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**Department of Chemistry**

**College of Science**

**University of Salahddin**

**Subject: Practical Inorganic Chemistry**

**Course Book: 2nd Stage of Chemistry**

**Lecturer's name: MSc. Bayan Omar Ahmad**

**Academic Year:( 2022/2023)**

**Course Book**

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| **1. Course name** | **Practical Inorganic Chemistry** | |
| **2. Lecturer in charge** | **Bayan Attalla Faiq** | |
| **3. Department/ College** | **Chemistry /Science** | |
| **4. Contact** | **e-mail:** [**Bayan.faiq@su.edu.krd**](mailto:Bayan.faiq@su.edu.krd)  **Tel: (optional)** | |
| **5. Time (in hours) per week** | **Practical: 2 hours per week** | |
| **6. Office hours** | **18 hours per week to the student during the week** | |
| **7. Course code** |  | |
| **8. Teacher's academic profile** | **BSc. (1989),(MSc. 2009)** | |
| **9. Keywords** | **Inorganic chemistry ,Salts preparation, Determination of ions in Salt.** | |
| **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**.  **Familiarity with Periodic Table**  The Periodic Table (consist of 18 groups and 7 periods) the group consist of many elements and study of atomic number and atomic weight, Electronegativity, atomic radius, ionization energy, electron affinity  Atomic Structure  1. The fundamental particles: protons, electrons and neutrons, their charges and relative masses.  2. The nucleus of the atom. Proton (or atomic) number and nucleon (or mass) number. Isotopes and  relative atomic masses. The C12 scale, use of isotopes as tracers in mechanistic studies  exemplified by the use of O16 .  **Electronic Theory and Chemical Bonding.**  1. The ionic (electrovalent), covalent and co-ordinate (or dative) bond.  Electronegativity. Intermediate bonding: ion polarization and bond polarization. Electrical dipoles in  molecules (qualitative treatment only).  Polar covalent bonds which may, or may not, give rise to molecules with a permanent dipole.  2. Nature of forces in bonding. Comparison between ionic and covalent bonding. Multiple bonding | | |
| **11. Course objective:**  (a) Manipulate chemicals and simple apparatus in quantitative and qualitative exercises.  (b) Observe and record results of experimental work.  (c) Interpret these observations and deduce correct inferences and conclusions based both on qualitative  and quantitative data.  The examination will primarily attempt to test practical skills. Quantitative exercises including the measurement of mass, volume, temperature and time may be set. Volumetric analysis involving acids and alkalis, redox titrations including iodimetry and iodometry.  Qualitative exercises involving observations of reactions and requiring deductions on the chemical nature of the substances will also be set. These include inorganic materials. Classification of Inorganic Compounds:Acids **Acids** are compounds that produce H+ ions when dissolved in water. Examples of acids include sulfuric acid (H2SO4), hydrochloric acid (HCl), hydrofluoric acid (HF), ascetic acid or vinegar (HC2H3O2) and citric acid (C6H8O7). Most acids can be dissolved in water and are corrosive, and those that can be ingested have a sour taste. In water, HCl is decomposed in H+ and Cl-  HCl (H+) + (Cl-) Bases **Bases** are compounds that produce OH- (hydroxyl ions) when dissolved in water. They are usually found in household products. Some common bases are ammonia (NH3), potassium hydroxide (KOH), calcium hydroxide or caustic lime (Ca (OH)2)and sodium hydroxide or caustic soda (NaOH). In water,  KOH dissociates in K+ and OH- :  KOH (K+) + (OH-) Salts **Salts** are compounds that result from the reaction between an acid and a base. They are ionic compounds formed by two oppositely charged ions (atoms that are not electrically neutral because they have lost or gained one or more electrons). For example, table salt or sodium chloride (NaCl) is formed by the bonding an **anion**(positively charged ion) and a **cation** (negatively charged ion): Na+ and Cl-.  Some common salts include sodium chloride or table salt (NaCl), calcium chloride (CaCl2), magnesium chloride (MgCl2) and potassium chloride (KCl). Most salts can be dissolved in water to form a solution of the ions. Ions derived from salts like Na+, Mg2+ and K+ are critical for the functioning of the human body. In water, CaCl2 is decomposed in the following way:  CaCl2 (Ca2+) + 2(Cl-) Oxides **Oxides** are compounds that contain at least one oxygen atom combined with another element. Oxygen is usually in the form of an anion (O2-). Transition metal oxides such as titanium (III) oxide (Ti2O3) and iron (III) oxide (Fe2O3) have useful magnetic and catalytic properties. | | |
| **12. Student's obligation**  The attendance & completion of all tests  Assignments and Quiz ( 12%)  Reports (8%)  Exams ( 15%) | | |
| **13. Forms of teaching**  White Board and Data show | | |
| **14. Assessment scheme**  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: | | |
