

CHEMISTRY EDUCATION

Code:.....

Grade XII

Full Marks: 75

Teaching hours: 150

I. Introduction

Chemistry is concerned with the study of physical and chemical characteristics of substances, the nature of matter and chemical reactions. Chemistry, thus, is a powerful tool for uncovering and extending our understanding of various natural phenomena. The power resides in the combination of concepts and experiments involving careful observation and quantitative measurements under controlled conditions. The resulting concepts suggest further experiments and investigations which may cause a modification of the existing concepts leading to a creativity of thought. This creativity involves the recognition of problem; formulation of ideas in solving the problem and ultimately refinement of the original ideas. The present curriculum aims to foster this uniqueness among students by enabling them to study both theoretical and practical aspects of chemistry.

The course is intended to consolidate the learning in chemistry achieved in the secondary school and make the student capable of teaching chemistry to lower secondary level students in schools. Furthermore, it intends to provide a body of knowledge and skills appropriate both for those students continuing further studies in chemistry and the students not studying the subject beyond this stage. The course seeks to strike a balance between useful facts, concepts and theories which will facilitate understanding of the properties of substances, reactions among them and chemical processes. Emphasis is placed to stimulate, create and sustain students' interest in chemistry.

Chemistry being an experimental science, laboratory work is an essential component of its syllabus. The course intends to make the students aware of the importance of scientific method for accurate experimental work and also intends to develop the abilities to interpret, organize and evaluate data in order to make appropriate decisions and solve problems.

II. General Objectives

After completion of this course, the students will be able:

- to apply appropriate chemical principles, concepts, theories, definitions, laws, models and patterns to interpret, draw conclusion, make generalization, predictions ;
- to select appropriate facts to illustrate a given principle, concept, theory, model and pattern;
- to select and organize data and perform chemical calculations in which guidance on the method is not supplied;
- to state and apply fundamental facts and principles of chemistry dealing with the nature and properties of matter, preparation and the physical and chemical properties of chemical substance; changes that occur in chemical reactions and important to industrial processes;
- to familiarize with the mineral resources of Nepal and
- to appreciate the scientific, social, economic, environmental and technological contributions and applications of chemistry.

III. Specific Objectives

After studying the course, the student shall be able to:

1. identify and describe important properties of matter;
2. draw and describe the structure of atoms, arrange them into molecules and compounds;
3. explain the behaviour of gases and derive related equations;
4. classify the different kinds of matter;
5. write down the chemical equation and interpreted electronic oxidations and reductions reaction;
6. describe the properties of Oxygen, Hydrogen, Carbon dioxide and Nitrogen;
7. write down electronic configuration of atoms;
8. describe the general preparation and properties of some common nonmetallic elements and their compounds;
9. describe general metallurgy and properties of some common metals and their compounds;
10. explain general concept and properties of acids, bases and salts;
11. describe the general concept of hydrocarbons and its derivatives and
12. illustrate the applications chemistry in daily life.

COURSE UNITS, TITLES, AND CONTENTS

Unit-I : Language of Chemistry

Teaching hours:08

- Atoms, molecules, elements and compounds
- Symbols, valency and formula
- Chemical equation, types, significances and limitations
- Balancing the chemical equation (hit and trial, partial equation method)

Unit-II : States of Matter

Teaching hours:22

- Three states of matter
- Basic concepts of Kinetic theory of gas
- Boyle's Law
- Charles' Law, Kelvin scale of temperature
- Universal gas constant, Equation of state
- Dalton's law of partial pressure
- Graham's law of diffusion
- Deviation from ideal behaviour
- Laws of Stoichiometry
- Avogadro's Hypothesis
- Relation between Molecular weight and vapour density
- Properties of solid
- Simple chemical calculation

Unit-III : Atomic Structure and Valency

Teaching hours:12

- Dalton's atomic theory
- Rutherford's atomic model
- Bohr's postulates
- Aufbau principle, electronic configuration of atoms
- Electronic theory of valency

