

八十五學年度 化學工程學系 系(所) 乙 組碩士班研究生入學考試

科目 分析化學 科號 1603 共 2 頁第 1 頁 *請在試卷【答案卷】內作答

- (10%) 1. Seven replicate measurements were made on a random sample of the polluted water. The results were: 3.36, 3.20, 3.15, 3.12, 3.10, 3.09 and 3.06 ppm of cadmium.
- Calculate the sample mean and the sample standard deviation.
 - Calculate the cadmium content of the polluted water for the 90% confidence interval. (student t values = 2.015, 1.943 and 1.895 for degree of freedom 5, 6, and 7 respectively).
 - Use Q-test to point out the outlying value. (the rejection quotient, $Q_{90} = 0.51$ for seven measurements)
 - Calculate the cadmium content for the 90% confidence interval after Q-test.
- (10%) 2. An air sample, polluted with SO_2 , is passed through a continuous coulometric cell which automatically maintains a small concentration of I_2 by electrogenerating it from acidic potassium iodide. The SO_2 is oxidized to SO_3 by the iodine. If the air sample flow rate is 5 l min^{-1} , and the coulometer averaged an output of 1.40 mA to maintain the I_2 concentration for 10 min, what is the concentration of SO_2 in $\mu\text{g/l}$ (weight by air volume)?
- (10%) 3. After passing 100 ml of 0.005 M Cs^+ solution through an ion-exchange resin the concentration of Cs^+ in solution was found to be 5 ppm
- Calculate the partition coefficient, K_D , for the Cs^+ ion on the resin (assume the atomic weight of Cs = 133 g) $K_D = \frac{(\text{Cs}^+)_{(s)}}{(\text{Cs}^+)_{(aq)}}$
 - How much weight of Cs^+ metal was extracted in the ion-exchange resin.
- (10%) 4. (a) Titration of 100 ml of river water with 0.100 M EDTA solution consumes 2.85 ml EDTA to the Erichrome black T indicator equivalence end point. Calculate the total hardness of the sample. (Total hardness expressed in mg l^{-1} unit as if it were all CaCO_3)

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- (b) Titration of 100 ml of river water with 0.100 M HCl solution consumes 2.85 ml HCl to the methyl orange equivalence point. Calculate the total alkalinity of the sample. (The total alkalinity is expressed in meq l^{-1})
- (10%) 5. Briefly define or describe
- Beer-Lambert law
 - Standard addition
 - Micromembran suppression
 - Solvent extraction
 - Purge and trap technique
- (6%) 6. Describe the six basic components for a pH meter.
- (6%) 7. Describe the principle and functions of hydride generation techniques.
- (12%) 8. Compare the analytical performance of graphite furnace atomic absorption spectrometer (GF-AAS) and inductively coupled plasma mass spectrometer (ICP-MS).
- (12%) 9. Compare the analytical performance of SIM and full scan modes used in the GC-MS analysis.
- (8%) 10. The determination of volatile organics in drinking water is becoming important. Suggest an analytical method to fulfill this need. Justify your recommendation by defining the problem and evaluating the figures of merit.
- (6%) 11. The contamination of heavy metals in the agricultural soils in Taiwan is regarded widespread. Suggest an analytical method to survey the contamination extent of heavy metals in Taiwan soils. Justify your suggestion by taking into consideration of the budget.