| **15. Student learning outcome:**  Preparation simple salts and determination their contents, purification food salt and equivalent weight of metal ex. Zinc.  1-To study the crystallization method on the purification food salt by evaporation and precipitation method and preparation of simple salts like CuCl,CuI,Cu(IO3)2 and double salt like Potash alum , improve of the double and re-crystallization skills as the basic for laboratory activities.  2- Determine the percentage of cation (%Mn+) in prepared salt by titration method like (acid - base titration , back titration and iodimetry titration )  3- Determine the percentage of anions (%Xn-) in prepared salt by titration method like (iodimetry titration)  4- Usage and some application of prepared simple and double salts in daily uses. [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 cansense i 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 behaviour 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).  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. For example:   * **Ammonia** is a nitrogen source in fertilizer, and it is one of the major inorganic chemicals used in the production of nylons, fibers, plastics, polyurethanes (used in tough chemical-resistant coatings, adhesives, and foams), hydrazine (used in jet and rocket fuels), and explosives. * **Chlorine** is used in the manufacture of polyvinyl chloride (used for pipes, clothing, furniture * etc.), agrochemicals (e.g., fertilizer, insecticide, or soil treatment), and pharmaceuticals, as well as chemicals for water treatment and sterilization. * **Titanium dioxide** is the naturally occurring oxide of titanium, which is used as a white powder pigment in paints, coatings, plastics, paper, inks, fibers, food, and cosmetics. Titanium dioxide also has good ultraviolet light resistance properties, and there is a growing demand for its use in photo catalysts.   Inorganic chemistry is a highly practical science—traditionally, a nation’s economy was evaluated by their production of sulphuric acid because it is one of the more important elements used as an industrial raw material.  Cleaning your drains with sodium hydroxide.  Polishing your silver with sodium tartrate.  Keeping your pool clean with sodium hypochlorite.  Sterilising your spa bath with hydrogen peroxide.  Fertilising your garden with nitrates, phosphates, potash and trace elements.  Brushing your teeth with paste containing sodium bicarbonate and fluorides. | | |
| **16. Course Reading List and References‌:**  **References :**   * Handbook of preparative Inorganic Chemistry by Brouer, c., Academic Press, (1963). * Inorganic Synthesis (Book Series). * Experimental Inorganic Chemistry by W.G.Palmer. * Advanced Practical Inorganic Chemistry by D.M.Adams &O.BRaynor | | |
| **17. The Topics:** | | **Lecturer's name** |
| In this section the lecturer shall write titles of all topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture  Each term should include not less than 16 weeks | | Lecturer's name |
| **16. Practical Topics ( Each group 2 hrs.week)** | | ***Lecturer's name***  ***MSc. Bayan Attalla MSc. Bayan Omer*** |
| Introduction of Practical inorganic chemistry  ***Semester (1)***  Week (1) Exp: No. (1) Purification of table salt(NaCl) or cooking salt.  Week (2) Exp: No. (2) ) Unknown of pervious experiment.  Week (4) Exp: No. (4) Preparation of copper (I) chloride CuI.  Week (5) Exp: No. (5) Preparation of copper (I) iodide CuCl.  Week (6) Exp: No. (6) Preparation of copper (II) iodate dihydrate  Cu (IO3)2.2H2O.  Week (7) Exp: No. (7) Determination of( Cu2+ ) percentage in Cu(IO3)2.2H2O  Week (8) Exp: No. (8) Preparation of Potassium Manganate ( KMnO4)  ***Examination Jan.2023***  ***Semester (2)***  Week (1) Exp: No. (1) Determination of Eq.Wt of Zn  Week (2) Exp: No. (2) Preparation of potassium periodate KIO4.  Week (3) Exp: No. (3) Preparation of sodium thiosulfate Na2S2O3  Week (4) Exp: No. (4) Quantitative & qualitative analysis of sodium thiosulfate Na2S2O3  Week (5) Exp: No.(5) Preparation of potassium chromate K2CrO4  Week (6) Exp: No.(6) Determination of Chromium(%Cr3+) in K2CrO4  Week (7) Exp: No.(7) Preparation of chromium Alum (Double salt) KCr(SO4)2.10H2O  Week (8) Exp: No.(8) Preparation of Potash Alum (Double salt) KAl((SO4)2.12H2O  ***Examination 4/2023***  **References :**   * Handbook of preparative Inorganic Chemistry by Brouer, c.,Academic Press, (1963). * Inorganic Synthesis (Book Series). * Experimental Inorganic Chemistry by W.G.Palmer. * Advanced Practical Inorganic Chemistry by D.M.Adams&O.BRaynor. | |  |
| **19. Examinations:**  Q **1.** Oxidation states  How many oxidation state of iodine? Give an example for each of state  Oxidation states of the iodine are:  for example  (0) ) for example) I2)  (1-) for example KI  (1+) for example ICl  (3+) for example ICl3  (5+) for example KIO3  (7+) for example KIO4  Q **2.**  Preparation of salt  Prepare and balance the chemical reactions .  1-Sodium thiosulfate  Na2SO3 + S Ø Na2S2O3  S S2+ +2e- oxidation  2e- + S4+ S2+ reduction  Q **3.** /Determination of chromium percentage in potassium chromate.  Q **4.**  /What are differences between iodometry and iodimetry titration ?explain in detail.  Write the usages of sodium thiosulphate with chemical equations.  Q **5.**  Multiple Choice.  1- A 0.9182 g sample of KMnO4 (in neutral medium)is dissolved in enough water to give 500 ml of solution. What is normality in this solution?  a) 0.0459 eq\L (b) 0.2304 eq\L (c) 0.03487 eq \L (d) 0.01162 eq\L  2- For 3.2 gm of impure table salt, the mass of BaSO4 is equal to 1.5 gm the percentage of sulfate ion is?  a) 19.28% (b) 15.1 % (c) 7.8 % (d) 35.4 %  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:**  Not | | |
| **21. Peer reviewپێداچوونه‌وه‌ی 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.‌‌ | | |