

Department of Chemistry College of Education University of Salahaddin-Erbil Subject: Gravimetric Analysis Course Book – 2nd year (first Semester)

Lecturer's name: Dr. Mohammad Salim Academic Year: 2023-2024

Course Book

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| **1. Course name** | **Gravimetric Analysis** |
| **2. Lecturer in charge** | **Dr. mohammad salim** |
| **3. Department/ College** | **Chemistry** |
| **4. Contact** | **e-mail:** [**mohammad.abdullah@su.edu.krd**](mailto:mohammad.abdullah@su.edu.krd)  **Tel: 009647507968748** |
| **5. Time (in hours) per week** | **Theory: 4 hours (2 groups x 2 hours)**  **Practical: 18 hours (6 groups x 3 hours)** |
| **6. Office hours** | **Wednesday and Tuesday; 8:30 AM – 2:30 PM** |
| **7. Course code** |  |
| **8. Teacher's academic profile** | Mohammad salim is assistant professor in the Department of Chemistry, Education College at Salahaddin University-Erbil, where he has been since 1999. He has taught Instrumental Analysis and Analytical Chemistry. He received a B.Sc. from Salahaddin University-Erbil in 1995, and an M.S. from the Salahaddin University-Erbil in 1999. He received his Ph.D. in Analytical Chemistry from the Salahaddin University-Erbil in 2008.  His research interests span both FIA and spectrophotometry. Much of his work has been on determination of elements and pharmaceutical drugs. |
| **9. Keywords** |  |
| **10. Course overview:**  This course describes the specific steps of gravimetric analysis, including preparing the solution in proper form for precipitation, the precipitation process and how to obtain the precipitate in pure and filterable form, the filtration and washing of the precipitate to prevent losses and impurities, and heating the precipitate to convert it to a weighable form. It gives calculation procedures for computing the quantity of analyte from the weight of precipitate. It also provides some common examples of gravimetric analysis. Also, it discusses the solubility product and associated precipitation equilibria. | |
| 1. **Course objective:**   The studnts will learn from this course the following key things:   * + Steps of a gravimetric analysis: precipitation, digestion, filtration, washing, drying, weighing, and calculation.   + Precipitation ragents' type   + Mechanism of Precipitation   + Impurities of Particles   + Ways to Minimize Impurities   + Gravimetric Calculations   + Volatilization and Particulate Gravimetry   + The solubility product, the common ion effect. | |

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| **12. Student's obligation**  The students have to attend lectures and labs, do quizzes and homework, write reports,  and pass in exams. |
| **13. Forms of teaching**  Classes will primarily consist of lectures with some in-class discussions, tutorials, problem- solving, debates, and demonstrations. Questions at any time during class are highly encouraged. Lectures will be accompanied by PowerPoint presentations of the head titles and notes. |
| **14. Assessment scheme**  This course is divided into two portions: lecture and laboratory. The lecture portion constitutes 65% of the overall final grade, while the laboratory portion constitutes 35%. **Lectures Grade**  The lecture grade for this course is based on one theoretical midterm exam (12 pts), quizzes (3 pts), and a comprehensive final exam (50 pts).  **Exams;** One midterm exam will be given during the course at regular class times, as indicated in the attached class schedule, and one comprehensive final at the end of the course. Exams will comprise material and problems similar to those discussed during class lectures, textbook example problems, and problems assigned at the end of each chapter. In-class examinations will generally concentrate on new material covered since the last exam. The final examination will be comprehensive and cover material from the entire course.  **Laboratory Assessment:**  The grade for the laboratory portion of the course will be based on performance concerning three items: the actual experiments reports (15 pts), quizzes (5), and an evaluation by the instructor(exam) (15 pts).   1. There will be at least ten laboratory experiments. Students will work in a group on all of the experiments. For each experiment, every student will submit a laboratory report and answers to the post-lab questions the next laboratory class after completing the laboratory. Each report will be graded separately. The grades for individual experiments will be averaged to produce a single grade applying to all of the experiments. This laboratory report grade will constitute 15 pts of the final laboratory grade.   2- The quizzes grade will constitute 5 pts of the final laboratory grade. The quizzes will include theoretical knowledge and practical operation of tools and instruments relevant to  all experiments done during the course.  **Note: two extra mark for no absent class, one extra mark for one absent class (in final out)**  **There is no extra marks for more than one absent** |
| **15. Student learning outcome:**  Successful students should be able to:   * Know the different type of gravimetric analysis . |

