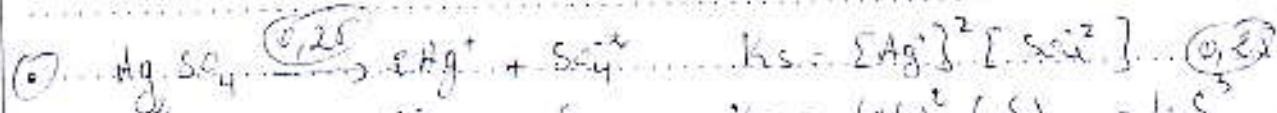
oxydant: $\text{K}_2\text{Cr}_2\text{O}_7$
réducteur: FeCl_2



$K_s = [\text{Ag}^+]^3 [\text{PO}_4^{3-}] = (3S)^3 (S) = 27S^4 \Rightarrow S = \sqrt[4]{\frac{K_s}{27}}$

$K_s = 1,9 \cdot 10^{-19} \Rightarrow K_s = 1,9 \cdot 10^{-19} = 27 \cdot S^4 \Rightarrow S = \sqrt[4]{\frac{1,9 \cdot 10^{-19}}{27}}$

$S = \sqrt[4]{\frac{1,9 \cdot 10^{-19}}{27}} = 4,64 \cdot 10^{-6} \text{ mol/l}$



$K_s = (2S)^2 (S) = 4S^3$

$S = \sqrt[3]{\frac{K_s}{4}}$

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$K_3 = 4,8$ $K_3 = 10^{-4,8} \Rightarrow K_3 = 1,58 \cdot 10^{-5}$ (0,25)
 $S = \sqrt[3]{\frac{1,58 \cdot 10^{-5}}{4}} \Rightarrow S = 0,016 \text{ mol/l}$

c) AgCl (0,25) $\text{Ag}^+ + \text{Cl}^-$ $K_3 = [\text{Ag}^+][\text{Cl}^-]$ (0,25)
 $S \quad S \quad K_3 = S^2 \Rightarrow S = \sqrt{K_3}$ (0,25)
 $\text{p}K_3 = 9,8$ $K_3 = 10^{-9,8} \Rightarrow K_3 = 1,58 \cdot 10^{-10}$ (0,25)
 $S = \sqrt{1,58 \cdot 10^{-10}} \Rightarrow S = 1,25 \cdot 10^{-5} \text{ mol/l}$

Exercice 2 (4pts)

a) $\text{FeCl}_3 \rightarrow \text{Fe}^{3+} + 3\text{Cl}^-$ (0,25) $M_{\text{FeCl}_3} = 162,5 \text{ g/mol}$ $K_3 = 5 \cdot 10^{-10}$
 $n = \frac{m}{M} = \text{C} \cdot V \Rightarrow C = \frac{m}{V \cdot M} \Rightarrow C = [\text{FeCl}_3]$
 $C = \frac{0,1822}{162,5 \cdot 1\text{l}} \Rightarrow C = 1,12 \cdot 10^{-3} \text{ mol/l}$ (0,25)

$[\text{FeCl}_3] = [\text{Fe}^{3+}] = \frac{[\text{Cl}^-]}{3} \Rightarrow [\text{Cl}^-] = 3[\text{Fe}^{3+}] = 3C = 3 \cdot 10^{-3} \text{ mol/l}$
 $[\text{Fe}^{3+}] = 10^{-3} \text{ mol/l}$ $[\text{Cl}^-] = 3 \cdot 10^{-3} \text{ mol/l}$ (0,25)

produit ionique $P_i = [\text{Fe}^{3+}] \cdot [\text{Cl}^-]^3 = 10^{-3} \cdot (3 \cdot 10^{-3})^3 = 2,7 \cdot 10^{-12} \text{ mol/l}$ (0,25)
 $P_i = 2,7 \cdot 10^{-12}$ $K_3 = 5 \cdot 10^{-10}$ donc $P_i < K_3$ donc aucune précipitation

e) AgCl (0,25) $\text{Ag}^+ + \text{Cl}^-$ $C = [\text{AgCl}] = [\text{Ag}^+] = [\text{Cl}^-]$ (0,25)
 $C = \frac{m}{V \cdot M} = \frac{1,433}{10 \cdot 143,3} = 0,01 = 10^{-2} \text{ mol/l}$ $C = 10^{-2} \text{ mol/l}$ (0,25)

