

**B.Sc. 5<sup>th</sup> Semester (Honours) Examination, 2020 (CBCS)**  
**Subject: Chemistry**  
**Paper: DSE-2**  
**Analytical Methods in Chemistry**

**Time- 2 Hours**

**Full Marks: 40**

*Candidates are required to give their answers in their own words as far as practicable.*

**Answer any eight questions from the following:**

**8 x 5 = 40**

1. The analysis of a calcite sample yielded CaO percentage of 55.95, 56.00, 56.04, 56.08 and 56.23. The last value appears anomalous; should it be retained or rejected? [Given:  $Q_{\text{crit.}}$  at the 90% confidence level is 0.64]. Differentiate between accuracy and precision.
2. Write down two causes for deviation of the Beer's law. State how the Lambert-Beer's law could be useful in the quantitative analysis of two substances (*say*, A and B) in a mixture. What is the unit of molar extinction coefficient?
3. Write down the advantage(s) of thin layer chromatography (TLC) over paper chromatography. What is the  $R_f$  value in resolution to TLC? Mention two applications of TLC.
4. Which selection rule is used for IR spectroscopy? Write down the limitation(s) of infrared (IR) spectroscopy. Why KBr is used in IR?
5. Mention important merit(s) and demerit(s) of atomic absorption spectroscopy (AAS). What do you know about Hollow-Cathode Lamp (HCL) used in AAS?
6. What do you mean adsorption chromatography and partition chromatography? Describe the comparison of HPLC, GLC and GC.
7. What do you mean by extraction by chelation and extraction by solvation? Explain the role of pH in solvent extraction process.
8. Which types of information will you get from a thermo-gravimetric curve? Write the factors which affect thermo-gravimetric process.
9. Write down the important criteria for selecting organic solvents for solvent extraction. State important application (s) of Craig's Counter Current extraction.
10. Distinguish between AAS and FES. Name the possible types of thermo-gravimetric method.

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**Paper: DSE-2**

**(Instrumental methods of chemical analysis)**

**Time: 2 Hours**

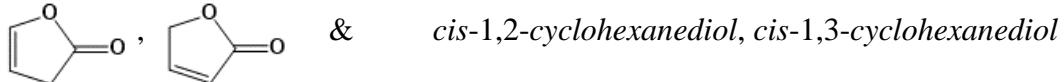
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**Answer any eight questions from the following:**

**$8 \times 5 = 40$**

1. What are the light sources used in fluorescence spectroscopy? Why tetramethyl silane (TMS) is used as internal standard in NMR spectroscopy?
2. Write down the differences between gas chromatography and liquid chromatography? What are the advantages of Fourier Transform in Infrared Spectroscopy?
3. Write down the feasible structures of this compound: *3-methyl-2-butanol*, *m/z* 43, 45, 71, 73, 88.
4. A compound with molecular formula, C<sub>7</sub>H<sub>7</sub>OCl shows three-proton singlet at  $\delta$  3.80, two-proton doublet at  $\delta$  6.55 and also two-proton doublet at  $\delta$  7.35. Identify the compound.
5. Distinguish the following pairs of isomers using Infrared Spectroscopy:



Why KBr pellet is used to measure infrared spectroscopy in solid state?

6. Explain the various types of electronic transitions. What is wavelength dispersion?
7. Describe the principle of Atomic Absorption Spectroscopy (AAS)? Which gases are used in AAS?
8. What are the differences between single and double beam spectrophotometer? Draw a diagram of the double beam spectrophotometer.
9. Explain the factors influencing ‘chemical shift’? How will you differentiate benzene from acetone by NMR spectra?
10. Explain the differences between potentiometry and voltammetry. Draw a cyclic voltammogram of Ru(II)/Ru(III) couple.