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| **DEPARTMENT OF CHEMISTRY**  **FOURAH BAY COLLEGE**  **UNIVERSITY OF SIERRA LEONE** CHEM 311**PHYSICAL ANALYTICAL CHEMISTRY II****Unit 2 – Electroanalytical Techniques** **CONTINUOUS ASSESSMENT**  **ASSIGNMENT**  This assignment must be submitted no later than 2 pm on Friday March 23rd 2018  You must submit this cover sheet with your assignment.  Name: ……………………………………………………  Admission No. ………………..  Note:  Unit 2 Continuous Assessment is worth 10% of the total marks for CHEM312  Your score will be divided into three parts:  Lecture and Tutorial Attendance 10%  Assignment 40%  Test 50% |

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| **1.** | (a) | Name the electroanalytical method used to obtain the following graphs:   1. potential vs volume of titrant 2. current vs volume of titrant 3. current vs potential 4. potential vs time |
|  | (b) | Sketch a typical graph for each method |
|  | (c) | Briefly explain the principles behind each method |
|  | (d) | Describe the instrumentation used for each method  [25] |
| **2.** | What is the difference between a polarograph and a polarogram? Draw diagrams to show the main features of each.  [5] | |
| **3.** | Describe the main features of a dropping mercury electrode and explain why it is useful in polarography.  [5] | |
| **4.** | (a) | What is meant by the term “diffusion-limited current” |
|  | (b) | In the presence of a supporting electrolyte, the flux due to diffusion is given by  **fM = DM**  Hence derive an expression linking the current at an electrode to the concentration gradient, in the presence of a supporting electrolyte. |
|  | (c) | Fick’s Law of diffusion relates the concentration gradient to the rate of change of concentration as follows:  This equation can be solved to show that = when [M] has reduced to zero at the electrode.  Hence derive an expression for the diffusion current ID |
|  | (d) | Derive an expression for the surface area of mercury at the dropping electrode in terms of the flow rate m, the density of mercury and the time. |
|  | (e) | Hence show that ID is proportional to |
|  | (f) | Discuss some of the limitations of the Ilkovic equation.  [25] |
| **5.** | (a) | For the equation O + ne 🡪 R, use the Nernst equation to write an expression for the potential E at the electrode in terms of Eo, n, [O]e and [R]e |
|  | (b) | Show that [O]e = and that [R]e = |
|  | (c) | Hence show that = E0 + ln |
|  | (d) | Discuss the validity of the approximation that = E0.  [10] |

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| **6.** | (a) | Write an equation for the formation of the complex ion [MLp]x+py and hence write an expression for the stability constant Kstab of the complex | |
|  | (b) | The value of E1/2 for a complex ion can be shown to be E1/2 = Eo - lnKstab - ln[Ly] | |
|  |  | (i) | Explain the meaning of the terms in this expression |
|  |  | (ii) | Show how the expression can be used to deduce values for p and Kstab  [5] |
| **7.** | (a) | Draw three different shapes of curves obtained in amperometric titrations; in each case, suggest a possible titrand and titrant which could give each type of curve and explain the shape of the curves obtained.  [5] | |
| **8.** | (a) | What is the difference between an amperometric titration and a potentiometric titration? | |
|  | (b) | In potentiometric titrations, a graph of ΔE/ΔV against V is more useful than a graph of E against V. Explain why, and sketch the shape of a graph of ΔE/ΔV against V.  [5] | |

**TOTAL 85 MARKS**