



Course Specifications

| | |
|----------------------|--------------------------|
| Course Title: | Chemistry of Main groups |
| Course Code: | CHEM 221 |
| Program: | Bachelor in Chemistry |
| Department: | CHEMISTRY |
| College: | College of Science |
| Institution: | Jazan University (JU) |

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A. Course Identification

| | |
|---|---|
| 1. Credit hours: | 4 hrs |
| 2. Course type | |
| a. | University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/> |
| b. | Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/> |
| 3. Level/year at which this course is offered: | Level 4, Year 2 |
| 4. Pre-requisites for this course (if any): | non |
| 5. Co-requisites for this course (if any): | non |

6. Mode of Instruction (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|----|-----------------------|---------------|------------|
| 1 | Traditional classroom | 45 | 100 |
| 2 | Blended | 30 | |
| 3 | E-learning | | |
| 4 | Distance learning | | |
| 5 | Other | | |

7. Contact Hours (based on academic semester)

| No | Activity | Contact Hours |
|----|-------------------|---------------|
| 1 | Lecture | 45 |
| 2 | Laboratory/Studio | 30 |
| 3 | Tutorial | 0 |
| 4 | Others (specify) | 0 |
| | Total | 75 |

B. Course Objectives and Learning Outcomes

1. Course Description

| Course Title | Course Number | Contact Hours (CH) | | Credit unit (CU) | Year | Level | Pre-requisite |
|--------------------------|---------------|--------------------|-------|------------------|--------|--------|---------------|
| | | Lec. | Prac. | | | | |
| Chemistry of Main Groups | CHEM 221 | 3 | 2 | 4 | Second | Fourth | ----- |

Course objectives: They are to identify the following.

- 1- Recognizing the elements and their chemical and physical properties.
- 2- Recognizing the periodic table of the elements.
- 3- Recognizing the properties of elements by knowing the group that belongs to.

Syllabus: A-Theoretical contents

Study effective nuclear charge - formal charge - draw molecular orbital diagram for the molecule - Study of the properties of the elements in the groups and periods of the periodic table - Chemistry of hydrogen - Elements of the first group (Alkali Metals) - Elements of the second group (Alkaline Earth Metals) - Elements of the third group - Elements of the fourth group - Elements of the fifth group - Elements of the sixth group - Elements of the seventh group (Halogens) - Elements of the eighth group (Noble Gases).

Syllabus: B-Practical contents

Selected experiments in qualitative and quantitative analysis.

*See attachment

2. Course Main Objective

The course of chemistry of main groups is designed to give the students basic information about the General properties of S and b-block elements in periodic table.

3. Course Learning Outcomes

| CLOs | | Aligned PLOs |
|------|---|--------------|
| 1 | Knowledge and Understanding <i>Up on completing this course, student will be able to</i> | |
| 1.1 | Demonstrate a broad, knowledge in the properties of Hydrogen, periodic table groups (I, II, III,...etc) elements and their related properties, preparation and uses. (I) | K.1 |
| 1.2 | Describe the types of hydrides, oxides and carbides. Describe the allotropy phenomena, and the difference in chemical and physical properties of the main groups. (I) | K.2 |
| 2 | Skills : <i>Up on completing this course, student will be able to</i> | |

| CLOs | | Aligned PLOs |
|----------|--|--------------|
| 2.1 | Demonstrate the knowledge and skills required to calculate effective nuclear charge, formal charge, and draw molecular orbital diagram for the molecule. (I) | S.1 |
| 2.2 | Carry out scientific experiments as well as accurately record and analyze the results of such experiments. (I) | S.2 |
| 2.3 | Examine his material and lab safety background to Follow proper procedures and regulations for safe handling and use of chemicals. (I) | S.3 |
| 3 | Values: <i>Up on completing this course, student will be able to</i> | |
| 3.1 | Work as a group leader in cooperation with other colleagues. (I) | V1 |

