NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
BACHELOR OF SCIENCE HONOURS DEGREE
SUPPLEMENTARY EXAMINATIONS – AUGUST 2014
ANALYTICAL CHEMISTRY II – SCH 2106
TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES

Answer ***FOUR*** questions out of ***FIVE*** questions provided.
Requirements: Calculator, Graph Paper and Standard electrode tables.

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1. (a) What do you understand by a liquid- junction potential? Explain how it develops? [5]

(b) Calculate the equilibrium constant for the reaction

$2MnO_4^- + 3Mn^{2+} + 2H_2O \Leftrightarrow 5MnO_2(s) + 4H^+$ [15]

(c) Describe three mechanisms by which electricity is transported through an electrochemical cell. [5]

2. (a) Define the following

(i) Absorbance [2]

(ii) Transmittance [2]

(iii) Beer Lambert's Law [2]

(b) What are the limitations of Beer Lambert's Law? [10]

(c) A solution containing a complex formed between Bi(III) and thiourea has a molar absorptivity of 9.32×10^3 $L.cm^{-1}.mol^{-1}$ at 470nm.

(i) What is the absorbance of a 6.24×10^{-5} M solution of the complex in a 1.00 cm cell?

(ii) What is the percentage transmittance of the solution described in (i)?

(iii) What is the molar concentration of the complex in a solution that has the absorbance described in (i) when measured at 470 nm in a 5.00 cm cell? [9]

3. (a) Why is atomic emission more sensitive to flame instability than atomic absorption? [7]

(b) Draw a diagram illustrating the main parts of an atomic absorption spectrophotometer. [8]

(c) What processes occur to produce light emission from the flame when a solution containing sodium ions is presented to the instrument? [10]

4. (a) Briefly, but informatively define the following electrochemical terms;

(i) Ohmic Potential
(ii) Salt Bridge
(iii) Electrolytic Cell
(iv) Galvanic Cell
(v) Electrode Potential [10]

(b) The molar extinction coefficient (ε) of compound riboflavin is 4.7×10^3 Litre/cm/Mole. If the absorbance reading (A) at 350 nm is 1.09 using a cell of 1.25 cm, what is the concentration of compound riboflavin in sample? [5]

(c) Calculate the thermodynamic cell potential for the following cell and indicate whether, as written, it is a galvanic or electrolytic cell.

$Pt \mid UO_2^{2+}(7.93 \times 10^{-3}M),\ U^{4+}(6.37 \times 10^{-2}M), H^{+}(1.16 \times 10^{-3}M) \parallel Fe^{3+}(0.003876\ M),\ Fe^{2+}(0.1134\ M) \mid Pt$ [10]

5. (a) Define the following:

(i) Ground state
(ii) Continuous spectra
(iii) Resonance fluourescence
(iv) Molar absorptivity
(v) Relaxation [10]

(b) Describe in detail the transitions that are responsible for absorption by:

(i) lanthanide and actinide. [5]

(ii) Elements of the first and second transition metal series. [5]

(c) Using examples explain how conjugation affects absorption. [5]

End of question Paper!!!