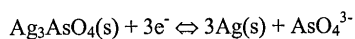


NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
SUPPLEMENTARY EXAMINATION – JULY 2004
ANALYTICAL CHEMISTRY II – SCH 2106
TIME – 3 HOURS

INSTRUCTIONS TO CANDIDATES

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

1. (a) Calculate the standard potential for the reaction



$$K_{\text{sp}} \text{ for } \text{Ag}_3\text{AsO}_4 = 1.2 \times 10^{-22} \quad [5 \text{ marks}]$$

- (b) Give the schematic representation of a cell with a silver indicator electrode as the cathode and the saturated calomel as an anode that could be used for determining AsO_4^{3-} . [2 marks]

- (c) Derive the equation that relates the measured potential of the cell in (b) to pAsO_4 (assume that the junction potential is zero). [5 marks]

- (d) Calculate the pAsO_4 of a solution that is saturated with Ag_3AsO_4 and contained in a cell described in (b) if the resulting potential is 0.312 V. [3 marks]

- (e) List five limitations of the glass electrode for pH measurement. [5 marks]

- (f) Describe how a mercury electrode could function as an electrode of first kind for $\text{Hg}(\text{II})$ and of second kind for EDTA. [5 marks]

2. (a) With the aid of labelled diagrams explain the difference between single-beam and double beam spectrophotometers. [7 marks]

- (b) Discuss the limitations of Beer's Law. [13 marks]

(c) Why is it necessary for the glass in the membrane of pH-sensitive electrode to be appreciably hygroscopic? [5 marks]

3. (a) Draw different wave forms encountered in voltammetry. [8 marks]

(b) List the advantages and disadvantages of the dropping mercury electrode compared with platinum or carbon microelectrodes. [8 marks]

(c) Distinguish between a limiting current and a diffusion current. [4 marks]

(d) The polarogram for 20.0 ml of solution that was 3.65×10^{-3} M in Cd^{2+} gave a wave for that ion with a diffusion current of 31.3 μA . Calculate the percentage change in concentration of the solution if the current in the limiting current region were allowed to continue for 5 mins. [5 marks]

4. (a) Two types of interferences are encountered in atomic absorption methods. Give a detailed description of each. What steps can be taken to eliminate or minimize such interferences? [10 marks]

(b) Draw a diagram of a ISFET for measuring pH. Explain how this device responds to any changes in the hydronium ions. [10 marks]

(c) Describe charge-transfer absorption. [5 marks]

5. The chromium in an aqueous sample was determined by pipetting 10.0 ml of the unknown into each of five 50.0 ml volumetric flasks. Various volumes of a standard containing 12.2 ppm Cr were added to the flasks, following which the solutions were diluted to volume.

Unknown, ml	Standard, ml	Absorbance
10.0	0.0	0.201
10.0	10.0	0.292
10.0	20.0	0.378
10.0	30.0	0.467
10.0	40.0	0.554

(a) Plot the data [5 marks]

(b) Derive the equation for the relationship between absorbance and volume of standard. [5 marks]

(c) Calculate the standard deviation for the slope and the standard deviation about regression in (b). [5 marks]

(d) Calculate the ppm Cr in the sample. [5 marks]

(e) Calculate the standard deviation of the result in (d) [5 marks]

END OF PAPER!!!!