NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
END OF SECOND SEMESTER EXAMINATIONS: TTE– MAY 2013
ANALYTICAL CHEMISTRY III – SCH 4206
TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES
Answer **ANY FOUR** questions out of **FIVE** questions provided.
Each question carries 25 marks.

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1. (i)   What is a super critical fluid?   [2 marks]

    (ii) Discuss the advantages of supercritical fluid extraction (SFE) over solvent extraction.   [8 marks]

    (iii) Differentiate between the following terms as used in solvent extraction.
       (a) An exhaustive and countercurrent extraction.   [5 marks]
       (b) Distribution coefficient and distribution ratio.   [5 marks]

    (iv) What are the main disadvantages of solvent extraction.   [5 marks]

2. (i)   Discuss the differences and advantages that microwave digestion has over wet ashing using conventional heating.   [10 marks]

    (ii) The K_d for a weak acid between water and diethyl ether is found to be 800 and its K_a in water is 1.50×10^{-5}. Calculate the analytical concentration of HA remaining in an aqueous solution after 50.0ml of 0.0500M HA is extracted with 25.0ml of ether, assuming the aqueous solution is buffered to a pH of (a) 2.00 and (b) 8.00.   [15 marks]

3. (i)   What is a masking agent and how does it function?   [10 marks]

    (ii) What are the steps involved in obtaining a laboratory sample?   [15 marks]

4. (a)   In the analysis of environmental samples, briefly describe what do the following terms mean and how are they determined experimentally?

    (i) Total Organic Content (TOC)   [5 marks]

    (ii) Chemical Oxygen Demand (COD)   [5 marks]

    (b) Name any four sources of error and explain how they can be minimized.   [15 marks]

5. (a)   The distribution coefficient for X between chloroform and water is 9.6. Calculate the concentration of X remaining in the aqueous phase after 50.0 ml of 0.150M X is treated by extracting with the following quantities of chloroform.

(i)   One 40.0 ml portion
(ii)   Two 20.0 ml portions
(iii)   Four 10.0 ml portions
(iv)   Eight 5.00 ml portions   [15 marks]

(b)   Derive the expression that relates the distribution ratio, D, to the distribution coefficient, K_D and the dissociation constant K_A.   [10 marks]

End of examination