THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. Degree Programme / Stand alone courses in Chemistry
Level 5 –Assignment Test 1 – 2012 / 2013

CMU 3128/CME 5128 – INSTRUMENTAL METHODS IN CHEMICAL ANALYSIS

Duration: One and half hours
Date and time: 05th August, 2013
4.00 p.m. to 5.30 p.m.

Reg. No……………………………………

Question number	marks
1	
2	
3	
Total	

Instructions to students

Answer all questions in the spaces given. Additional sheets will not be marked.

1. (i) Draw and label a schematic diagram of Mass spectrophotometer. (10 marks)

(ii) Explain how Infra Red (IR) spectrums and Raman spectrums are resulted by ~~a~~ molecules. (12 marks)

(iii) Sketch and label a conventional IR spectrum and a Raman spectrum. (10 marks)

(iv) Write two main differences between UV/Visible spectroscopy and Fluorescence Spectroscopy. (08 marks)

2. (i) Sketch the expected photometric titration curve of a titration of which only the product absorbs light. (10 marks)

(ii) Give two situations where photometric titrations can be applied but not classical titrations. (06 marks)

(iii) A 1.50 g of a steel sample was dissolved in H_2SO_4 acid and the Mn in the sample was oxidized to $KMnO_4$ and the volume was made up to 250.0 cm^3. The absorbance of this solution was 0.500 at 530 nm. Another $KMnO_4$ solution having a concentration of 1.02×10^{-4} M gave an absorbance of 0.250 at similar conditions. Calculate the percentage of Mn in the steel sample. (Mn= 54.94 g) (16 marks)

3.(i) Explain the following statement.
In molecular fluorescence spectroscopy, emitted wavelength is longer than absorbed wavelength. (10 marks)

(ii) Explain the following in brief. (18 marks)

(a) Singlet excited state.

(b) Molecular ion peak in a Mass spectrum.

(c) Disadvantages of using flame in Emission Spectroscopy.

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ASSIGNMENT TEST I – 2012/2013 - ANSWER GUID

1. (i) Refer page no. 57

   (ii) **IR Sprectums**

   Molecules which can result a vibrational dipole will absorb IR radiation and move to a higher vibrational state resulting an IR spectrum.

   Raman Spectrums

   The scattered light resulted when a monochromatic light is shone on a sample will have frequencies different to incident light and this difference is frequencies correspond to vibrational transitions in a molecule.

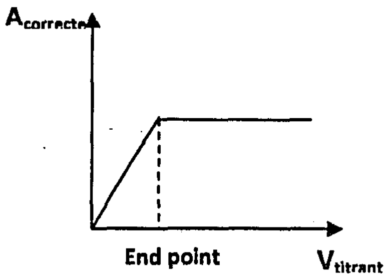
   The scattered light varying with frequency will give a Raman Spectrum.

   (iii) Refer page no. 45 & 47

   (iv)

UV/Visible	Fluorescence
Absorption is measured.	Emission is measured.
Molecular Absorption method.	Can be either atomic or molecular absorption.
In the instrumentation, the light source is placed along with the detector.	The light source is placed right angle to the detector.
Less sensitive compared to Fluorescence Spectroscopy.	More sensitive compared to UV/Visible Spectroscopy.
Light produced by the light source is used for absorption.	Light produced by the light source is used to excite the atoms in the sample.

2. (i)



In order to get the correct end point we should either remove the dilution effect practically or we have to calculate the corrected absorbance. Since the question does not indicate how the analysis was carried out, it is always better to assume that the corrected absorbance was calculated.

(ii) a. Coloured solutions which interfere with indicator colour.

b. Analysis of very low concentrations.

c. Situations where indicators are not available.

(iii) $A = \varepsilon cl$

$\varepsilon = A/cl \quad = 0.250 / (1.02 \times 10^{-4}\ M \times l)$

To the sample

Steel $\longrightarrow$ $KMnO_4$
1.5 g in 250ml
Mn % ? A= 0.5

$A = \varepsilon cl$
$c = A / \varepsilon l = 0.5 / (0.250 / (1.02 \times 10^{-4}\ M \times l)\ l \quad = \quad 2.04 \times 10^{-4}\ M$

Weight of Mn in $1dm^3$ $= 2.04 \times 10^{-4}\ M \times 54.94$

Weight of Mn in 250ml $= \frac{\underline{2.04 \times 10^{-4}\ M \times 54.94}}{4}$

Mn% $= \frac{2.04 \times 10^{-4}\ M \times 54.94}{4} \times \frac{100\%}{1.5}$

$= \underline{0.187\%}$

3. (i) In Molecular Florescence Spectroscopy, molecules in the lowest vibrational level of the ground state absorbs light and goes to any vibrational level of the excited state.
Then they loose some energy & relax to the lowerst vibrational state whithin the same electronic state.
Therefore, emission occurs from the lowest vibrational level of the excited state to any vibrational level of the ground state.

(ii) a. The transition of an electron from the ground state to an excited state without involving a change of spin.

b. Peak which corresponds to the molecular weight of the original compound. It is the peak corresponding to the highest mass if the molecule doesn't have isotopes.

c. Interference is high.
Less sensitive.
List of elements that can be analysed is less.