



**Department of .....General Science**

**College of .....Basic education**

**University of ...Salahaddin.....**

**Subject: Analytical chemistry.....**

**Course Book – (Year 2)**

**Lecturer's name: PhD Shahnaz Abdulhamid Hamad.**

**Lecturer's name: Gulkhater Hammad Sharif**

**Academic Year: 2023/2024**

## Course Book

<b>1. Course name</b>	<b>Analytical chemistry</b>
<b>2. Lecturer in charge</b>	<b>Dr. Shahnaz abduhamid Hamad</b>
<b>3. Department/ College</b>	<b>General Science/Basic education</b>
<b>4. Contact</b>	<b>e-mail: shahnaz.hamad@su.edu.krd Tel: (optional) 07503963751</b>
<b>5. Time (in hours) per week</b>	<b>Theory: 4</b>
<b>6. Office hours</b>	<b>Availability of the lecturer to the student during the week</b>
<b>7. Course code</b>	
<b>8. Teacher's academic profile</b>	<p>2010 PhD in Medicine, The University of Sydney, Australia</p> <p>The Title of the theses is "New multivalent platinum complexes with a cis - geometry for terminal metal centres"</p> <p>1994 M Sc in Analytical chemistry, University of Salahaddin, Erbil, Iraq.</p> <p>1988 B Sc, University of Salahaddin, Erbil, Iraq,</p> <p><b>Teaching Experience</b></p> <ul style="list-style-type: none"> <li>• Undergraduate lecturer, Acid base balance, Discipline of Biomedical Science, The University of Sydney (2009)</li> <li>• Practical undergraduate classes, Discipline of Biomedical Science, The University of Sydney (2007 - 2009)</li> <li>• Assistant Lecturer on Analytical Chemistry, Department of Chemistry Sciences, College of Education, Salahaddin University (1992-1996). Duties: teaching, examination, marking, laboratory supervision and thesis project supervision.</li> </ul> <p><b>Publications</b></p> <p>(1) Huq F and Al Qassab S. (2007) Molecular modelling of the metabolism of Raloxifene, Int. J. Pure and Appl. Chem. 2, 204.</p> <p>(2) Hamad, S., Beale, P., Yu, J., Fisher, K., Huq, F. (2012), Synthesis and Anticancer Activity of <math>[\text{Cis-PtCl}(\text{NH}_3)_2]_2\mu\{\text{Tetrahydroxypyridine}(\text{H}_2\text{N}(\text{CH}_2)_6\text{NH}_2)_2\}\text{Cl}_4</math> in the Human Breast Cancer Cell Line MCF-7. Medicinal Chemistry. 8(3), 384-391</p> <p>(3) Shahnaz A Hamad, Philip Beale, Jun Qing Yu, Keith</p>

	<p>Fisher, Fazlul Huq (2014) Synthesis and activity of three new trinuclear platinum complexes with cis- geometry for terminal metal centres, Journal of Biomedical Science. <b>21</b>:41</p> <p>(4) 4- Shahnaz A Hamad, Philip Beale, Jun Qing Yu, Fa (2014) Synthesis and Antitumour Activity of a New T Platinum Compound[<math>\{cis-PtCl(NH_3)_2\mu\{trihydroxypyridine\}_2 H_2N(CH_2)_5NH_2\}_2]</math> Cl<sub>4</sub> in Ovarian Cancer Cells, ANTICANCER RESEARCH 1930 (2014)</p> <p><b>Conference participations</b></p> <p>(1) 14th International Conference on Biological Inorganic Chemistry (ICBIC14) in Nagoya, Japan at July 2009</p> <p>(2) Sydney Cancer Conference 2008 ~ July 24-26, 2008, The University of Sydney</p> <p>(3) The Biennial Health Research Conference 2006 (From Cell to Society), 9<sup>th</sup> - 10<sup>th</sup> of November at Blue mountain. Sydney, Australia</p> <p>(4) Faculty of Health Sciences Higher degree Research Students Colloquium, 1-2 December, 2005, Sydney, Australia</p>
<b>9. Keywords</b>	<b>Concentration, titration , buffers</b>
<p><b>10. Course overview:</b></p> <p>Analytical chemistry is the first in a series of courses designed to introduce students to the topic of chemical detection and measurement. As well as being a varied and interesting discipline in its own right, analytical chemistry plays an essential role in many other important subjects such as biochemistry, clinical chemistry, environmental science, food and nutrition, forensic science, organic chemistry and spectroscopy, medicinal and pharmaceutical chemistry, pharmacology, and toxicology.</p> <p>This course provides an introduction to the fundamental principles of chemical measurement used in medical diagnosis, quality assurance and control, and research studies. It will teach the students how to correctly handle and interpret experimental measurements, compare results and procedures, and calibrate analytical instrumentation. They will also learn how to perform many analytical procedures including volumetric analysis, titrations, and chromatography. Throughout this course, there will be a strong emphasis on good laboratory practice (GLP), error analysis and the correct use of statistics, and problem-solving skills. As such, it will provide an excellent practical foundation for students interested in teaching science or research opportunities, regardless of the specific area of interest or program of study.</p>	
<p><b>11. Course objective:</b></p> <p>This courses designed to introduce students to the topic of chemical detection , domination and measurement. Studding different types of concentration , titration As well as being a varied and interesting discipline in its own right, analytical chemistry plays an essential role in many other important subjects such as biochemistry, clinical chemistry, environmental science, food and nutrition, forensic science, organic chemistry and spectroscopy, medicinal and</p>	

## 12. Student's obligation

All students should read ahead for both lectures and labs, and complete all required preparation. The students are expected to attend all the lecturers and have the course hand outs prior to the lecturer. Always they have to be ready for any unexpected tests.