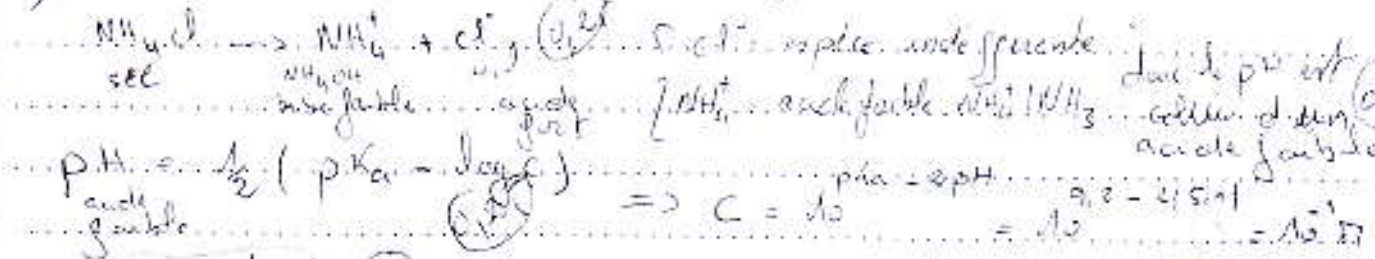
$[\text{Cl}^-]_{\text{total}} = [\text{Cl}^-]_{\text{AgCl}} + [\text{Cl}^-]_{\text{HCl}} = 3 \cdot 10^{-3} + 10^{-2} = 0,3 \cdot 10^{-2} + 10^{-2} = 1,3 \cdot 10^{-2} \text{ mol/l}$

$[\text{Cl}^-]_{\text{total}} = 1,3 \cdot 10^{-2} \text{ mol/l}$ $P_i = [\text{Fe}^{3+}][\text{Cl}^-]^3 = (10^{-3})(1,3 \cdot 10^{-2})^3 = 10^{-3}(2,197 \cdot 10^{-6})$ (0,25)
 $P_i = 2,197 \cdot 10^{-9}$ $K_3 = 5 \cdot 10^{-10}$
 $P_i > K_3$ il y a donc une précipitation (0,5)

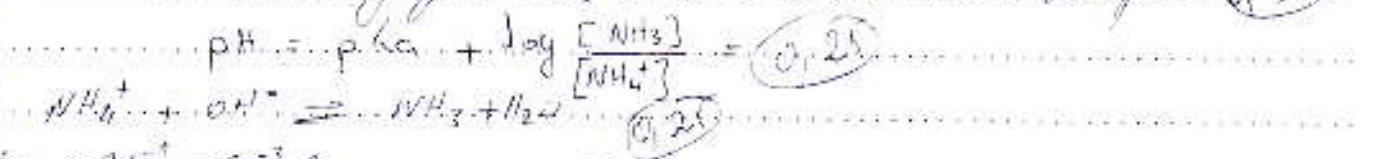
2

Ex. 6666-3 (5 pts)

1) calcul de la concentration de NH_4^+ en l.

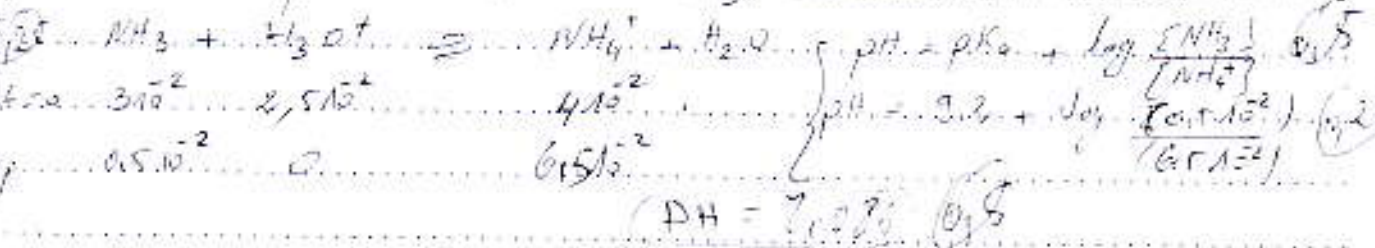


2) prouve l'ajout de NH_4Cl (15ml, 2M) dans la solution on a l'acide NH_4^+ et la base conjuguée NH_3 donc c'est un milieu tampon. (0,5)

