Std. XI Sci.

Perfect Chemistry - I

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Perfect Chemistry - I

Salient Features :

- Exhaustive coverage of syllabus in Question Answer Format.
- Covers answers to all Textual, Intext and NCERT Questions.
- Simple and Lucid language.
- Neat, Labelled and authentic diagrams.
- Quick review for instant revision and summary of the chapter.
- Solved & Practice Numericals duly classified.
- Multiple Choice Questions for effective preparation.

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PREFACE

In the case of good books, the point is not how many of them you can get through, but rather how many can get through to you.

"Std. XI Sci. : PERFECT CHEMISTRY - I" is a complete and thorough guide critically analysed and extensively drafted to boost the students confidence. The book is prepared as per the Maharashtra State board syllabus and provides answers to all **textual and intext questions**. Sub-topic wise classified 'question and answer format' of this book helps the student to understand each and every concept thoroughly. Neatly labelled diagrams have been provided wherever required.

National Council Of Educational Research And Training (NCERT) questions and problems based on Maharashtra board syllabus have been provided along with solutions for a better grasp of the concept and preparing the students on a competitive level.

Additional information about a concept is provided in the form of **Note**. Definitions, statements and laws are specified with italic representation. Formulae are provided in chapters which involve numericals to help the students to tackle difficult problems. Solved problems are provided to understand the application of different concepts and formulae. **Quick Review** has been provided which gives an overview of the chapters. **Additional theory questions** have been provided to help the student gain insight on the various levels of theory-based questions.

Practice problems and **multiple choice questions** help the students to test their range of preparation and the amount of knowledge of each topic.

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

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A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

Yours faithfully

Publisher

Contents

'Chapters 9 to 17 are a part of Std. XI Chemistry -II'

Note: All the Textual questions are represented by * mark
All the Intext questions are represented by # mark

01 SOME BASIC CONCEPTS OF CHEMISTRY

1.0 Prominent scientists

Scientists		Contributions
Joseph Louis Gay-Lussac (1778 – 1850) (French chemist and physicist)	i. ii. iii.	Formulated the gas law. Collected samples of air at different heights and recorded temperatures and moisture contents. Discovered that the composition of atmosphere does not change with increasing altitude.
Amedeo Avogadro (1776 – 1856) (Italian scholar)	i. ii.	Published article in French journal on determining the relative masses of elementary particles of bodies and proportions by which they enter combinations. Published a research paper titled "New considerations on the theory of proportions and on determination of the masses of atoms."

Note:

In order to give a tribute to Avogadro's contributions related to molecular theory, the number of elementary entities (atoms, molecules, ions or other particles) in 1 mole of a substance, 6.022×10^{23} is known as Avogadro number.

1.1 Introduction

Q.1. Chemistry has played an important role in the fulfillment of basic needs of man. Explain.

Ans: Increasing population has led to an increase in the demands of basic needs of man (food, clothing and shelter). Developments in the field of chemistry have helped to cope up with these necessities as follows:

i. Food:

a. The population of a country requires nutritious and hygienic food in sufficient quantity. To achieve the same, there is a need to manufacture good quality fertilizers and insecticides.

b. The advancement of chemistry has helped many countries to become not only self sufficient but also an exporter of food commodities.

ii. Clothing:

a. Good quality clothes are required for every individual to adjust with changing environmental conditions.

b. Because of the production of synthetic fibres like nylon, rayon, etc. in factories, this need has been fulfilled.

iii. Shelter:

a. The human population needs comfortable and well-built houses. Iron, cement and steel are required in large quantities for construction of such houses.

b. Chemistry has played an important role in the extraction of these metals from their respective ores.

Q.2. Define chemistry.

Ans: ***Chemistry*** *is defined as the study of the composition, structure and properties of matter and the reactions by which one form of matter may be converted into another form.*

Q.3. Give reason : Chemistry is called as a central science.

Ans: i. Chemistry is an active evolving science and is of vital importance to the entire world. Although the subject has very ancient roots, it is a modern science.

ii. The basic knowledge of chemistry is essential for development of subjects like physics, biology, geology, engineering, environmental science and many others.

Therefore, it is called as a central science.

Q.4. What are the various branches of chemistry?

Ans: The several branches of chemistry are as follows:

i. Physical chemistry:
It is the branch of chemistry that deals with the structure of matter, the energy changes and the theories, laws and principles that explain the transformation of matter from one form to another.

ii. Inorganic chemistry:
It is the branch of chemistry that deals with chemistry of elements other than carbon and their compounds.

iii. Organic chemistry:
This branch of chemistry deals with reactions of the compounds of carbon.

iv. Analytical chemistry:
This is the branch of chemistry which deals with the separation, identification and quantitative determination of the compositions of different substances.

v. Biochemistry:
This is the branch of chemistry that deals with substances which are constituents of living organisms.

Note:

Pharmaceutical, environmental and nuclear chemistry are also branches of chemistry.

1.2 Importance and scope of chemistry

Q.5. Explain the importance and scope of chemistry.

Ans: Chemistry has a wide scope and importance in various fields.

i. Processes based on chemical technology help to extract, purify, synthesize and analyse materials like iron, steel, aluminium, zinc, alloys like brass, amalgams as well as precious metals like silver, gold, platinum.

ii. All drugs are synthesized in chemical / pharmaceutical laboratories.

eg.

