



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016**

COURSE NAME : ANALYTICAL CHEMISTRY
COURSE CODE : DAS 12403
PROGRAMME : 1 DAU
EXAMINATION DATE : JUNE / JULY 2016
DURATION : 3 HOURS
INSTRUCTION : SECTION A) ANSWER **ALL**
QUESTIONS
SECTION B) ANSWER **THREE (3)**
QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

CONFIDENTIAL**SECTION A**

Q1 (a) Analytical chemistry is often described as the area of chemistry responsible for characterizing the composition of matter, both qualitatively and quantitatively. Answer the followings;

(i) State four areas that analytical chemistry can be applied for. (2 marks)

(ii) Differentiate the terms of qualitative and quantitative in analytical chemistry. (2 marks)

(iii) State two roles of Analytical Chemist in the field of analytical chemistry. (2 marks)

(b) A lab assistant is required to prepare 250 ml solution of 0.5 M sulfuric acid (H_2SO_4) from the concentrated solution. If the following information are written on the bottle;

Molar mass = 98.08 g/mol
Density = 1.84 g/ml, 97% (w/w)

(i) Determine the concentration of the concentrated sulfuric acid in M. (4 marks)

(ii) Describe the procedure to prepare 0.5 M sulfuric acid in a 250 ml clean calibrated volumetric flask. (7marks)

(c) (i) Precision and accuracy are two terms that usually enter into any discussion of the reliability of an experimental result. Define the terms accuracy and precision. (2 marks)

(ii) The following data were collected as part of quality control study for the analysis of sodium concentration in river water. The concentrations of Na^+ are expressed in ppm. Determine the mean, median, standard deviation and the variance of this data.

0.140 0.143 0.141 0.137 0.132 0.157 0.143 0.149 0.118 0.145

(6 marks)

CONFIDENTIAL**SECTION B**

- Q2** (a) Describe the following terms.
- The titrimetric method.
 - The equivalence point and the end point of a titration.
- (5 marks)
- (b) Given four (4) types of titration curve as shown in **Figure Q2(b)**.
- Name the type of titration for each titration curve of Titration (a), Titration (b), Titration(c) and Titration(d).
- (4 marks)
- Give any one example of each titrant and analyte for Titration (a), Titration (b), Titration (c) and Titration (d).
- (8 marks)
- Consider Titration (b). Calculate the original concentration of the acid or base in the flask if the original volume was 100 mL and it was titrated with a standard solution (in buret) that had a concentration of 0.100 M. Assume the titration involved the reaction between NaOH and HCl. The volume of standard solution at the end point was 250 ml.
- (8 marks)
- Q3** (a) (i) Write the Beer's Law. State each parameter complete with the unit.
- (3 marks)
- (ii) Explain the difference between the transmittance and absorbance.
- (2 marks)
- (iii) Write the relation between the absorbance and transmittance.
- (2 marks)
- (b) **Table 1** shows the UV/Vis analysis of five (5) samples at different concentration. Answer the following questions.

Table 1

Absorbance at 425 nm	I	I ₀	%T	Concentration (mol/L)
0.0		0.50		
0.3		0.50		
1.0		0.50		
2.0		0.50		
3.0		0.50		0.03
4.0		0.50		

- (i) Redraw the table and fill in the table completely. Show all the calculations.
- (10 marks)

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(ii) Plot the graph of Absorbance versus Concentration (mol/L).
(6 marks)

(iii) Determine the concentration of unknown sample labeled as Sample A if the absorbance detected is 2.5.
(2 marks)

Q4 (a) Explain the following terms related to chromatography.

(i) Mobile phase and stationary phase.
(ii) Eluant and eluate.
(iii) Liquid chromatography and gas chromatography.
(6 marks)

(b) Discuss the components of a basic High Performance Liquid Chromatography (HPLC) system.
(12 marks)

(c) Calculate the number of theoretical plates N and the plate height H , when the retention time is 20.40 minutes, half of the base width (given in minutes) is 0.65 minutes and the column length is 30 cm.
(7 marks)

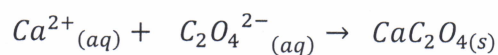
Q5 (a) Define the following terms.

