M.Sc. DEGREE I SEMESTER EXAMINATION IN ENVIRONMENTAL TECHNOLOGY, JANUARY 2003

CHEMOMETRY AND GOOD LABORATORY PRACTICES
(Old Scheme)

Time: 3 Hours   Maximum Marks: 50

SECTION - A
(Answer ANY FIVE questions)
(All questions carry EQUAL marks)

$(5 \times 2 = 10)$

I. 1. Round off to the nearest hundredth. Express to 3 significant figures
            (i)   0.32000   (ii)   0.00021301
    2. Give the number of significant figures in the following:
            (i)   0.0021   (ii)   2.2300
    3. Give answers in proper significant figures :
            Add   11.23,   131.1,   130.21, 1.24×10^{-2}
    4. Define precision and accuracy.
    5. What are the classes of errors ?
    6. Define molar conductance .

SECTION - B
(Answer ANY FIVE questions)
(All questions carry EQUAL marks)

$(5 \times 3 = 15)$

II. 1. Pure iron weighing 0.192g is dissolved in 25ml of 6M Nitric acid and
        made upto 250ml. Calculate the normality of Fe (III) as oxidising
        agent.
    2. Calculate the volume of HCl (Sp. Gr. 1.130, 25.75% HCl) required to
        neutralise 50ml of aq. Ammonia (Sp.Gr. 0.90, containing 28.33% NH_3).
    3. In a set of 4 measurements of Cadmium in a water sample, the
        standard deviation is 0.20ppm. If 16 measurements are carried out,
        what would be the standard deviation ?
    4. The solubility product of AgCl is $1.0 \pm 0.1 \times 10^{-4}$. Calculate its
        solubility. What is the uncertainty in this calculated value of solu-
        bility ?
    5. What are the principle errors associated with volumetric glassware ?
    6. Give a method for separation of Ge, As, Sb and Sn, when present
        together.

SECTION - C
(Answer ANY FIVE questions)
(All questions carry EQUAL marks)

$$(5 \times 5 = 25)$$

III.   Enumerate the five safety rules to be followed by those working in a chemical laboratory.

IV.   Explain the difference between mean and median of a set of results.

V.   A cell is made by coupling -
      (i)   a platinum wire dipping in 0.01M Fe2 + and 0.005M Fe3+ and
      (ii)   a platinum wire dipping in a solution of 0.005M Ce3+ and 0.01M Ce4+
      Calculate the e.m.f. of the cell. Indicate the direction of flow of electrons in the outside circuit connecting the two wores.
      Standard potential -
      $Ce^{4+} + e^- \rightarrow Ce^{3+}$ 1.61V
      $Fe^{3+} + e^- \rightarrow Fe^{2+}$ 0.77V

VI.   The Titanium content of a paint found on the cloths of a hit and run victim was compared with that of a suspected car. Does the following data confirm the probability of suspicion. It is established by long years of experimentation that the standard deviation of the method for determination of Ti is 0.35%
      % Ti in paint from cloths   -   4.0, 4.6
      % Ti in paint from car   -   4.5, 5.3, 5.5, 5.0, 4.9

VII.   Standard deviation of results of Cd on three seawater samples are 0.02, 0.03 and 0.05 ppb. What is the standard deviation of the combined results ?

VIII.   A titrimetric method for Calcium in a limestone standard sample gave a mean of 30.26% CaO from four analysis. The certified value is 30.15% CaO. The standard deviation of the method is established to be 0.094% CaO. Does the data indicate a determinate error at 95% confidence level ?

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