- Concept of electrovalency, covalency and co-ordinate covalency with examples
- Basic principle of electrolysis
- Faradays Laws of Electrolysis

Unit-IV : Periodic Classification and Chemical Equilibrium Teaching hours:08

- Mendeleef's Periodic Law
- Modern Periodic Law
- Anomalies of Periodic Table
- Chemical Equilibrium
- Equilibrium constant
- Le Chateliers' Principle

Unit-V :Acids, Bases and Salts, and oxidation reduction Teaching hours:15

- Arrhenius, Bronsted-Lowry and Lewis concepts of acids, bases with suitable examples
- oxidation and reduction
- Electronic interpretation of oxidation and reduction reaction

Unit-VI : Equivalent Weight, Acidimetry, Alkalimetry and pH Teaching hours:05

- Definition of Equivalent weight
- Equivalent weight of acid, base and salt
- Determination of equivalent weight by hydrogen displacement method
- Acidimetry and alkalimetry
- Simple acid, base titration
- Concept of pH

Unit-VII : Chemistry of Non-metals Teaching hours:20

- General preparation and properties of Halogens and its compounds (HCl, HBr and HI)
- General preparation and properties of compounds of Nitrogen (HNO₃ and NH₃)
- General preparation and properties of compounds of Sulphur (H₂S, H₂SO₄ and SO₂)
- Manufacture of NH₃ and H₂SO₄

Unit-VIII : Chemistry of Metals Teaching hours:15

- Introduction to metallurgy
- Mineral resources of Nepal
- Important processes in metallurgy (concentration, calcination, roasting, smelting and refining)
- Extraction of the following metals from their important ores and study of their physical and chemical properties and uses:

a. Iron	b. Sodium
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- Preparation, properties and uses of the following compounds:

a. Green vitriol	c. White vitriol
b. Blue vitriol	d. Sodium Carbonate

Unit-IX : Carbon and its compounds Teaching hours:30

- Definition classification and uses of organic compounds

- Empirical and molecular formulae
- Qualitative analysis of organic compounds (detection of N,X and S)
- Functional group and IUPAC Nomenclature
- Orbital, hybridization and bonding
- Introduction to aliphatic and aromatic hydrocarbons
- General preparation and properties of Alkane, Alkene and Alkyne, aldehyde, ketone, carboxylic acid and chloroform.
- Lab preparation and properties of the following compounds:
 - a. Methane
 - b. Ethane
 - c. Ethyl alcohol
 - d. Phenol
 - e. Nitrobenzene
 - f. Aniline
 - g. Benzoic acid

Unit-X : Uses of chemistry in daily life**Teaching hours:15**

- Structure uses and abuses of DDT, BHC
- Structures and uses of simple drugs [Analgeics and Antipyritics(aspirine and phenacetin)] Antibiotics(chloromycitin and penicillin)
- Polymers : synthetic polymers(nylon 66, dacron) and their uses
- Fertilizers : NPK fertilizers
 - a. Nitrogenous fertilizer(urea, ammonium sulphate)
 - b. Phosphorous fertilizer(supper-phosphate of lime)
 - c. Potassium fertilizer(potassium- nitrate, sulphate and chloride)

Textbooks:

1. Foundations of Chemistry (Vol. I, II and III)– Moti Kaji Sthapit, Prof. Dr. Raja Ram Pradhananga, Taleju Publication, Kathmandu.
2. Principles of Chemistry (Second Edition) – Prof. Dr. Mohan Bikram Gewali, Prof. Dr. Pradyumna Wagley, Buddha Academic Publisher, Kathmandu 2006.