(i) Precipitation gravimetry.
(ii) Nucleation and particle growth.
(4 marks)

(b) List four (4) factors that determine the particle size of the precipitates.
(4 marks)

(c) Briefly explain the basic experimental procedure for gravimetric analysis.
(8 marks)

(d) A 2.00 g sample of limestone was dissolved in HCl and all the calcium present in the sample was converted to $\text{Ca}^{2+}(\text{aq})$. Excess ammonium oxalate solution, $(\text{NH}_4)_2\text{C}_2\text{O}_4(\text{aq})$ was added to the solution to precipitate the calcium ions as calcium oxalate, $\text{CaC}_2\text{O}_4(\text{s})$ (128.10g/mol). The precipitate was filtered, dried and weighed to a constant mass of 2.43 g. Determine the percentage by mass of calcium in the limestone sample. The balanced chemical equation for the precipitation reaction is given by;



(9 marks)

-END OF QUESTIONS-

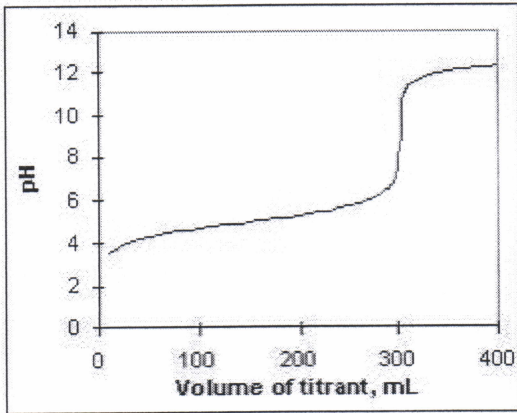
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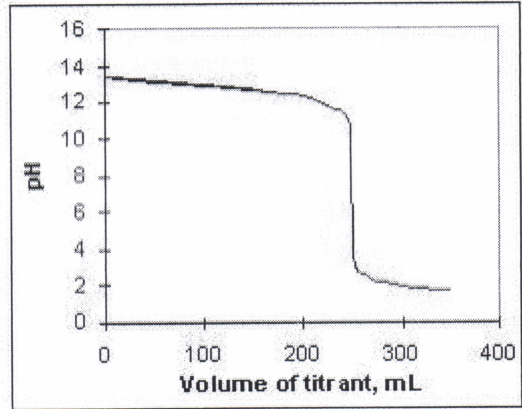
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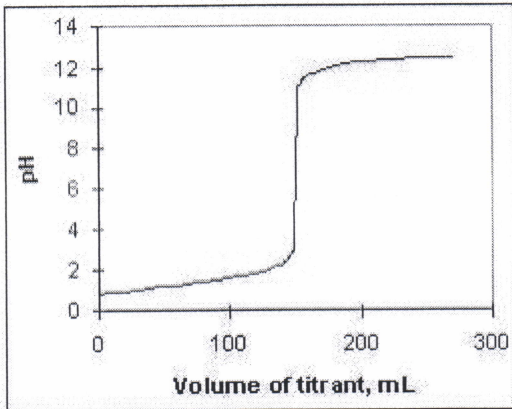
Titration (a)



Titration (b)



Titration (c)



Titration (d)

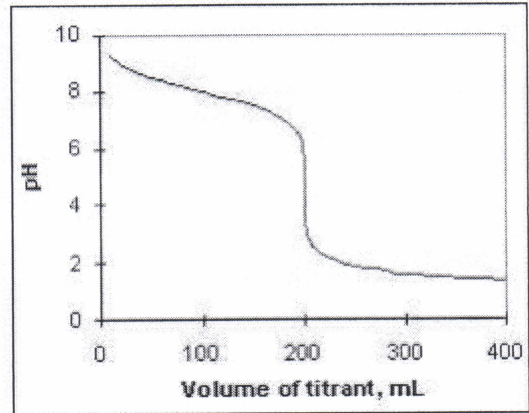


Figure Q2(b)

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