CHEM 102 SYLLABUS

Text book: Raymond Chang, Chemistry,10th edition, 2010

Topics	Text book pages	Number of Lectures	
Chapter 7: Quantum Theory and the Electronic Structure of Atoms			
7.1 From Classical Physics to Quantum Theory: Speed, length, frequency, number of the waves of light, Electromagnetic radiation, Plank's equation (The quantization of light energy) **7.2 The photoelectric Effect** (The matter nature of light) ***Exercises***	276- 282	2	**3**
7.3 Bohr's theory for hydrogen atom: Emission spectra**, emission** spectrum of hydrogen atom Assumptions ***Exercises***	282-287	1	
7.4 The dual nature of electrons: De Broglie hypothesis **7.5 Quantum mechanics**: Heisenberg principle, Quantum mechanics of the hydrogen atom ***Exercises***	288-294	1	**5**
7.6 Quantum numbers: The principle quantum number, the angular momentum quantum number, the magnetic quantum number, the electron spin quantum number, ***Exercises***	294-296	1	
7.7 Atomic orbitals: s*, p, d,* orbitals, energy of ng up, or n + *l* principle) ***Exercises***	297-300	1	
7.8 Electron configurations: The Pauli exclusion, principle diamagnetism and para magnetism. the shielding effect of many-electron atoms, Hund's rule, general rules for assigning electron to atomic orbitals ***Exercises***	300 - 307	1	
7.9 The building-up principal: The Aufbau principle, building irregularities of configurations in transition elements ***Exercises***	307-309	1	
Chapter 8: Periodic Relationship Among the Elements			
8.2 Periodic classification of elements: Representing free elements in chemical equation, electron configuration of cations and anions ***Exercises***	326-330	3	**4**
8.3 Periodic variation in physical properties of elements: Effective nuclear charge, atomic radius**, ionic** radius **8.4 Ionization energy** **8.5 Electron affinity** ***Exercises***	331- 343	1	

Topics	Text book pages	Number of lectures	
Chapter 9: Chemical Bonding I			
9.1 Lewis dot symbols **9.2 The ionic bond** **9.3 Lattice energy of ionic compounds: The** Born-Haber cycle for determining lattice energy, lattice energy and the formula of ionic compounds, **9.4 The covalent bond** ***Exercises***	366 367-369 369-374 374-377	2	**6**
9.5 Electronegativity: Electronegativity and oxidation numbers ***Exercises***	377-380	1	
9.6 Writing Lewis Structures **9.7 Formal charge and Lewis structure** ***Exercises***	380 – 386	1	
9.8 The concept of resonance ***Exercises***	386 – 398	2	
9.9 Exceptions to the Octet Rule: The incomplete octet, odd-electron molecules, the expanded octet ***Exercises***			
9.10 Bond energy (enthalpy) ***Exercises***			
FIRST MIDTERM EXAM			
Chapter (10): Chemical Bonding II. Molecular geometry and hybridization of atomic orbitals			
10.1 Molecular geometry: Molecules in which the central atom has no lone pairs, geometry of molecules with more than one central atom, guidelines for applying the VSEPR model **10.2 Dipole Moment** ***Exercises***	410 - 424	1	**5**
10.3 Valence bond theory **10.4 Hybridization of atomic:** sp^3, sp^2, and sp hybridization, procedure for hybridizing atomic orbitals, hybridization of *s, p* and *d* orbitals ***Exercises***	424 – 436	2	
10.5 Hybridization in molecules **10.6 Molecular orbital theory:** Bonding and antibonding molecular orbitals ***Exercises***	437 - 443	1	
10.7 Molecular orbital configurations: Rules governing molecular electron configuration and stability, hydrogen and helium molecules, homonuclear diatomic molecules of second-period	443– 452	1	

elements, the lithium molecule, the carbon molecule, the oxygen molecule **10.8 Delocalized molecular orbitals:** Benzene molecule, the carbon ion ***Exercises***			
Chapter (5): Gases			
5.7 The kinetic molecular theory of gases:(chapter 5) **5.8 Deviation from the ideal gas**	203-204 211-213	1	
Chapter (11): Intermolecular forces and liquids and solids **11.1 The kinetic molecular theory of liquids and solids** **11.2 Intermolecular forces:** Dipole-dipole forces, ion-dipole forces, dispersion forces, hydrogen bond **11.3 Properties of liquids:** Surface tension, viscosity, the structure and properties of water ***Exercises***	462-472	2	**3**

