DQB-FCUL
2nd Semester 2015/2016

Aquatic Chemistry A

06/07/2016

Time: 2,5 h.
Justify every answer.
2,0 points for each question.

1 - Refer what are the main causes and the consequences of acid precipitation.

2 - Explain how oil spills in the ocean can influence gases exchange with the atmosphere and the consequences that may arise.

3 - Among the various constituents of the atmosphere which one dissolves more easily in water? Refer some of the consequences that this dissolution causes.

4 - "The effects of PM2.5 on human health are of more concern than those of PM10." Comment the sentence explaining what are we talking about.

5 – An aqueous matrix has been analysed as to its color and turbidity, with the following results:

matriz X	10 uH	10 UNT

a) Explain the meaning of these values and the process in which they were determined.
Answer: Slide 20 e 22 (Matrizes Aquosas2017)
Colour (10 Hazen units at a APHA-Hazen colour scale / Padrão – 500ppm Pt using Spectrophotometer)
and Turbidity (10 Nephelometric Turbidity Units determined using Turbidimeter / measurement is given for the amount of absorbed light calibrated with a standard suspension)

b) Could the matrix X be potable water? Justify your answer.
Slide 20
Answer: > **5 UNT** → No

6 – Compare the consequences for humans of Cadmium or Arsenic contaminated food, mentioning, for these metals, their most toxic forms.

Answer: Slides 17 e 21 (Metais Tóxicos) pag 410-414 "Environmental Chemistry", Colin Baird

Most toxic forms: Cd^{2+} and AsH_3

Humans are protected against chronic exposure to low levels of cadmium (pag 411)

Much of the arsenic present in food occurs in the water-soluble organic acids form and is readily excreted and rather non-toxic to humans (pag 412)

7 – Consider water from a lake bed, which has the following values:
pE= -3 e pH=4.

a) Write the chemical scheme relative to the dominant process in this situation, showing the change in oxidation numbers of the element involved.
Answer: Slide 46 (Matrizes Aquosas2017)
Anaerobic matrix
$1/8\ CO_2 + H^+ + e \rightarrow 1/8\ CH_4 + 1/4\ H_2O$ (C: +4 → - 4 reduction of Carbon)

b) Considering those values and pE^o=2.87, determine the relation between the chemical species that one can consider predominant in that matrix.

$pE_m = 2{,}87 - pH - 1/8 \log (pCH_4 / p\ CO_2)$

$-3 = 2{,}87 - 4 - 1/8 \log (pCH_4 / p\ CO_2) \rightarrow pCH_4 / p\ CO_2 = 1x10^{15}$

8 – Knowing that Chloroform and Toluene are two contaminants in an aquifer.
a) Regarding their contaminant type, label these two compounds.
b) Describe these aquifer characteristics.
c) What are the possible treatments.

This issue it was not explained this year (Slide 4 - Análise e Tratamento)

9 – For water disinfection of a swimming pool, we can use electrolysis of a sodium chloride aqueous solution.
a) Which species are produced in this process and with what purpose.
b) Answer: Slide 33 (Matrizes Aquosas2017)
Cl_2 , H_2 and NaOH. Cl_2 is produced to generate HOCl

b) Write the relevant chemical scheme for the disinfection process, identifying the chlorination agent.

Answer: Slide 16 e 17 (Análise e Tratamento)

pag 471 e 472 "Environmental Chemistry", Colin Baird

$Cl_2(g) + H_2O(aq) \rightleftharpoons HOCl(aq) + H^+ + Cl^-$ chlorination agent HOCl

$OCl^- + H_2O \rightleftharpoons HOCl + OH^-$ for the pH control

10 - Describe how agricultural activities near a lake can affect its trophic level and what measures should be taken to minimize impacts.