

Identification	Subject (code, title, credits)	CHEM 112: Chemistry 2 (6 ECTS)	
	Department	Chemistry and Chemical Engineering	
	Program (undergraduate, graduate)	Undergraduate	
	Term	Spring 2020	
	Instructor	Dr. Rasoul Moradi	
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	Phone:		
Prerequisites	This course is a prerequisite for the Course "Chemical/Petroleum/Civil/Biomedical Engineering" studied further		
Language	English		
Compulsory/Elective	compulsory		
Required textbooks and course materials	<p><u>Core textbooks</u></p> <ol style="list-style-type: none"> 1. R.Chang, Chemistry. New-York, 1988, <u>Additional textbooks</u> 2. <u>General Chemistry, Atoms First</u>, Mcquarrie, Rock & Gallogly <p>For class presentations and discussions, the student should utilize journal and internet materials. Moreover, the course does not limit the use of learning materials available at Khazar University library.</p>		
Course website	This course is based on traditional face-to-face classes		
Course outline	Quantum Theory & Electronic Structure of Atoms, Periodic Relationships among the elements, Chemical Kinetics, Chemical Equilibrium, Solubility Equilibria, Acid Base equilibria, Thermodynamics, Electrochemistry		
Course objectives	<p>Objectives of the Course:</p> <ul style="list-style-type: none"> -To support student academically, to provide a strong foundations of Chemistry required for further studies requiring a strong Chemistry knowledge -To encourage students participation and interaction in scientific perspective 		
Learning outcomes	<p>By the end of the course the students should be able:</p> <ul style="list-style-type: none"> -To perform fundamental Chemical calculations (Physical Chemistry) -To procure a fundamental knowledge in Inorganic Chemistry. -To achieve basic knowledge in Organic chemistry 		
Teaching methods	Lecture		x
	Group discussion		x
	Experimental exercise		
	Case analysis		
	Simulation		
	Course paper		x
	Others		
Evaluation	Methods	Date/deadlines	Percentage (%)
	Midterm Exam	April, 2020	30
	Assignment and quizzes		15
	Presentation/Group		15

	Discussion		
	Final Exam	June, 2020	40
	Total		100
Policy	<p>Attendance The students are required to attend all classes as a part of their studies and those having legitimate reasons for absence (illness, family bereavement, etc.) are required to inform the instructor.</p> <p>Tardiness / other disruptions. If a student is late to the class for more than 10 (ten) minutes, (s)he is not allowed to enter and disturb the class. However, this student is able to enter the second double hours without delaying.</p> <p>Exams In order to be excused from the exam, the student must contact the dean and the instructor before the exam. Excuse will not be granted for social activities such as trips, cruises and sporting events (unless you are participating). The exams will all be cumulative. Most of the questions on each exam will be taken from the chapters covered since the last exam. But some will come from the earlier chapters. In general the coverage will reflect the amount of the time spend in class on the different chapters.</p> <p>Withdrawal (pass / fail) This course strictly follows grading policy of the School of Science and Engineering. Thus, a student is normally expected to achieve a mark of at least 60% to pass. In this case of failure, he/she will be referred or required to repeat the course the following term or year.</p> <p>Cheating / plagiarism Cheating or other plagiarism during midterm and final examinations will lead to paper cancellation. In case, the student will automatically get 0 (zero), without any considerations.</p> <p>Professional behavior guidelines The student shall behave in the way to create favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly prohibited. Use of any electronic devices is prohibited in the classroom. All devices should be turned off before entering class. This is a university policy and violators will be reprimanded accordingly For successful completion of the course, the students shall take an active part during the class time, raising questions and involving others to discussions.</p> <p>Learning and Teaching Methods This course considers active learning process rather than passive one.</p> <p>Project: Students present their thoughts and idea about the new trends in Chemical Technology.</p>		
Tentative Schedule			
Week	Topic	Topics	Textbook/Assignments
1	1	<p style="text-align: center;">Quantum theory and the electronic structure of atoms</p> <p>i. From Classical Physics to Quantum Theory(217) Properties of waves (219), Electromagnetic radiation (221), Planck's quantum theory (223)</p> <p>ii. The photoelectric effect(224)</p>	[1]

