

Bago University
Department of Chemistry
First Semester Examination, March 2019

Fourth Year BSc
(Chemistry Specialization)
Answer any six Questions

Chem-4104
Analytical Chemistry III
Time Allowed: (3) hours

1. (a) Fill in the blanks with the correct word(s), unit(s), and etc., as necessary.
- (i) Application of potential greater than the thermodynamic potential to operate an _____ cell.
 - (ii) The first requirement in the extraction process is the select _____ solvents.
 - (iii) The extraction usually takes place in a specialized piece of glassware known as _____.
 - (iv) The current resulting due to condenser current and Faradaic current is collectively known as _____.
 - (v) * Constant current coulometric method is also called _____ because of their similarity to conventional titration.
 - (vi) The magnitude of _____ is related to the concentration of reducible species by Ilkovic equation.
- (b) Select the correct statement(s), word(s), unit(s) and etc., given in the followings.
- (i) The extraction usually takes place in a specialized piece of glass-ware known as a (separatory funnel, measuring flask, craig apparatus).
 - (ii) The most commonly used stationary phases are (absorbed, adsorbents, adsorption).
 - (iii) Capillary columns have an internal diameter of a few tenth of a (millimeter, kilometer, centimeter).
 - (iv) Polarizable electrode is also known as (macroelectrode, microelectrode, mesoelectrode).
 - (v) Kinetic polarization is most pronounced for electrode processes that yield (solid, liquid, gaseous) product.
 - (vi) (Coulometric cell, Potentiostat, Electronic integration) is used to control the potential of working electrode.
2. (a) Explain briefly about the principles of counter current distribution.
- (b) The distribution coefficient for iodine between CCl_4 and H_2O is 85. Calculate the concentration of I_2 remaining in the aqueous layer after extraction of 50.0 mL of $1.00 \times 10^{-3} M$ I_2 with the following quantities of CCl_4 : (i) 50.0 mL; (ii) two 25.0 mL portions; (iii) five 10.0 mL portions.

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3. (a) What are the two general types of columns in gas chromatograph? Explain any one.
(b) Lead forms a natural complex PbQ_2 , with the ligand Q^- . The constant k_{ex} for the distribution of this complex between water and CCl_4 has been found by experiment to be 2.0×10^4 and a 25.0 mL aliquot of an aqueous solution that is 5.00×10^{-4} M in Pb^{2+} and 0.5 M in $HClO_4$ is extracted with two 10.0 mL portions of CCl_4 that are 0.0250 M in HQ . Calculate the percentage of unrecovered Pb^{2+} in the aqueous solution.
4. (a) What are the three types of Zipax-type particles as HPLC column supports? Which one offers very high resolution?
(b) Distinguish normal phase HPLC from reverse phase HPLC.
5. (a) Write down the principle of electrogravimetry and discuss the electrodeposition of metals without cathode-potential control.
(b) Draw the schematic diagram of the apparatus for electrolysis at controlled potential and explain briefly about this.
6. (a) Define the followings.
(i) Polarograms (ii) Half-wave potential (iii) Ilkovic equation
(b) Describe the basic components of the experimental set up and draw a typical polarograph with its basic component.
7. (a) Draw and detailed description of apparatus for constant current coulometry.
(b) A constant current of 0.8 A is used to deposit copper at the cathode and oxygen at the anode of an electrolytic cell. Calculate the number of grams of each product formed in 15 minutes assuming no other redox reaction. ($1F = 96500$, $Cu = 63.5$, $O = 16$)