C. Course Content

| No | List of Topics | Contact Hours |
|--------------|--|---------------|
| 1 | General properties of the elements in periodic table. | 4 |
| 2 | Types of bonds | 7 |
| 3 | VSEPR theory and molecular orbital theory | 7 |
| 4 | Hydrogen, properties, position, isotopes, preparation and uses | 3 |
| 5 | Group (I): alkali metals , properties, oxides, stability and Extraction. | 3 |
| 6 | Group (II): Electronic configuration, occurrence, properties and extraction. | 3 |
| 7 | Group (III), Electronic configuration, occurrence, properties, extraction, | 3 |
| 8 | Group (IV), Electronic configuration, occurrence, properties, extraction hydrides, halides, oxygen compounds and carbides. | 3 |
| 9 | Group (V), Electronic configuration, occurrence, properties, extraction hydrides, uses ,(N,P,...)and oxides. | 3 |
| 10 | Group (VI), Electronic configuration, occurrence, extraction (S, O....) uses of ozone, H ₂ O ₂ , Halides, Oxides, and uses of Sulphur. | 3 |
| 11 | Group (VII), Halogens, Electronic configuration, occurrence, uses of HF and Halogen oxides. | 2+1 exam |
| 12 | Noble gases, Electronic structure, properties, occurrence and preparation | 3 |
| 13 | Selected Experiments related to course contents | 30 |
| Total | | 75 |

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|------------|---|--|------------------------------------|
| 1.0 | Knowledge and Understanding | | |
| 1.1 | Demonstrate a broad, knowledge in the properties of Hydrogen, periodic table groups (I, II, III,...etc) elements and their related properties, preparation and uses. I | lecture / group work discussion / project-based learning / work shop / presentation | MCQ Short answer Q Oral exam |
| 1.2 | Describe the types of hydrides, oxides and carbides. Describe the allotropy phenomena, and the difference in | lecture / group work discussion / project-based learning / work shop / presentation | Short answer Q Oral exam |

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|------|--|---|--|
| | chemical and physical properties of the main groups. I | | |
| 2.0 | Skills | | |
| 2.1 | Demonstrate the knowledge and skills required to calculate effective nuclear charge, formal charge, and draw molecular orbital diagram for the molecule. I | lecture / group work discussion / project-based learning / work shop / presentation | Papers, oral/written exam questions, problems, class discussions, concept maps, homework |
| 2.2 | Carry out scientific experiments as well as accurately record and analyze the results of such experiments. I | Lectures, Lab work | Practical exam laboratory Report |
| 2.3 | Examine his material and lab safety background to Follow proper procedures and regulations for safe handling and use of chemicals. I | lab demonstrations /hands-on student learning activities / whole group and small group discussion. | Safety exam |
| 3.0 | Values | | |
| 3.1 | Work as a group leader in cooperation with other colleagues. I | Lab work | Group work |

2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|----------------------|----------|--------------------------------------|
| 1 | Homework 1 | 3 | 1% |
| 2 | Homework 2 | 8 | 1% |
| 3 | quiz | 9 | 2% |
| 4 | Med -1 | 12 | 15% |
| 5 | Homework 3 | 13 | 1% |
| 6 | Quiz in safety | 13 | 0% |
| 7 | Laboratory | 15 | 10% |
| 8 | Sheet | 15 | 10% |
| 8 | Final Practical Exam | 15 | 20% |
| 9 | Final Exam | 16 | 50% |
| | Total | | 100% |

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

4h/week instructor will be available for student consultation in his office

F. Learning Resources and Facilities

1. Learning Resources

| | |
|---------------------------|---|
| Required Textbooks | Inorganic Chemistry, 5th Edition by Gary L. Miessler, Paul J. Fischer, Donald A. Tarr, (2013) |
|---------------------------|---|

| | |
|---------------------------------------|--|
| Essential References Materials | Concise Inorganic Chemistry, 5th Edition, J.D. Lee, Blackwell Science Ltd (1996) |
| Electronic Materials | <i>Some course contents and materials are posted on Black board sites</i> |
| Other Learning Materials | https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Group_Theory/Group_Theory_and_its_Application_to_Chemistry https://chem.libretexts.org/Special:Search?qid=&fpid=230&fpth=&qquery=group+theory&type=wiki |

