



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
SUPPLEMENTARY EXAMINATIONS – JULY 2005
ANALYTICAL CHEMISTRY II – SCH 2106
TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES

Answer **Four** questions. Each question carries 25 marks.

1. The equilibrium constant for the conjugate acid/base pair
 $\text{HIn} + \text{H}_2\text{O} \leftrightarrow \text{H}_3\text{O}^+ + \text{In}^-$
is 8.00×10^{-5} . From the additional information

Species	Absorption maximum, nm	Molar Absorptivity	
		430 nm	600 nm
HIn	430	8.04×10^3	1.23×10^3
In ⁻	600	0.775×10^3	6.96×10^3

- (a) Calculate the absorbance at 430 nm and 600 nm for the following indicator concentrations: $3.00 \times 10^{-4}\text{M}$, $2.00 \times 10^{-4}\text{M}$, $1.00 \times 10^{-4}\text{M}$, $0.500 \times 10^{-4}\text{M}$, $0.250 \times 10^{-4}\text{M}$ [15 marks]
- (b) Plot the absorbance as a function of the indicator concentration. [10 marks]
2. (a) Define the following:
- (i) Absorbance [2 marks]
 - (ii) Transmittance [2 marks]
 - (iii) Beer Lambert's Law [2 marks]
- (b) Discuss the limitations of Beer Lambert's Law? [13 marks]
- (c) A solution containing a complex formed between Bi(III) and thiourea has a molar absorptivity of $9.32 \times 10^3 \text{ L.cm}^{-1}.\text{mol}^{-1}$ at 470nm.
- (i) What is the absorbance of a $6.24 \times 10^{-5}\text{M}$ 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? [6 marks]
3. (a) Draw a diagram of a glass membrane indicator electrode. With the aid of relevant equations explain how this membrane is pH sensitive. [10 marks]
- (b) Discuss errors that affect pH measurements using a glass membrane. [10 marks]
- (c) What do you understand by a liquid-junction potential? Explain how it develops. [5 marks]
4. (a) What processes occur to produce light emission from the flame when the solution of the metal ions is presented to the flame photometer? [8 marks]
- (b) Explain the difference between a fluorescence emission spectrum and a fluorescence excitation spectrum. Which more closely resembles an absorption spectrum? [5 marks]
- (c) In which solvent would the fluorescence of naphthalene be expected to be the greatest? Explain [6 marks]
- (d) Differentiate between amperostatic and potentiostatic coulometry. [6 marks]
5. (a) A 0.400-g sample of toothpaste was boiled with a 50-mL solution containing citrate buffer and NaCl to extract the fluoride ion. After cooling, the solution was

diluted to exactly 100 mL. The potential of a selective ion/calomel system in a 25.0 mL aliquot of the sample, was found to be -0.1823 V. Addition of 5.0 mL of a solution containing 0.00107 mgF/mL caused the potential to change to -0.2446 V. Calculate the weight-percent F in the sample. [10 marks]

- (b) Discuss about different types of electronic transitions exhibited by various UV/VIS absorbing species and their influence on molar absorptivity. [15 marks]

End of question Paper!!!