		<ul style="list-style-type: none"> iii. Bohr's theory of the Hydrogen atom(225) Emission spectra(225), Emission spectrum of the hydrogen atom (227) iv. The dual nature of the electron (233) 	
2	1	<ul style="list-style-type: none"> v. Quantum Mechanics (236) vi. Applying Schrödinger equation to the Hydrogen atom (238) vii. Quantum numbers (239) The principal quantum number (239), The angular momentum quantum number (239), The magnetic quantum number (240), The electron spin quantum number (240) viii. Atomic orbitals (241) 	[1] Quiz1
3	1	<ul style="list-style-type: none"> ix. Electron configuration (246) The Pauli Exclusion Principle (247), Diamagnetism and Para magnetism (248), The shielding effect in many electron atoms (248), Hund's rule (249), General rules for assigning electrons to atomic orbitals (251) x. Building up Principle of the periodic table (253) xi. Review of the topic 	[1]
4	2	<p>Periodic Relationships among the elements</p> <ul style="list-style-type: none"> i. Development of periodic table (264) ii. periodic classification of the elements (267) Representing free elements in chemical equations (270), Electron configurations of cations and anions (271), Ions derived from representative elements (271), Cations derived from Transition metals (272) iii. periodic variation in physical properties (273) Effective nuclear charge (273), atomic radius (274), ionic radius (276), Variation in physical properties across a period (278), predicting physical properties (280) iv. ionization energies (281) v. Ionisation energies in many electron atoms (282) vi. Electron affinity (285) General trends in Chemical Properties (287), Chemical Properties in 	[1]

		<p>individual groups (288), Comparison of group 1A and 1B elements (295), Properties of oxides across a period (296)</p> <p>vii. Variation in Chemical Properties</p>	
5	3	<p>Chemical Kinetics (524-575)</p> <p>i. The rate of a reaction (524),</p> <p>ii. The rate laws (532)</p> <p>iii. Activation energy and temperature dependence of rate constants(545)</p> <p>iv. Reaction mechanisms (553)</p> <p>v. Catalysts(558)</p>	<p>[1]</p> <p>Quiz2</p>
6	4	<p>Chemical Equilibrium(576-605)</p> <p>i. The concept of Equilibrium (576)</p> <p>ii. Chemical Equilibrium (578)</p> <p>The magnitude of equilibrium constant (578)</p> <p>iii. Ways of Expressing equilibrium constants (579)</p> <p>Homogenous equilibria (579), Heterogeneous equilibria (584), multiple equilibria (587), the form of K and the equilibrium equation (588), Summary of rules for writing equilibrium constant expressions(590)</p> <p>iv. Relationship between Chemical Kinetics and Chemical Equilibrium (590)</p> <p>v. What does the equilibrium constant tell us? (591)</p> <p>Predicting the direction of a reaction (592), Calculating equilibrium concentrations (593)</p> <p>vi. Factors that affect chemical equilibrium (597)</p> <p>Le Chatelier's principle (597), Changes in concentrations (597), Changes in volume and pressure (600), Changes in Temperature (602), The effect of a catalyst(602), summary of factors that may affect the equilibrium position (603)</p>	<p>[1]</p>
8	1-4	<p>Review topics:: Quantum theory and electronic structure of atoms, Periodic Relationships among the elements, Chemical Kinetics, Chemical Equilibrium</p>	<p>[1]</p>
Mid exam			

9	5	<p>Acid-Base Equilibria (645-694)</p> <ul style="list-style-type: none"> i. Weak acids and acid ionization constants (646) ii. Weak bases and base ionization constants (654) iii. The relationship between conjugate acid-base ionization constants (657) iv. Diprotic and poly protic acids (658) v. Acid-base properties of salts (662) vi. The common ion effect (669) vii. Buffer solutions (672) viii. A closer look at acid-base titrations (680) ix. Acid-base indicators (687) 	Quiz3
10	6	<p>Solubility Equilibria (696-727)</p> <ul style="list-style-type: none"> i. Solubility and solubility product (696) ii. Separation of ions by fraction precipitation (704) iii. The common ion effect and solubility(705) iv. pH and solubility (708) v. Complex ion equilibria and solubility (712) vi. Application of solubility product principle to qualitative analysis (716) 	[1]
11	7	<p>Thermodynamics (728-759)</p> <ul style="list-style-type: none"> i. Some definitions (728) ii. The first law of thermodynamics(729) iii. Entropy and the second law of thermodynamics(737) iv. Gibbs free energy(743) v. Free energy and chemical equilibrium (750) 	Quiz4
12	8	<p>Electrochemistry (760-787)</p> <ul style="list-style-type: none"> i. Redox reactions, a review (760) ii. Galvanic cells (761) iii. Standard electrode potentials (762) iv. Spontaneity of redox reactions (768) v. Effect of concentration on cell EMF(773) Nernst equation(773), Concentration cells(777) vi. Batteries (778) Dry cell battery (778), Mercury battery (778), Lead storage battery(779), Nickel-Cadmium battery(780), Fuel cells (780), Aluminium-air batter (782) 	[1]
13	8	<ul style="list-style-type: none"> vii. Corrosion(784) viii. Electrolysis(787) Electrolysis of molten NaCl(788), Electrolysis of Water(788), Electrolysis of aqueous NaCl solution (790), Qualitative aspects of electrolysis (791) ix. Review Electrochemistry(760-787) 	[1] Quiz5

14 & 15		Tutorials Problem solving sessions	
		Final exam :: June 2020:: topics 5-8	

This syllabus is a guide for the course and any modifications to it will be announced in advance.