Department of Chemistry

College of Science

University of Salahddin

Subject: Practical periodic table and stoichiometry

Course Book: 2nd Stage of Chemistry

Lecturer's name: MSc. Bayan Attalla Faiq

Academic Year:(2023/2024)

1. Course name	**Practical: periodic table and stoichiometry**
2. Lecturer in charge	**Theory: Bayan Omer Ahmed** **Practical :Bayan Attalla Faiq**
3. Department/ College	**Chemistry /Science**
4. Contact	**bayan.faiq@su.edu.krd**
5. Time (in hours) per week	**Theory: 2 hr** **Practical : 2 hr**
6. Office hours	Sunday: 8:30 –4:30 Monday: 8:30 – 4:30 Wednesday: 8:30 – 12:30
7. Course code	
8. Keywords	**Inorganic chemistry, Simple Salts preparation, Determination of ions in Salt. Double salt preparation**

9.Teacher's academic profile

Academic achievements and Qualifications: (starting from the most recent degree)

From- To	Degree	College-University	Country
2022 to date	Lecturer in Department of Chemistry	College of Science- University of Salahaddin	Iraq
2006-2009	M. Sc. in Inorganic Chemistry, Department of Chemistry	College of Science - University of Salahaddin	Iraq
1985-1989	B.Sc. Chemistry, Department of Chemistry,	College of Science- University of Salahaddin	Iraq

1- Assignments and Posts

From- To	Post	Department -College	University
2022 to date	Lecture	Chemistry Department-College of Science	Salahaddin University
2010-2021	Assistant Lecture	Chemistry Department-College of Science	Salahaddin University
2004-2006	Chemical Assistant	Chemistry Department-College of Science	Salahaddin University
2013&2014	Member of Examination Committee	Chemistry Department-College of Science	Salahaddin University

2- Teaching Activities:

From- To	Subject	Stage-College	University
2012- to date	Practical Inorganic Chemistry	2 nd-year students / Department of Chemistry - College of Science	Salahaddin University
2019-2022	Basic Inorganic Chemistry/ Theory	1St -year students/chemistry College of Science, University of Salahaddin	Salahaddin University
2010- 2012	Complexes preparation / Practical Inorganic Chemistry	3 ed -year students / Department of Chemistry - College of Science	Salahaddin University

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 C_{12} scale, use of isotopes as tracers in mechanistic studies exemplified by the use of O_{16} .

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) Mmanipulate 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 (H_2SO_4), hydrochloric acid (HCl), hydrofluoric acid (HF), ascetic acid or vinegar ($HC_2H_3O_2$) and citric acid ($C_6H_8O_7$). 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^-

$HCl \longrightarrow (H^+) + (Cl^-)$

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 (NH_3), 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^- :

$KOH \longrightarrow (K^+) + (OH^-)$

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

($CaCl_2$), magnesium chloride ($MgCl_2$) and potassium chloride (KCl). Most salts can be dissolved in water to form a solution of the ions. Ions derived from salts like Na^+, Mg^{2+} and K^+ are critical for the functioning of the human body. In water, $CaCl_2$ is decomposed in the following way:

$CaCl_2 \longrightarrow (Ca^{2+}) + 2(Cl^-)$

Oxides

Oxides are compounds that contain at least one oxygen atom combined with another element. Oxygen is usually in the form of an anion (O^{2-}). Transition metal oxides such as titanium (III) oxide (Ti_2O_3) and iron (III) oxide (Fe_2O_3) have useful magnetic and catalytic properties.

12. Student's obligation

The attendance & completion of all tests

Practical Inorganic Chemistry (35 %)

Quiz, report, seminar, practical exam: (20 %)

Consist of :

Assignments and Quiz (12%)

Reports (8%)

Midterm 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,$Cu(IO_3)_2$ 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 (%M^{n+}) in prepared salt by titration method like (acid - base titration , back titration and iodimetry titration)

3- Determine the percentage of anions (%X^{n-}) 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:

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 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.

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) . Preparation of copper (II) iodate dihydrate $Cu(IO_3)_2.2H_2O$. Week (3) Exp: No. (3) Determination of(Cu^{2+}) percentage in $Cu(IO_3)_2.2H_2O$ Week (4) Exp: No. (4) Unknown of previous exp. Week (5) Exp: No. (5) Preparation of copper (I) iodide CuCl. Week (6) Exp: No. (6) Preparation of copper (I) chloride CuI. Week (7) : Seminar Week (8) : Seminar ***Examination Jan.2024*** ***Semester (2)*** Week (1) Exp: No. (1) Determination of Eq.Wt of Zn Week (2) Exp: No. (2) Preparation of Potassium Manganate ($KMnO_4$). Week (3) Exp: No. (3) Preparation of sodium thiosulfate $Na_2S_2O_3$ Week (4) Exp: No. (4) Quantitative & qualitative analysis of sodium thiosulfate $Na_2S_2O_3$ Week (5) Exp: No.(5) Preparation of potassium chromate K_2CrO_4 Week (6) Exp: No.(6) Determination of Chromium(%Cr^{3+}) in K_2CrO_4	

Week (7) Exp: No.(7) Preparation of chromium Alum (Double salt) $KCr(SO_4)_2.10H_2O$

Week (8) : Seminar

Examination 21/4/2024

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 (I_2)

(1-) for example KI

(1+) for example ICl

(3+) for example ICl_3

(5+) for example KIO_3

(7+) for example KIO_4

Q **2.** Preparation of salt

Prepare and balance the chemical reactions .

1-Sodium thiosulfate

$Na_2SO_3 + S \xrightarrow{\emptyset} Na_2S_2O_3$

$S \longrightarrow S^{2+} + 2e^-$ oxidation

$2e^- + S^{4+} \longrightarrow S^{2+}$ 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 $KMnO_4$ (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 $BaSO_4$ 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 review **پێداچوونەوەی هاوەڵ**

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).

ئەم کۆرسبووکە دەبێت لەلایەن هاوەڵێکی ئەکادیمیەوە سەیر بکرێت و ناوەڕۆکی بابەتەکانی کۆرسەکە پەسەند بکات و جەند ووشەیەک بنووسێت لەسەر شیاوی ناوەڕۆکی کۆرسەکە و واژووی لەسەر بکات.
هاوەڵ ئەو کەسەیە کە زانیاری هەبێت لەسەر کۆرسەکە و دەبیت پلەی زانستی لە مامۆستا کەمتر نەبێت.

Course Book