

**U.G. 6th Semester Examination - 2020****CHEMISTRY****Course Code : BCEMDSHC4****Course Title : Analytical Methods in Chemistry**

Full Marks : 30

Time : 2 Hours

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any **ten** questions: 1×10=10
- a) Find out the number of significant figures in the following numbers:  
 $6.023 \times 10^{23}$ , 0.0204
- b) Explain confidence interval of the mean.
- c) In a sample you find out the amount of  $\text{Fe}^{2+}$  is 5.04 gm/L but true value is 5.00 gm/L. Find out the value of relative error.
- d) What do you mean by random error and give an example?
- e) What do you mean by retention time in chromatographic separation?

*[Turn Over]*

- f) Which of 'adsorption chromatography', 'Partition chromatography' and 'ion-exchange chromatography' always involve a solid state stationary phase?
- g) Define ion-exchange capacity with its unit.
- h) What reference is generally used in FTIR spectroscopy?
- i) What is the wavenumber of UV-visible radiation?
- j) Write the relation between absorption and transmittance.
- k) What radiation source is generally used in Atomic Absorption Spectroscopy?
- l) Which of the following molecules do not absorb in the IR region?  
 $\text{HCl}$ ,  $\text{O}_2$ ,  $\text{N}_2$ ,  $\text{H}_2$
- m) Draw the conductometric titration graph (conductance vs volume added) for weak acid vs strong base and strong acid vs weak base.
- n) What is molar extinction coefficient? Write its unit.
- o) Distinguish between eluent and effluent.

2. Answer any **five** questions:  $2 \times 5 = 10$

- a) The following values were obtained for the determination of cadmium in a sample of dust: 4.2, 4.0, 4.4, 3.8, 3.2  $\mu\text{g g}^{-1}$ , should the value 3.2 be rejected at the 95% confidence level?  
[Given  $Q_{crit}$  for five observation = 0.71]
- b) Explain that 'high precision and low accuracy' is more acceptable than 'low precision and high accuracy'.
- c) What is the finger print region in IR spectroscopy?
- d) 96% of a solute is removed from 100 ml of an aqueous solution by extraction with two 50 ml portion of an organic solvent. What is the distribution ratio of the solute?
- e) The mixture of Zn(II) and Mg(II) are usually separated employing anion exchanger rather than cation exchanger– why?
- f) What are the criteria for a good solvent in liquid-liquid extraction?
- g) A mixture of CaO and  $\text{CaCO}_3$  is analysed by TGA. The result indicates that mass of sample decreases from 250.6 mg to 190.8 mg only

between 600°C and 900°C. Calculate the percentage of  $\text{CaCO}_3$  in the mixture.

- h) Why  $R_f$  value is important in chromatographic separation?

3. Answer any **two** questions:  $5 \times 2 = 10$

- a) i) A mixture containing  $\text{K}_2\text{Cr}_2\text{O}_7$  and  $\text{KMnO}_4$  is analysed by measuring the absorbance at 440 nm and 545 nm with the result  $A_{440} = 0.405$  and  $A_{545} = 0.712$  in a 1.0 cm cell. The absorbance of pure solution of  $\text{K}_2\text{Cr}_2\text{O}_7$  ( $1.00 \times 10^{-3}$  M) and  $\text{KMnO}_4$  ( $1 \times 10^{-3}$  M) using same cell gave the following results:  
For  $\text{K}_2\text{Cr}_2\text{O}_7$  solution:  $A_{440} = 0.374$  and  $A_{545} = 0.009$   
For  $\text{KMnO}_4$  solution:  $A_{440} = 0.019$  and  $A_{545} = 0.475$   
Find out the concentration of  $\text{KMnO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$  in the mixture.
- ii) What is the isobestic point in spectrophotometry?  $4 + 1 = 5$
- b) i) Find out the equivalence point potential during the titration of a 0.1(M) Fe(II)

solution with 0.1(M) Ce(IV) solution.

[Given  $E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^0 = 0.77 \text{ V}$  and

$E_{\text{Ce}^{4+}/\text{Ce}^{3+}}^0 = 1.57 \text{ V}$ ]

- ii) What is  $P_{1/2}^H$ ? State the importance of  $P_{1/2}^H$  in the extraction process. 2+3=5
- c) i) Analyse of a sample of iron ore gave the following percentage values for the iron content 7.08, 7.21, 7.12, 7.09, 7.16, 7.14. Calculate the standard deviation and coefficient of variance.
- ii) Find out the value of  $\log[(3.00 \pm 0.03) \times 10^{-4}] = ?$  3+2=5

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