2. Facilities Required

| Item | Resources |
|--|---|
| Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) | <i>1 Lecture room(s) for groups of 50 students</i> <i>1 Lab room(s) for groups of 25 students</i> |
| Technology Resources (AV, data show, Smart Board, software, etc.) | <i>Smart board, Data show, Black board, internet,</i> |
| Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | https://scilearn.sydney.edu.au/fychemistry/calculators/make_mo.shtml?type=year1&theMolecule=no |

G. Course Quality Evaluation

| Evaluation Areas/Issues | Evaluators | Evaluation Methods |
|--|--|--|
| <i>Effectiveness of Teaching and Assessment</i> | <i>Student</i> | <i>Likert-type Survey (CES)</i> <i><u>Indirect</u></i> |
| <i>Extent of achievement of course learning outcomes</i> | <i>Instructor & Course coordinator</i> | <i><u>Class room evaluation</u></i> <i><u>(direct & indirect)</u></i> |
| <i>Quality of learning resources</i> | <i>Program coordinator</i> | <i><u>Indirect</u></i> |
| <i>Exam Quality assessment</i> | <i>Assessment committee</i> | <i><u>Indirect</u></i> |

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

| | |
|----------------------------|---|
| Council / Committee | Chemistry Department Council |
| Reference No. | 42 / 35 /102 112 |
| Date | 17 /09 /1442 Corresponding to 28 / 04 /2021 |

The practical work of the course (221) involves the following Experiments.
Separation and determination of main groups elements

| No. | Experiment Title | Required Chemicals | Required Glass Wear & equipment | week |
|------------|---|--|--|------------------|
| 1 | Safety | ----- | ---- | 1 |
| 2 | Separation and determination of potassium | 1- Potassium chloride salt. 2- Tartaric acid (17% solution). | Conical flask , beakers , tubes , filter papers, holders, heater ,vacuum gas chamber | 2 |
| 3 | Separation and determination of calcium | 1- Calcium Chloride salt. 2- Sodium carbonate Na ₂ CO ₃ (10% solution). | Conical flask , beakers , tubes , filter papers, holders, heater ,vacuum gas chamber | 3 |
| 4 | Separation and determination of aluminum | 1. Aluminum Chloride salt. 2. Sodium sulphide Na ₂ S (23% solution). | Conical flask , beakers , tubes , filter papers, holders, heater ,vacuum gas chamber | 4 |
| 5 | Separation and determination of tin | 1-Tin Chloride salt. 2- Sodium sulphide Na ₂ S (15% solution). | Conical flask , beakers , tubes , filter papers, holders, heater ,vacuum gas chamber | 5 |
| 6 | Separation and determination of lead | 1- Lead acetate salt. 2- Potassium dichromate K ₂ CrO ₄ (10% solution). | Conical flask , beakers , tubes , filter papers, holders, heater ,vacuum gas chamber | 6 |
| 7 | Separation and determination of bismuth | 1- Bismuth nitrate salt. 2- Potassium iodide KI (45% solution). | Conical flask , beakers , tubes , filter papers, holders, heater ,vacuum gas chamber | 7 |
| 8 | Separation and determination of barium | 1- Diluted sulphoric acid. 2- Barium chloride BaCl ₂ . 3- Hydrochloric acid HCl | Conical flask , beakers , tubes , filter papers, holders, heater ,vacuum gas chamber | 8 |
| 9 | Separation and determination of iodine | 1- Sodium iodide salt. 2- Lead acetate (CH ₃ COO) ₂ Pb (33% solution). | Conical flask , beakers , tubes , filter papers, holders, heater ,vacuum gas chamber | 9 |
| 10 | determination of total hardness of tape water | 1-EDTA 2-EBT 3- buffer solution | Conical flask , burette beakers , tubes , filter papers, holders, heater ,vacuum gas chamber | 10 and 11 |
| 11 | Separation and determination of chloride | 1-Sodium chloride 2- silver nitrate | Conical flask , beakers , tubes , filter papers, holders, heater ,vacuum gas chamber | 12 |
| 12 | General revision | ---- | ---- | 13 and 14 |
| 13 | Final practical exam | ---- | --- | 15 |