Reference books:

1. Comprehensive Chemistry (Part 2) – Prof. Dr. Pradyumna Wagley et. al., Kala Books Center, Bagbazar, Kathmandu, 2006.
2. A Text Book of Inorganic Chemistry – Ladli Mohan Mitra, Ghose and Company, Calcutta.
3. Elementary Organic Chemistry – B.S. Bahl, S. Chand and Company, New Delhi.
4. Elementary Chemical Calculations – Moti Kaji Sthapit, Prof. Dr. Raja Ram Pradhananga.
5. Pradeep's New Course Chemistry – S.N. Dhawan, P.N. Kapil, S.C. Khetarpal, Pradeep Publications, Jalandhar, India.

CHEMISTRY EDUCATION

PRACTICAL

Full Marks : 25

Teaching hours:2periods/week

This list of practical activities for class twelve (science education) includes those experiments which are to be demonstrated and those which the students themselves are to do. The two categories have not however been separated.

Objectives:

After completing the practical course students will have skill in:

1. setting the apparatus for gas preparations
2. estimating the dissolved and undissolved substances in water by weighing method;
3. performing acid and base titration and prepare standard solution;
4. detecting acid and basic radicals of salts by dry and wet ways;
5. preparing saturated solution of blue vitriol at lab temperature and to recover the pure crystals of the given salt.
6. making accurate observations and measurements, being aware of possible sources of error
7. recording accurately and clearly the results of experiments; draw conclusion and make generalization from experiments; and

List of activities /experiments:

1. Simple lab techniques.
2. To set up an apparatus and prepare H_2 , O_2 , CO_2 and NH_3 gases and study their properties.
3. To prepare a sample of fairly pure water from an impure sample and fresh for impurities of water.
4. To prepare a saturated solution of blue vitriol at lab temperature and to recover pure crystals of the salt.
5. To obtain sodium chloride by the neutralization of (a) bench hydrochloric acid with bench sodium hydroxide (b) sodium carbonate with hydrochloric acid
6. To prepare the standard solution of sodium carbonate.
7. To standardize the given sulphuric acid with the help of the standard alkali by titration method.
8. To determine the strength of the given sample of sulphuric acid (bench) in terms of normality, grams per liter with the help of a standard solution of sodium carbonate.
9. To recover calcium carbonate from the given mixture of calcium carbonate and magnesium carbonate.
10. To separate the volatile component from the given mixture of a volatile and a non-volatile solid.
11. To detect the acid and basic radicals by dry wet way method (Cl^- , SO_4^{2-} , NO_3^- , CO_3^{2-} , Ag^+ , Cu^{++} , Cd^{++} , Al^{+++} , Fe^{++} , Cr^{+++} , Zn^{++} , Mn^{++} , Co^{++} , Ca^{++} , Ba^{++} , Mg^{++} , Na^+ , NH_4^+).
12. To detect the foreign elements present in a given organic compound
13. To identify the functional group present in a given organic compound

Textbooks for Practical:

1. Elementary Practical Chemistry – Moti Kaji Sthapit, Taleju Prakashan, Kathmandu, 2005.

Referencebooks for Practical:

2. Elementary Qualitative Analysis – Moti Kaji Sthapit and Chitta Bahadur Tuladhar, Taleju Prakashan, Kathmandu, 2005.
3. A Hand Book of Practical Chemistry – P.M. Singh and K.K. Baidya.

Teaching Instructions : The following will be the teaching instructions regarding the prescribed course contents of all above course units:

Lecture, Demonstration, Discussion, Experiments, Question-answer, Observation, Problem solving, Project Work, Inquiry and Field trip method

Teaching/Instructional Materials: Teaching materials could be either of the following or in combination or more than the mentioned ones for all above course units.

Visual aids, Chart, Black board / White board, Pictures, Models, LCD, Power point, OHP, Laboratory equipments, Chemicals

Evaluation Scheme

Out of the total coverage Theory portion will cover 75% and rest 25% will be covered by practical.

