

**Department of Chemistry**

**College of Science**

**University of Salahaddin**

**Subject: Practical Inorganic Chemistry**

**Course Book – 3rd Stage**

**Professor (assistant)'s name M.Sc Adnan Muhammad Qadir**

**Academic Year: 2023/2024**

**Course Book**

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| **1. Course name** | **Practical inorganic chemistry** | |
| **2. Lecturer in charge** | **Adnan Muhammad Qadir** | |
| **3. Department/ College** | **Chemistry/science** | |
| **4. Contact** | **adnan.qadir@su.edu.krd** | |
| **5. Time (in hours) per week** | **Practical: 18** | |
| **6. Office hours** | **Wednesday 8:30-5:30 , Thursday 8:30-5:30** | |
| **7. Course code** |  | |
| **8. Teacher's academic profile** | **Obtained B.Sc. in 1996, M.Sc. in 2000** | |
| **9. Keywords** | **Inorganic chemistry, coordination compounds preparation, Determination the ions of it.** | |
| **10. Course overview:**  **What is Inorganic Chemistry?**  With this lesson, you will learn the definition of inorganic chemistry. You will also learn the types of inorganic compounds, how they react and their applications in several industry sectors.  **Inorganic chemistry** is the study of the *formation, synthesis and properties* of compounds that do not contain carbon-hydrogen bonds. Chemical substances containing carbon-hydrogen bonds are studied in **organic chemistry**.    [**Importance of chemistry in our daily life HYPERLINK "http://www.answers.com/Q/Importance\_of\_chemistry\_in\_our\_daily\_life":**](http://www.answers.com/Q/Importance_of_chemistry_in_our_daily_life)  The importance of chemistry in daily life is that the elements studied in chemistry are the elements that make up the entire world; everything we touch and see and can sense. The importance of chemistry in daily life is that the elements studied in chemistry are the elements that make up the entire world; everything we touch and see and can sense is a result of chemistry. Because this is true, it is important that we understand how these elements compounds came to be, what they can do, and how they work together, so that we can build upon our knowledge, make new discoveries, and change the way our world comes together.  Inorganic chemistry is concerned with the properties and behavior of inorganic compounds, which include metals, minerals, and organometallic compounds. While [organic chemistry](http://www.acs.org/content/acs/en/careers/college-to-career/areas-of-chemistry/organic-chemistry.html) is defined as the study of carbon-containing compounds and inorganic chemistry is the study of the remaining subset of compounds other than organic compounds, there is overlap between the two fields (such as organometallic compounds, which usually contain a metal or metalloid bonded directly to carbon). | | |
| **11. Course objective:**  The principles governing metal—ligand complex stability and specificity depend on the properties of both the metal ion and the chelating agent, as summarized briefly in the following sections. More comprehensive reviews on ligand design for selective complexation of metal ions in aqueous solution are available. This discussion sets the stage for understanding the properties of the compounds presented throughout this article.   * They are used in photography, i.e., AgBr forms a soluble complex with sodium thiosulfate in photography. * K[Ag(CN)2] is used for electroplating of silver, and K[Au(CN)2] is used for gold plating. * Some ligands oxidize Co2+ to Co3+ ion. * Ethylenediaminetetraacetic acid (EDTA) is used for estimation of Ca2+ and Mg2+ in hard water. * Silver and gold are extracted by treating zinc with their cyanide complexes. | | |
| **12. Student's obligation**  the attendance & completion of all tests  assignments and Quiz  Reports and Seminar  exams | | |
