



DQB-FCUL
2nd Semester 2014/2015

Aquatic Chemistry A
08/07/2015

Time: 2,5 h.

Justify every answer.

2,0 points for each question.

1 - Define atmospheric aerosols. What are the most likely sources of atmospheric aerosols in Lisbon and how do you classify them? Justify.

2 - What are the deposition processes you know and how do you characterize them?

3 - a) Define Alkalinity of a water. How is it possible to measure and evaluate it?

b) Write the chemical equations and the expressions of the equilibrium' constants corresponding to the balance of carbonate species in aqueous medium.

4 - "The solubility of a gas in water is influenced by several factors." Comment the statement and give examples.

5 - Name the water properties or characteristics that allow to explain the aqueous "dissolution" of such different substances as Sodium Chloride, Saccharose, Xenon and Propane, classifying each one of those processes with the appropriate name.

Answer: Slide 11 (Matrizes Aquosas2017)

NaCl High dielectric constant of the water and polarity - Ionic hydration

Saccharose - Polarity - Electrophilic hydration

Xenon and Propane - Hydrogen Bonds/ Chlratres - Hydrophobic hydration

6 - Try to explain the following sentence "Large marine fish ingestion from within certain areas can cause severe intoxications", relating it with the significant toxic chemical species, the process of formation and its toxicity properties.

Answer: Slides 9 e 10 (Metais Tóxicos) pag 390-393 "Environmental Chemistry", Colin Baird
Toxic chemical specie: Methylmercury

7 – Consider an anaerobic aqueous matrix with pH=4.

a) Choose, to this matrix, a pE value that would be adequate, from the following: **-5, 0 and +10.**

Answer: Slide 46 (Matrizes Aquosas2017)

pE= -5 for an anaerobic matrix

b) With the selected value in the previous answer, and knowing that $pE^0 = +37,2 \text{ V}$ for the ionic pair $\text{FeO}_4^{2-} / \text{Fe}^{3+}$, find out, under these conditions, which one should be the predominant species.

Answer: Slide 45 e 46 (Matrizes Aquosas2017)

pag 432-434 “Environmental Chemistry”, Colin Baird

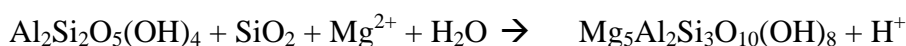
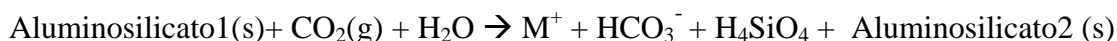
$$pE_m = pE^0 - \log \left(\frac{[\text{Fe}^{3+}]^{1/3}}{[\text{FeO}_4^{2-}]^{1/3} [\text{H}^+]^{8/3}} \right) = 37,2 - 8/3 \text{ pH} - 1/3 \log ([\text{Fe}^{3+}]/[\text{FeO}_4^{2-}])$$

$$-5 = 37,2 - 8/3 \times 4 - 1/3 \log ([\text{Fe}^{3+}]/[\text{FeO}_4^{2-}])$$

$$\log ([\text{Fe}^{3+}]/[\text{FeO}_4^{2-}]) = 94,6 \quad [\text{Fe}^{3+}]/[\text{FeO}_4^{2-}] = 4 \times 10^{94}$$

Predominant Fe^{3+} the reduced form, which agrees with the anaerobic condition

8 – a) Explain the meaning of the following chemical schemes, showing how they can be related:



Answer: Slide 29 e 31 (Matrizes Aquosas2017)

Formation of Mg^{2+} from Aluminosilicato1(s) and its withdrawal from the matrix forming $\text{Mg}_5\text{Al}_2\text{Si}_3\text{O}_{10}(\text{OH})_8$

b) How can we take advantage, from a business point of view, of the Mg^{2+} ion presence in the seawater?

Answer: Slide 33 (Matrizes Aquosas2017)

9 – Name the 3 common stages of a typical sewage and wastewater treatment system, summing up for each one, their major characteristics and purposes.

Answer: Slide 20 (Análise e Tratamento)

pag 479-481 “Environmental Chemistry”, Colin Baird

Primary, Secondary and Tertiary Treatments

10 - Which are the most relevant physico-chemical parameters in the eutrophication of a lake and how to manage the impact of a large city in the lake to where wastewater is discharged?