In theory portion Questions will be of three groups

Long questions each carrying 10 marks 2 to be attempted out of 4 choices.	20
Short questions each carrying 5 marks 5 to be attempted out of 7 choices.	25
Very short questions each carrying 2 marks 15 to be attempted out of 20 choices.	<u>30</u>
Total	75

Theory 75

Unit	Course	Very short (2)*15		Short (5)*5		Long (10)*2	
		To be attempted	Choices	To be attempted	Choices	To be attempted	Choices
I	Language of chemistry	15	1	5	1	2	1
II	State of matter		3				
III	Atomic structure and valency		2				
IV	Periodic classification and chemical equilibrium		1		2		
V	Acids, bases and salts and oxidation and reduction		2				
VI	Equivalent weight, acidimetry and alkalimetry		1				
VII	Chemistry of non-metals		2		2		
VIII	Chemistry of metals		2				
IX	Carbon and its compounds		4		1		
X	Use of chemistry in daily life		2		1		
	Total	15	20	5	7	2	4

Practical Marks

1. Experiment (Theory 2, Obs. 4, Results 4)-	10
2. Activity (School Curriculum) improvisation, item preparation-	8
3. Oral /Viva –	3
4. Note book –	<u>4</u>
	25

Chemistry Education
Grade XII
(Sample Model Question)

F.M. — 75

P.M. — 27

Time — 3 hrs

Candidates are required to give their answers in their own words as far as practicable.

Group A

Very short answer questions

Answer any fifteen questions only

(2×15=30)

1. State Avogadro's Hypothesis.
2. Write the resonating structures of ozone.
3. Why do the electrons of an atom not jump in to the nucleus ?
4. Name two important ores of iron and write down their formulae.
5. What are condensation polymers ? Give an example of such polymer.
6. Define normality. How is it related with molarity ?
7. Give the reactions of ammonia with: (a) copper sulphate and (b) chlorine.
8. Name two carbonates that do not give carbon dioxide upon heating.
9. Give the name of the halogen which exist at solid state at room temperature.
10. Why sodium chloride is not a good conductor of electricity in solid state but conducts electricity in molten state ?
11. Why does iron get rusted ?
12. What will be the pH of 0.02M HCl ?
13. Show that water can act both as a lewis acid as well as a lewis base.
14. What is an antipyretic drug ? Give the structure of an antipyretic drug.
15. Why are the noble gases chemically inactive ?
16. Between a ketone and an aldehyde which is more active and why ?
17. What is Tollen's reagent ? What is its use ?
18. Define rate constant of a chemical reaction. What do you understand by the term order of a reaction ?

19. Write the names and structures of (a) picric acid (b) formaline.
20. Give the IUPAC name of $(\text{CH}_3)_2\text{-CH-CH}_3$.

Group B

short answer questions

Attempt any five only

5×5=25

21. How does Bohr's theory explain the existence of line spectra of hydrogen atom ?
22. How will you prepare sulphureted hydrogen in the laboratory ? Draw a neat labeled diagram and write the reaction involved.
23. How can ethyne be prepared in the laboratory ? How will you show that ethyne is an unsaturated compound ?
24. Write notes on (a) Markonikov's Rule and (b) Carbylamine reactions.
25. What volume of 0.25N sulphuric acid will be required to neutralize 25 ml of 2%(W/v) Sodium hydroxide ?
26. State and explain the Faraday's Laws of electrolysis.
27. Give the chemistry of green vitrol.
28. Give the advantages and disadvantages of using chemical fertilizers.

Group C

Long questions

Attempt any two

10×2=20

29. Explain the Down's process for extraction of sodium. What happens when sodium is heated in the atmosphere of carbon dioxide ?
30. Explain how aniline is prepared in the laboratory ? Give reactions of aniline with (a) acetic anhydride and (b) sodium nitrite and hydrochloric acid.
31. State and explain the law of reciprocal proportion. Marsh gas is found to contain 75% carbon and 25% hydrogen, carbon monoxide is found to contain 42.86% carbon and 57.14% oxygen and water is found to contain 11.11% hydrogen and 88.89% oxygen. Illustrate the law using these data.
32. Write note on: (a) Kinetic theory of gases and (b) Le Chatelier's principle.