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| * Analyze analyte in various sample quantitatively * Work to find active/desired components percent inaccurate & precision range * Solve their problems during the analysis * Assess and find ingredients sample * Get pure precipitation * Detect the solubility and solubility product of slightly soluble salts | |
| **16. Course Reading List and References:**   * Modern Analytical Chemistry, 1st edition, David Harvey * Quantitative Chemical Analysis, 8th edition, Daniel C. Harris. * Fundamentals of Analytical Chemistry, 9th edition, D. A. Skooge, and D.M. West * Analytical Chemistry, 5th edition, Gary D. Christian | |
| **17. The Topics:** | **Lecturer's name** |
| **Syllabus of course Program:**  **Expecting a number of weeks with lecture syllabus:** 1- General review in analytical chemistry   1. Gravimetric analysis by Vitalization, Isolation, and precipitation method. 2. Types of precipitating agent 3. Formation and properties of precipitation. 4. Process of formation of nuclei precipitation process and growth of crystals. 5. Relative supersaturation value in precipitation. 6. Chemical composition of the ppt., gravimetric factors, and calculation relation. 7. Solubility of the precipitate and solubility product. 8. Factors affecting the solubility of precipitation such as the nature of solute, nature of the solvent, temperature effect, ionic strength value, PH, and common ion effect. 9. Inter-ionic attraction and activity coefficients. 10. Precipitant agent, both organic and inorganic precipitant agent. 11. Colloidal precipitate: Coagulation and Peptization. 12. Digestion, Re-precipitation, and Washing process of the precipitate. 13. Homogeneous precipitate, such as direct and indirect formation precipitate. | Dr. Mohammad Salim (2 hrs) each week |

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| 1. Contamination: Simultaneous, co-precipitation, & post precipitate contamination. 2. Treatment of contamination. |  |
| **18. Practical Topics (If there is any)** |  |
| Giving instruction to students about the lab, how to write excremental reports.  Exp. **1**: Determination of crystallization water in barium chloride and hygroscopic water in sodium hydroxide  Exp. **2**: Saturation point and solubility product Exp. **3**: Determination of calcium as oxalate Exp. **4**: Determination of silver as silver chloride Exp. **5**: Determination of lead as lead sulphate Exp. **6**: Determination of lead as lead chromate  Exp. **7**: Determination of lead as lead chromate (homogeneous solution)  Exp. **8**: Determination of sulphate as barium sulphate Exp. **9**: Determination of aluminum as aluminum oxinate  Exp. **10**: Determination of Nickel as the dimethyl glyoximate Exp. **11**: Determination of cobalt with α-nitroso-ß-naphthol | Dr. Mohammad Salim and Mrs. Shaymam and Mrs.Hawraz |

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| 1. **Compositional:** includes various questions and most of them are calculations as problems.   **Ex: Answer all of the following:**   * 1. Prove that Wn = Wo (V1 / KDV2+V1)n, if KD = [solute]extracted/[solute]remained ?   2. What mass in grams of CO2 is evolved in the complete decomposition of a 2.300-g sample that is 38.0% MgCO3 and 42.0% K2CO3 by mass?   3. In the determination of crystallization water, 2 g of FeSO4.XH2O was heated in 125 for 1h. Find the number of X (number of crystalline hydride molecule) in the salt if the practically %H2O and %E are equal to 43.15% and -4.85%, respectively?   4. A 0.8102-g sample of impure Al2(CO3)3 decomposed with HCl; the liberated CO2 was collected on calcium oxide and found to weigh 0.0515 g. Calculate the percentage of aluminum in the sample?   ***2. True or false type of exams:* Answer the following by True or False?**   1. Quantitative analysis tells 'what' is in a sample, while qualitative analysis is used to tell 'how much' is in a sample. 2. In TLC, short-wave or long-wave UV-light is used for detection of colored substances. **3-** In gravimetric methods, we determine the volume of the analyte or some compound chemically related to it.   ***3. Multiple choices:***  **1-** Convert an analyte to its elemental form for weighing.  a- organic precipitating agent b- inorganic precipitating agent c- reducing agent  **2-** Inorganic precipitating agents form .............................. or with the analyte.  a- slightly soluble salts or hydrous oxides b- acids or bases c- liquids or solids  **4. Explain the difference between:**   * Specific precipitating agent **and** selective precipitating agent * Precipitation **and** co-precipitation * Nucleation **and** particle growth | |
| **20. Extra notes:**  Experience has shown that the students who attend class, read more references, and  complete more problems do much better! To be successful you will have to spend a significant amount of time on this course outside of the class time | |
| **21. Peer review** | |