Topics	Text book pages	Number of lectures	
Chapter (13) Chemical Kinetics			
13.1The rate of a reaction: Reaction of molecular bromine and formic acid, decomposition of hydrogen peroxide, reaction rate and stoichiometry **13.2 The rate low** **13.3The relation between reactant concentration and time:** First order reaction **(only)** **13.4 Activation energy and temperature dependence of rate constant:** The collision **theory** of chemical kinetics, the Arrhenius equation **13.5 Reaction mechanisms**: rate laws and elementary steps. experimental support for reaction mechanisms **13.6 catalysis:** Heterogeneous catalysis (**only)** ***Exercises***	558-5576 582-549 594-596	3	**5**
SECOND MIDTERM EXAM (10 GRADS)			

Chapter (14)Chemical equilibrium			
14.1 The concept of equilibrium and the equilibrium constant: The equilibrium constant **14.2 Writing equilibrium constant expressions**: Homogenous equilibrium , equilibrium constant and units, Heterogenous equilibrium, multiple equilibrium, the form of K and the equilibrium equation, summary of guidelines for writing equilibrium constant expressions ***Exercises***	616 – 630	2	**5**
14.3 The relationship between chemical kinetics and chemical equilibrium **14.4 What does the equilibrium constant tell us?:** Predicting the direction of a reaction, calculating equilibrium concentration ***Exercises***	630 – 637	2	
14.5 Factors that affect chemical equilibrium: Le chateliers principle, changes in concentration, changes in volume and pressure, changes in temperature, the effect of a catalyst, the summary of factors that may affect the equilibrium position ***Exercises***	638 - 645	1	

Topics	Text book pages	Number of lectures	
Chapter (4) Reactions in aqueous solutions			
4.4 Oxidation -reduction Reaction: Oxidation numbers ***Exercises***	135-139	1	**1**
Chapter (19) Oxidation-reduction reactions (Redox reactions)			
19.1 Redox Reaction: Balancing redox reactions ***Exercises***	838-840	1	**1**
Chapter (15) Acid and bases			
15.1 Brønsted Acids and Bases **15.2 The Acid-Base properties of water:** The ion product of water **15.3 pH—A Measure of Acidity** ***Exercises***	660 - 666	1	**6**
15.4 Strength of Acids and Bases **15.5 Weak acids and acid ionization constants:** The quadratic equation, percent ionization **15.6 Weak bases and base ionization constants**	666 - 681	2	

15.7 The relationship between the ionization constants of acids and their conjugate bases ***Exercises***			
15.9 Molecular structure and the strength of acids: Hydrohalic acids, oxoacids, carboxylic acids **15.10 Acid-Base properties of salts:** Salts that produce neutral solutions, salts that produce basic solutions, salts that produce Acidic solutions, salts in which both the cation and the anion hydrolyze **15.11 Acid-Base properties of oxides and hydroxides:** Basic and amphoteric hydroxides **15.12 Lewis acids and bases** ***Exercises***	685 - 701	3	
TOTAL HOURS	**42**	**42**	

Distribution of the 100 grades over semester:

	Grades	
Practical		**30**
1st midterm	**15**	**30**
2nd midterm	**15**	
Final exam		**40**
Total		**100**

FINAL EXAM WILL BE IN ALL TOPICS

الاختبار النهائي سيكون في جميع مواضيع المقرر