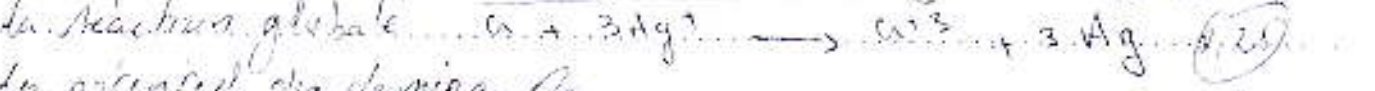
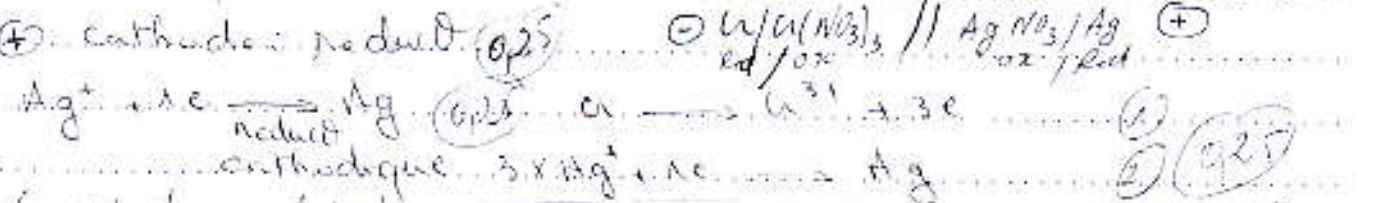
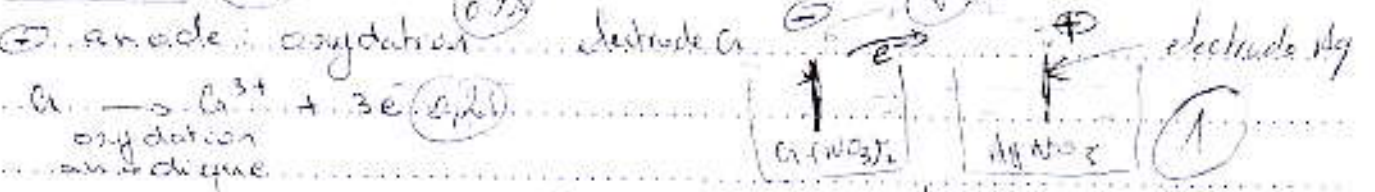


Eau: $0,7 \cdot 10^{-2} - 15 \cdot 10^{-3} \cdot 2$
 $7 \cdot 10^{-2} - 3 \cdot 10^{-2}$ (0,25)
 $4 \cdot 10^{-2}$ (0,25)
 $pH = pK_a + \log \frac{[3 \cdot 10^{-2}]}{[4 \cdot 10^{-2}]}$
 $pH = 9,075$ (0,5)

3) calcul de pH en l'addition de H_3O^+ ($2,5 \cdot 10^{-2}$ l)



Exercice 4 (5 pts)



la potentialité des demi-cellules:
 $E_1 = E_1^0 + \frac{0,06}{3} \log [Ca^{3+}]$ (0,25)
 $E_2 = E_2^0 + 0,06 \log [Ag^+]$ (0,25)

$$E_1 = -0.74 + \frac{0.06}{3} \log(10^{-1}) \Rightarrow E_1 = -0.76 \text{ V. } (0.25)$$

$$E_2 = 0.799 + 0.06 \log(10^{-1}) = E_2 = 0.739 \text{ V. } (0.25)$$

$$E_2 > E_1 \quad (0.25)$$

$$\text{F.e.m.} = E_2 - E_1 = 0.739 - (-0.76) = 1.449 \quad (0.25)$$

$$\text{F.e.m.} = 1.449 \text{ V. } (0.5)$$