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ICH 451

II Semester M.Sc. Degree Examination, May/June 2019

INDUSTRIAL CHEMISTRY

Analytical Chemistry

Time : 3 Hours]

[Max. Marks : 70

PART - A

1. Answer **any five** questions : **(5 × 2 = 10)**
- (a) State the distribution law.
 - (b) A steel sample was analysed repeatedly for its iron content and showed the following results : 24.6 ; 25.3 ; 22.1, 24.8 and 25.1 mg. Find whether the middle result in the set of analysis should be rejected or retained for the calculation and treatment of data. (Given : Q value at 90% confidence level = 0.642)
 - (c) Define ion exchange capacity of resin. Mention its significance.
 - (d) Calculate the number of theoretical plates of a column which showed retention time of 14 s and width of peak at its base 2 s for the elution of an analyte.
 - (e) What is quantum yield? How it is calculated?
 - (f) Why glycerol is added during the determination of sulphate by turbidimetry?
 - (g) Sketch the thermogram and identify the products in the decomposition of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$.
 - (h) Differentiate between X-ray diffraction and electron diffraction.

PART - B

Answer **any five** questions : **(5 × 12 = 60)**

2. (a) Briefly explain the different types of solvent extraction techniques.
- (b) A chemist obtained following set of results for vitamin C analysis in a tablet sample using a newly developed method : 48, 47, 49, 48 and 49 mg. The results of analysis on the sample by standard



method are 46.5, 48.1, 48.5, 47.2 and 49.6 mg. Find whether the new method is significantly different from standard method when F value is 6.59 at 95% confidence level.

- (c) With the help of chemical reactions, explain the procedure for the determination of total iron (Fe^{2+} and Fe^{3+}) in a given sample for haematite ore. **(4 + 4 + 4)**
3. (a) What are metal ion indicators? Write the structure of EBT and explain the mechanism of its colour change at the end point of a complexometric titration.
- (b) Write a note on the preparation and storage of solid and liquid samples for the analysis.
- (c) With the help of chemical reactions, explain the procedure for the determination of calcium in a given sample by complexometric titration. **(4 + 4 + 4)**
4. (a) Classify the chromatographic techniques based on the mechanism of separation of components.
- (b) The Na^+ ion in a 200 ml of a solution containing 10.0 g/L NaCl is to be removed by passing through a cation exchange resin column in H^+ form. If the exchange capacity of the resin is 5.2 meq/g of dry resin, what is the minimum weight of dry resin required? (mol. wt. of NaCl = 58.45)
- (c) Explain the principle of gas chromatography and discuss its application in the separation of volatile components. **(3 + 4 + 5)**
5. (a) Account briefly on the different types of paper chromatographic techniques.
- (b) Illustrate the principle and applications of thin layer chromatography in qualitative analysis.
- (c) With the help of a block diagram, explain the function of different components in HPLC. **(4 + 4 + 4)**
6. (a) Sketch and explain the conductometric titration curves for :
 (i) Strong acid and strong base
 (ii) Weak acid and strong base.
- (b) Explain the principle and application of nephelometry.
- (c) With the help of Jablonski diagram, explain the various relaxation processes of the excited molecule. **(4 + 4 + 4)**



7. (a) Briefly explain various factors affecting the fluorescence intensity.
(b) Draw the cyclic voltammogram for $K_4[Fe(CN)_6]$ and explain its characteristics.
(c) Write short notes on :
(i) Phosphorescence
(ii) Theory of turbidimetry. (4 + 4 + 4)
8. (a) Discuss the principle and applications of single crystal XRD.
(b) With a neat sketch, explain the working and applications of TEM. (6 + 6)
9. (a) Account briefly on the different types of atomic force microscopy techniques.
(b) Describe the principle and application of spectrophotometry in quantitative analysis.
(c) Draw a neat diagram of DSC and explain its functioning. (4 + 4 + 4)
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