

Department of Chemistry
University of Dhaka

Chemistry Minor Course

The Department of Chemistry offers the following chemistry courses for students of other Departments who wish to take chemistry as a minor subject.

1st Year

Course Type	Course No.	Course Name	Credits
Minor	*CMG 7100	Fundamentals of Chemistry	4
	*CMGL7101	General Chemistry Laboratory	2

*** These Courses are Compulsory.**

MINOR COURSES OFFERED BY THE DEPARTMENT OF CHEMISTRY

CMG7100: Fundamentals of Chemistry

4 CREDITS

- Structure of Atom:** Atomic masses, isotopes, mass spectroscopy, Bohr model, spectrum of atomic hydrogen, dual nature of electron, Heisenberg uncertainty principle, quantum numbers, atomic orbitals, electronic configuration of atoms, radioactivity, nuclear reactions, nuclear bombardment reactions, fission and fusion reactions, stability of nuclei, nuclear binding energy.
- Periodic Table:** Periodic law, periodic classification of elements, variation of properties such as ionization energies, electron affinity, electronegativity, atomic/ionic radius along a period and down a group, diagonal relationship, general properties of representative elements, transition elements and inner transition elements.
- Chemical Bonds:** Chemical bond, types of chemical bonds – ionic, covalent, coordination, metallic, hydrogen; Lewis dot structure, shapes of molecules, VSEPR theory, valence bond theory, hybridization, σ - and π -bonds, molecular orbital theory.
- Chemical reactions:** Types of chemical reactions, precipitation, substitution, elimination, redox reactions, charge and electronic concept of redox reactions, oxidation number, balancing of redox reactions.
- States of aggregation of matter, kinetic theory of matter, nature of heat, changes of state.
- The gaseous state: the gas laws, the perfect gas equation, the kinetic theory of gases, the distribution of molecular velocities, intermolecular attraction, liquefaction of gases, the critical state, the critical constants.

7. Vapour pressure of liquids, temperature dependence, mixtures of liquids, Raoult's law, fractional distillation; solutions of non-volatile solids: colligative properties of solutions. Henry's law, Nernst distribution law.
8. Energy changes in chemical reactions, the first law of thermodynamics, the concept of internal energy and enthalpy; measurement of enthalpy changes, enthalpy of formation, Hess's law, lattice enthalpy, Born-Haber cycle; spontaneous processes, concept of entropy.
9. Chemical equilibrium, the equilibrium law, the equilibrium constant, homogeneous and heterogeneous equilibria, the principle of Le Chatelier and Brown, the dependence of K on temperature.
10. Acids and bases, the Lewis concept, the Bronsted concept, strong and weak acids, acid-base equilibria in aqueous solutions, Ostwald dilution law, pH, buffer solutions, neutralization curves, indicators for acid-base titrations.
11. Electrolysis, galvanic cells, electrodes and electrode reactions, reduction potential, the electrochemical series, the standard hydrogen electrode, measurement of pH.
12. Rates of chemical reactions, order and molecularity, zero and 1st order reactions, half-life, carbon dating, temperature dependence of rates of reactions.
13. The organic compounds and organic chemistry, hydrocarbons, aliphatic hydrocarbons, saturated and unsaturated hydrocarbons, alkanes, alkenes and alkynes, the aromatic hydrocarbons, delocalization in the benzene ring; nomenclature of organic compounds, the IUPAC system. Petroleum, natural gas, refining of petroleum; petrochemicals.
14. The concept of acids, bases, nucleophiles, electrophiles, carbocations, carbanions and free radicals.
15. Reactions of alkanes, alkenes and alkynes; substitution and hydrogen abstraction reactions in alkanes; hydrogenation, hydrohalogenation, ozonolysis of alkenes and alkynes, homolytic addition of hydrogen halides; geometrical isomers.
16. Functional groups, alcohols, aldehydes, ketones, esters, ethers, epoxides, amines, amides; typical reactions of the functional groups.
17. Some important reactions of aromatic compounds; substitution at the benzene ring, Friedel-Craft's reaction, diazotization and coupling; sulphonation and nitration.
18. Organic macromolecules: polythenes, Teflon, plastic, resin, nylon, peptides, protein, cellulose and starch.

Books recommended:

1. General Chemistry, D. D. Ebbing, Houghton Mifflin Co.
2. Chemistry – The Molecular Nature of Matter and Change, M. Silberberg, WCB/McGraw-Hill.
3. Introduction to Modern Inorganic Chemistry, S. Z. haider, Friends' International.
4. Principles of Physical Chemistry, M. M. Huque and M. A. Nawab, Students' Publications.
5. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and A. Bahl, S. Chand & Co. Ltd.
6. Advanced Organic Chemistry, B. S. Bahl and A. Bahl, S. Chand & Co. Ltd.

1. Preliminary investigation: action of heat on selected inorganic compounds such as NH_4Cl , NaNO_2 , NaNO_3 , $\text{Pb}(\text{NO}_3)_2$, Zn-salts, metal carbonates, halides, sulphides, sulphites; action of dilute and concentrated sulphuric acid on inorganic compounds and action of acids in presence of Cu turnings and MnO_2 ; action of sodium hydroxide; flame colouration and borax bead reactions.
2. The identification of acid radicals (anions) in solution.
3. The identification of metal ions (cations) in solution: the analytical classification of the metal ions; analysis of the silver group (Group I), copper group (Group IIA), arsenic group (Group IIB); test for the interfering radicals such as phosphates, borates and their removal; analysis of the iron group (Group IIIA), zinc group (Group IIIB), calcium group (Group IV), and the alkali group.
4. Standardisation of a given HCl solution with standard Na_2CO_3 solution and determination of sodium carbonate and sodium hydrogen carbonate in a sample of washing soda.
5. Standardisation of a given thiosulphate solution with $\text{K}_2\text{Cr}_2\text{O}_7$ solution and determination of copper content of a supplied solution.
6. Preparation of Mohr's salt and determination of its iron content by titration against standard $\text{K}_2\text{Cr}_2\text{O}_7$.
7. Determination of the enthalpy of neutralization of an acid calorimetrically.
8. Determination of the partition coefficient of I_2 between water and CH_2Cl_2 .
9. Investigation of the effect of reactant concentration on the rate of a chemical reaction.
10. Investigation of the effect of temperature on the rate of a chemical reaction.
11. Construction of a chemical cell and measurement of its e.m.f. and determination of the redox potential of an electrode.
12. Investigation of the variation of conductance of a weak electrolyte with concentration.
13. Determination of the molar mass of a volatile liquid by the Duma's method.
14. Purification of a given organic compound by recrystallization/distillation and determination of its m.p./b.p and refractive index.
15. Determination of the presence of nitrogen, halogen and sulphur in organic compounds.
16. Identification of the functional groups (unsaturation, alcohol, phenol, carbonyl, aldehyde, ketone, carboxylic acid; aromatic amine, amide and nitro- groups) in organic compound.
17. Preparation of organic compound using substitution, elimination and oxidation reactions.