| **13. Forms of teaching**  White Board and data projector. | | |
| **14. Assessment scheme**  Breakdown of overall assessment and examination  The student are required to achieve one closed exam at the mid of each semester for practical course beside other assignments. For each experiment the students must prepare full text paper which includes theory, calculations, discussion and homework.  The grads are arranged as follows:  Course exam: 12 %.  Class room and assignments:  Seminar: 6 %.  Reports: 7 %.  Activity; 3 %.  Quiz: 7 %.  Total: 35 %. | | |
| **15. Student learning outcome:**  Preparation complexes and determination their contents and absorbances.  **“Medicinal Applications of Coordination Chemistry”**  Inorganic compounds have been used in medicine for thousands of years, often without a known molecular basis for their mechanism of action, and with little attempt to design them. The design of coordination (metal) complexes is not an easy task. The organic chemist often deals with diamagnetic compounds which are both kinetically and thermodynamically stable, and benefits from the use of well developed speciation techniques, especially 1H and 13C nuclear magnetic resonance (NMR) spectroscopy. For metal compounds the situation is more complicated. Ligand substitution and redox reactions can be facile, can occur over very wide timescales, and are not so easily followed by conventional techniques, especially under physiologically relevant conditions (for instance, at micro molar concentrations). But the challenge is real and worth exploring. We need new drugs with novel mechanisms of action. Inorganic chemistry offers that possibility.  **Platinum Anticancer Drugs**  Two areas of work have highlighted the potential of inorganic chemistry in recent years: the platinum anticancer field and gadolinium compounds, used as contrast agents in magnetic resonance imaging (MRI). Both of these are well covered in this new book. Platinum commands about forty pages. This is warranted. Platinum compounds are now the world's best-selling anticancer drugs – they have billion-dollar sales each year. If you are not familiar with atomic structure, types of chemical bonds, oxidation states, coordination geometries, isomerism, electronic structure and magnetism, then there are some one hundred pages (just over a quarter of the book) of introduction to help you, including the background on square-planar platinum complexes needed to understand the mechanism of action of the first platinum complex to be approved for clinical use: cisplatin (*cis*-diamminedichloroplatinum (II)).  Inorganic compounds are used as catalysts, pigments, coatings, surfactants, medicines, fuels, and more. They often have high melting points and specific high or low electrical conductivity properties, which make them useful for specific purposes. | | |
| **16. Course Reading List and References‌:**  ***References :***   * Inorganic Experiments by J.Derek Woollins. * Inorganic Chemistry by Shriver and Attkins. * Inorganic Chemistry by Carthrine E. Housecroft. * Basic Inorganic Chemistry by Cotton and Wilkinson. * Modern Inorganic Chemistry by Jolly. * Modern Inorganic Chemistry by Lagowski. | | |
| **17. The Topics:** | | **Lecturer's name** |
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| **18. Practical Topics** | | **Lecturer's name** |
