**DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2021/2022**

**YEAR ONE SEMESTER ONE EXAMINATION FOR THE DEGREE OF MASTERS OF SCIENCE IN LEATHER TECHNOLOGY**

**SLT 6101: INSTRUMENTAL METHODS IN LEATHER SCIENCE**

**DATE: SEP 2021**                                           **TIME: 3 Hours**

**INSTRUCTIONS:** Answer **ALL** questions

**QUESTION ONE [15 MARKS]**

a) An atomic absorption spectrometer requires a very different light source than does an instrument for molecular absorption. Describe the light source used by each instrument and explain why these two instruments need such different light sources.     [4 Marks]

b) You have been tasked with determination chromium from products isolated from chrome shavings obtained from a tannery. Explain how you would prepare the samples for analysis using AAS.     [4 Marks]

c) The figure below shows a simplified mass spectrum for pentane.
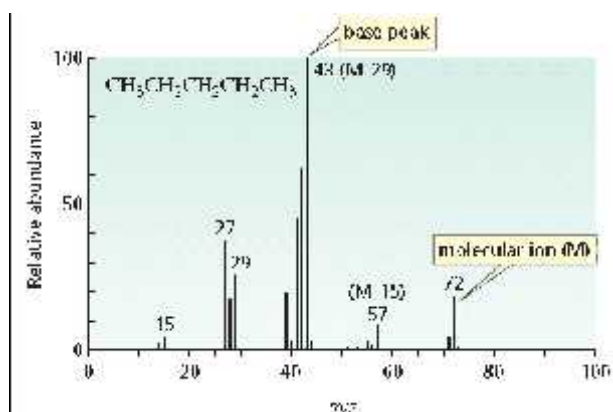


What causes the following line in Mz=57, Mz=43 and Mz=29     [3 Marks]

d) What do you understand by Cyclic Voltammetry     [1 Marks]

e) Concentration of a pure compound in solution can easily be determined by taking absorbance at any wavelength in a given spectral region if at these wavelengths is known. Explain why the absorbance is generally recorded at $_{max}$ [3 Marks]

## QUESTION TWO [15 MARKS]

a) A study on effect of cleaning goat leather using Acetone, ethanol-water, HCl, and white spirit is to be investigated, by use of FTIR and SEM-EDAX techniques.

    i)       Explain the role of these techniques [3 Marks]

b) Explain how separation is done in gel permeation chromatography [6 marks]

c) Explain how you should prepare samples for separation in gel chromatography [2 Marks]

d) Explain the mechanism of a thermal conductivity detector [4 Marks]

## QUESTION THREE [15 MARKS]

a) The oldest example of a leather shoe has been discovered by archaeologists in a cave in Kenya. TGA and DTA techniques are employed to study this leather Explain choice of the techniques [5 Marks]

b) Explain the working principle of polarography [5 Marks]

c) Draw a well labeled diagram for the instrumentation for potentiostatic coulometry [5 Marks]

## QUESTION FOUR [15 MARKS]

a) Explain the basic components of NMR Spectrometry [5 Marks]

b) what are the requirements for pumping system in HPLC [5 Marks]

c) If the stretching frequency of a hydrogen molecule is $1.2 \times 10^{14}$ vibrations/sec. Calculate the wavenumber where hydrogen molecule absorption band will be observed in an IR spectrum. [2 Marks]

d) How do you determine the crystal structure from XRD? [3 Marks]