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**63/1(SEM-5) DES1 CHMHE5016**

**2024**

**CHEMISTRY**

Paper : CHMHE5016

***(Analytical Methods in Chemistry)***

*Full Marks : 60*

*Pass Marks : 24*

*Time : 3 hours*

***The figures in the margin indicate full marks for the questions.***

1. Choose the correct answers : ***(any five)***  
1×5=5

***(a)*** How are systematic errors usually removed for an instrument?

***(i)*** By replacing it

***(ii)*** By recalibrating it

***(iii)*** By repairing it

***(iv)*** By not using it for some time.

- (b) In a measurement, the degree of conformity and closeness to the true value is known as
- Precision
  - Accuracy
  - Measuring scale
  - Torque
- (c) Which of the following is directly proportional to the path length and concentration of the sample
- Reflection of light
  - Refraction of light
  - Absorbance of light
  - Intensity of light
- (d) Aldehyde and ketones exhibit which of the following transitions in UV-visible region?
- $\sigma \rightarrow \pi^*$  and  $\pi \rightarrow \pi^*$
  - $n \rightarrow \pi^*$  and  $\pi \rightarrow \pi^*$
  - $\sigma \rightarrow \sigma^*$  and  $\pi \rightarrow \pi^*$
  - $n \rightarrow \sigma^*$  and  $\pi \rightarrow \pi^*$

- (e) Which of the following is the correct order of wavelength of the electromagnetic radiations
- X - rays < Infrared-rays < uv-rays < Microwaves
  - X - rays < uv-rays < Infrared-rays < Microwaves
  - Microwaves < X - rays < uv-rays < Infrared-rays
  - Microwaves < uv-rays < X - rays < Infrared-rays
- (f) Paper chromatography separates molecules based on which of the following property?
- Molecular weight
  - Polarity
  - Viscosity
  - Shape
- (g) In potentiometry, which of the following is considered as a standard electrode.
- Pt-electrode
  - Hydrogen electrode

- (iii) Glassy carbon electrode  
(iv) Copper-electrode
- (h) Which of the following is used for solvent extraction in chemistry lab.
- (i) Kjeldahl flask  
(ii) Distillation apparatus  
(iii) Soxhlet apparatus  
(iv) Kipps apparatus
- (i) Which of the following is an application of flame emission photometer ?
- (i) To determine functional groups  
(ii) To study chemical structure  
(iii) To assay to drug  
(iv) To estimate metal ions like Na, K, etc.
- (j) Which of the following statement is correct for normal phase HPLC ?
- (i) Stationary phase is nonpolar and mobile phase is polar.  
(ii) Mobile phase is non-polar which stationary phase is polar.

- (iii) Addition of more polar solvent to the mobile phase increases eluent strength.  
(iv) Addition of less polar solvent to the mobile phase increases eluent strength.

2. Answer the following questions: **(any five)**  
2×5=10

- (a) What do you mean by normal or Gaussian distribution of random errors?  
(b) Distinguish accuracy and precision.  
(c) Mention the validity of Beer Lambert's law.  
(d) How will you distinguish  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  and  $\text{CH}_3\text{CH}_2\text{OCH}_3$  by IR spectroscopy?  
(e) On what factors does the  $R_f$  value depend?  
(f) The following values were obtained for the determination of cadmium in a sample of dust: 4.3, 4.1, 4.0, 3.2  $\mu\text{g g}^{-1}$ . Should the last value, 3.2 be rejected?  
(g) Mention the applications of high

Performance Liquid Chromatography (HPLC).

3. Answer the following questions: **(any five)**  
5×5=25

- (a) (i) What is student's t-test?  
(ii) The mean ( $\bar{x}$ ) of four determinations of copper content of a sample of alloy was 8.27 per cent with a standard deviation  $s=0.17$  per cent. Calculate the 95% confidence limit for the true value.  
2+3=5
- (b) What do you mean by spectra? Explain how absorption and emission spectra are generated.  
1+2+2=5
- (c) Describe the principle of job's method for the determination of composition of metal complexes.  
5
- (d) Discuss the theory of thermogravimetric analysis (TGA). Draw a schematic diagram of a thermogravimetric analyzer and mention the important components of it.  
3+2=5
- (e) Explain the principle of pH metric titration. What type of buffer solution

is used in pH metric titration and why?  
3+1+1=5

- (f) Discuss the principle of conductometric titration for the determination of end point's in acid-bare titration.  
5
- (g) What is solvent extraction process? How it is classified? Explain the mechanism of extraction by chelation in solvent extraction.  
1+1+3=5
- (h) What is Thin Layer chromatography (TLC)? Write the principle of TLC. Mention two substances which are most commonly used in TLC as stationary phase.  
1+3+1=5
- (i) Discuss the basic principle of ion exchange chromatography. How does pH affect ion exchange chromatography? Mention two ion-exchange resins.  
3+1+1=5
4. Answer *any two* of the following questions:  
10×2=20
- (a) Discuss the basic principle of UV-VIS spectroscopy. Draw the schematic diagram and describe the

instrumentation of a double beam UV-VIS spectrophotometer.  $4+2+4=10$

- (b) Give an outline of the basic principle and instrumentation of Atomic Absorption Spectrometry (AAS). Discuss the techniques of atomization and sample introduction in AAS.
- (c) What is chromatography? Discuss the mechanism of separation by absorption, partition and ion exchange chromatography  $1+3+3+3=10$
- (d) Discuss the basic principle of Infrared (IR) spectrometry. Draw the schematic diagram of a IR spectrometer . Describe the methods for the preparation of solid samples in IR spectroscopy.  $5+2+3=10$

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