| Introduction of Practical inorganic chemistry  1-Preparation of tetraaminecupper(II)sulphatehydrate [Cu(NH3)4]SO4.H2O .  2-Determination of NH3 in the complex [Cu(NH3)4]SO4.H2O .  3-Determination of Cu2+ in the complex [Cu(NH3)4]SO4.H2O .  4-Preparation of bis(acetylacetonato)Copper(II) [Cu(acac)2]  5-Preparation of ethylenediaminenickel(II)thiosulphate [Ni(en)3]S2O3.  6- Determination of Ni2+ in the complex [Ni(en)3]S2O3.  6-Preparation of potassiumdiaquadioxalatoCromate(III)dehydrate K [Cr(C2O4)2(H2O)2].2H2O .  7- Determination of C2O42- in the complex K [Cr(C2O4)2(H2O)2].2H2O .  8- Determination of Cr3+ in the complex K [Cr(C2O4)2(H2O)2].2H2O .  9- Preparation of bis(acetylacetonato)Cobalt(II)dehydrate [Co(acac)2].2H2O  10- Preparation of trans-amoniumdiamminotetranitrocobaltate(III)hydrate NH4[Co(NO2)4(NH3)2].H2O .  11- Determination of Co3+ in the complex NH4[Co(NO2)4(NH3)2].H2O .  12- Determination of NO2- in the complex NH4[Co(NO2)4(NH3)2].H2O .  13- Preparation of Sodiumbis(oxalate)Copperate(II)dihydrate Na2[Cu(C2O4)2].2H2O .  14-Preparation of tris(acetylacetonato)Cobalt(III) [Co(acac)3] .  15- Preparation of Sodiumtriaquaethylendiamineteraacetataolanthanate(III) Na[La(EDTA)(H2O)3] .  16- Preparation of tris(acetylacetonato)Iron(III) [Fe(acac)3].  17- Preparation of tris(ethylenediamine)Cobalt(III)chloride [Co(en)3]Cl3.  18- Preparation of Sodiumaqua(ethylendiamineteraacetatao)ferrate(III)dehydrate Na[Fe(EDTA)(H2O)]2H2O .  19- Spectoscopic :  Beer-Lambert law application  20- Spectroscopic determination in complexes .  21- Preparation of tris(acetylacetonato)diaqualanthnium(III) [La(acac)3(H2O)2].  22- Determination of S2O32- in the complex [Ni(en)3]S2O.  ***References :***   * Inorganic Experiments by J.Derek Woollins. * Inorganic Chemistry by Shriver and Attkins. * Inorganic Chemistry by Carthrine E. Housecroft. * Basic Inorganic Chemistry by Cotton and Wilkinson. * Modern Inorganic Chemistry by Jolly. * Modern Inorganic Chemistry by Lagowski. | | Lecturer's name:  **Adnan Muhammad Qadir**  (3hrs) |
| **19. Examinations:**  Q1/ percentage absorbance of (2.5x10-4M) KMnO4 solution is (9%) in (0.1)cm cell at maximum absorption.   * What is the Molar absorption coefficient? * If the concentration was 700 ppm what would be the absorbance? * Calculate the transmittance percentage at 700 ppm.   Q2/A-Give reason for the following:  1-In preparation lanthanum complexes always produce high coordination number, why?  2- Addition H2O2 in preparation of [Co(en)3]Cl3 , could you use KMnO4, why?  3- Addition of ammonium sulphate (NH4)2SO4 for determination Cr3+ in the complex K[Cr(C2O4)2(H2O)2].2H2O.  B-Write the preparation chemical reaction with balancing and hybridization with name geometrical structure for each of the following complexes:   * cis-K[Cr(C2O4)2(H2O)2].2H2O . * [La(acac)3(H2O)2]. * [Co(en)3]Cl3.   Q3/ Find the weight percentage of NH3, when (0.2g) of its complex was dissolved in (15ml) of (0.25N)HCl, the excess of HCl was back titrated with 10ml of (0.1N) NaOH using methyl red as indicator.  Q4/ prepare the following complexes with balancing chemical reaction, write the hybridization and draw geometrical structure for each one:   * Trans-ammoniumdiamminetetranitrocobaltate (III) hydrate. * Trisacetylacetonatoiron (III).   Q5): Explain reason for each the following  a-Lanthanide contraction.  b-Addition of NaOH for preparation of tris(acetylaceton)diaqua Lanthanium(III)    In this type of exam there will be a number of phrases next or below a statement, students will match the correct phrase. Examples should be provided. | | |
| **20. Extra notes:**  Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks. | | |
| **21. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ**  This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.  *(A peer is person who has enough knowledge about the subject you are teaching; he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).*  ئه‌م کۆرسبووکه‌ ده‌بێت له‌لایه‌ن هاوه‌ڵێکی ئه‌کادیمیه‌وه‌ سه‌یر بکرێت و ناوه‌ڕۆکی بابه‌ته‌کانی کۆرسه‌که‌ په‌سه‌ند بکات و جه‌ند ووشه‌یه‌ک بنووسێت له‌سه‌ر شیاوی ناوه‌ڕۆکی کۆرسه‌که و واژووی له‌سه‌ر بکات.  هاوه‌ڵ ئه‌و که‌سه‌یه‌ که‌ زانیاری هه‌بێت له‌سه‌ر کۆرسه‌که‌ و ده‌بیت پله‌ی زانستی له‌ مامۆستا که‌متر نه‌بێت.‌‌ | | |