## 13. Forms of teaching

The course handouts will be provided for student prior to the lecturer, data show and white board will be used.

## 14. Assessment scheme

— Examination: 2 main exams	
Theory	10marks
— Quizzes, activities	(5 marks)
— Final exam	(50)
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## 15. Student learning outcome:

- By the end of the course, students will be expected to understand full concept of concentration and their types, buffers, titration and their types and indicators, chromatography, correctly prepare standard solutions and use appropriate calibration methods, be common with the correct use of volumetric glassware to prepare solutions and perform titrations.

The course will provide all basic analytical chemistry concepts which will be needed to teach chemistry especially for the secondary schools with a good skill in calculation and solving problems.

## 16. Course Reading List and References:

1- **Modern Analytical Chemistry** by *David Harvey*

2- **Fundamentals of Analytical chemistry** by *Douglas A. Skoog*

3- **Fundamentals of Chemistry** by *David E. Goldberg*

4- **Scientific webs and journals**

17. The Topics:	Lecturer's name
1. Introduction on analytical chemistry, electrolytes, acids and bases, conjugate acids and bases, units of weight and concentrations,	1 <sup>st</sup> week
2. Mole, millimole , molarity and normality examples	2 <sup>nd</sup> week
3. Percentage concentration, ppm examples,	3 <sup>rd</sup> week
4. Chemical equilibrium: le chatelier's principle	4 <sup>th</sup> week
5. Theory of neutralization, salts and their types, ionization of weak acids and bases , PKa, PKb, kw, examples	5 <sup>th</sup> week
6. PH , buffer solutions their properties, acidic buffer solutions , alkaline buffers, examples, adding acids or bases to the buffer solutions.	6 <sup>th</sup> week
7. Titrimetric analysis: classification of titrimetric analyses, acid-base titration reactions, acid- base indicators	7 <sup>th</sup> week
8. More on acid base indicators, titration strong acid with strong base, strong acid with weak base, weak acid with the weak base.	8 <sup>th</sup> week
9. Precipitation titrations: the formation of second precipitate, the Mohr method.	9 <sup>th</sup> week
10. The formation of colored method: Volhard method, adsorption methods (fajan method)	10 <sup>th</sup> week
11. Introduction to electrochemistry, Oxidation reduction reactions:, oxidation/ reduction titrations	11 <sup>th</sup> week
12. Complexometric titrations: introduction, titration using EDTA.	12 <sup>th</sup> week
13. Chromatography, introduction to chromatographic separations	
14. Idometric titration, Gravimetric analysis	13 <sup>th</sup> week

<b>18. Practical Topics (If there is any)</b>	
1- Introduction to the chemistry lab rules	Week 1
2- Introduction to the glass wear, distillation water and primary standard substances.	
3- Preparation of solid compounds. (0.1 M NaCl).	Week2
4- Calculating the concentration of acids in the main concentrated bottles.	Week 3
5-How to prepare a dilute concentration of acids(preparation of approximately 0.1M HCl.	
6-The preparation of 0.1N Sodium Carbonate( $\text{Na}_2\text{CO}_3$ ) in 250 mL of solution	Week 4
7-Standardization of HCl solution using standard $\text{Na}_2\text{CO}_3$ solution	Week5
8-Preparation of Sodium hydroxide solution. Approximate concentration 0.1 N NaOH in 250mL solution.	Week 6
9-Standardization of sodium hydroxide( NaOH )solution	
10-Determination of Acetic Acid in Vinegar	Week 7
11-precipitation titration(Mohr method)	Week 8
12-Oxidation reduction titration,Preparation of $\cong 0.1 \text{ N}$ Potassium permanganate in (1L) solution.	Week 9
13- Standardization of $\cong 0.1\text{N KMnO}_4$ solution against 0.1N Sodium Oxalate)	Week10
14- Determination of ferrous ion( $\text{Fe}^{2+}$ ) .	Week 11
15-Complexometric titration , Preparation and Standardization of EDTA	Week 12
16-Determination of hardness of water	Week 13,14
<b>19. Examinations:</b>	
1. -fill out the blanks,	
_____ is the number of moles of solute dissolved in one litre of solution	
<b>2 . Calculate the following :</b>	
a- How many moles and the number of atoms of Copper, are in 5 g of copper Cu?	
<b>3.. Explain the volhards method for the determination of <math>\text{Cl}^-</math> support your answer by using equations</b>	

**20. Extra notes:**

**21. Peer review**