	Drugs	Treatment of diseases
i	L-dopa	For treatment of Parkinson's disease.
ii	Human insulin	For treatment of diabetes.
iii	Cisplatin and taxol	Life saving drugs to give relief to cancer patients.
iv	Azidothymidine (AZT)	For treatment of AIDS.
v	Tamiflue	For treatment of swine flu.

iii. Photosynthesis is the process through which trees and plants prepare their food using chlorophyll (green pigment) in presence of sunlight. The process is a simple chemical reaction and takes place naturally.

$$CO_2 + H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} \text{food grains/fruits/flowers/cotton/medicine etc.}$$

iv. Fossil fuels like coal, petroleum, natural gas, etc. are combustible chemicals which are used to produce energy which is used to drive trains, trucks, buses and all automobiles. The energy is also used to generate electricity. Several electrochemical cells like Daniel cell, lead storage cell, dry cell, nickel cadmium cell, lithium ion cell, fuel cell, etc., are used as a source of energy. These cells are less polluting and more efficient. There are attempts being made to convert solar energy into electrical energy using photovoltaic cells, the solar cells. Attempt is also made to obtain hydrogen from water, which is used in fuel cells to generate electricity.

v. With the help of chemistry it is easy to design and generate large number of materials like polymers, plastic, liquid crystals, adhesives and surface coating materials like latex paints. Knowledge of chemistry can also be used to synthesize new materials that can act as super conductors at or near room temperature due to which loss of electricity will get reduced by almost 20%. Microprocessors used in computers are silicon chips formulated and developed by chemists.

#Q.6.Give five applications of subject chemistry which are not mentioned in the book.

Ans: i. Warfare:

With the knowledge of chemistry, various destructive gases and bombs have been invented which are used during wars.

ii. Cosmetics:

Chemistry has helped to produce good quality cosmetics.

iii. Health:

Chemistry plays an important role in maintaining one's good health by providing knowledge about proper intake of proteins, carbohydrates, fats, minerals, vitamins, etc.

iv. Education:

Chemistry provides inter-relationship to study the para-chemistry subjects such as Bio-chemistry, Pharmacy, Herbal Science, Toxicology, Archaeology, Environmental Science, etc.

v. In recent years, chemistry has given us new materials such as super–conducting ceramics, conducting polymers, optical fibres, micro alloys, carbon fibres, etc. which are used for various purposes.

1.3 Historical approach to particulate nature of matter

Q.7. Define matter.

Ans: ***Matter*** *is anything which has mass and occupies space.*

Q.8. Explain the classification of matter on the basis of its chemical composition.

Ans: Matter on the basis of chemical composition can be classified as follows:

i. Pure substances:

Substances which always have a fixed composition are called pure substances.

They are of two types:

a. Elements:

Elements are the pure substances which are made up of only one component.

eg. Gold, silver, copper, mercury, bromine, oxygen etc.

b. Compounds:

Compounds are the pure substances which are made up of two or more components.

eg. Water, ammonia, methane etc.

ii. Mixtures:

A mixture is a simple combination of two or more substances in which the constituent substances retain their separate identities.

The composition of mixture can be varied to any extent. Therefore, mixtures do not have fixed composition.

eg. Mixture of ethyl alcohol and water, salt in water, mixture of gases, etc.

Mixtures are of two types:

a. Homogeneous mixture:

A mixture in which the concentration of the constituents remains uniform throughout the mixture and all the constituents are present in one phase, is called a homogeneous mixture.

eg. Mixture of salt and water.

b. Heterogeneous mixture:

If two or more phases are present in a mixture, it is called a heterogeneous mixture.

eg. Phenol - water system, silver chloride-water system, iron fillings-sand system, etc.

Q.9. What is Phlogiston theory?

Ans: Phlogiston theory:

i. According to this theory, a combustible substance contains phlogiston (a mysterious matter) and some clax. During combustion, phlogiston evolves and is lost in the atmosphere. Clax remains in the form of an ash.

ii. Combustion reactions were explained by phlogiston theory.

eg. During the combustion of a candle in a closed container, the air inside the container is saturated with phlogiston. Since air cannot accommodate more phlogiston, the candle gets extinguished.

Q.10. What is "dephlogisticated air"? Who named it?

Ans: i. Joseph Priestley (a British scientist) focussed sunrays on a substance (mercuric oxide) to heat it.

ii. A gas evolved, in which substances could burn more vigorously than in air.

iii. A burning candle became brighter in this gas.

iv. Priestley was of the view that this gas is the normal air without phlogiston. Hence he named it "*dephlogisticated air*".

Q.11. What was the contribution of Sir Henry Cavendish in the phlogiston theory?

Ans: i. Sir Henry Cavendish carried out the reaction of a dilute acid with metals such as zinc, iron, etc. He named the gas evolved as "flammable air". It was found that this gas burnt in air and in dephlogisticated air and produced water.

ii. Cavendish suggested that flammable air is water associated with phlogiston. This is in continuation with the idea of phlogiston.

Q.12. Who ruled out the theory of phlogiston? Why?

Ans: i. The theory of phlogiston was ruled out by Antoine Lavoisier (a French Scientist).

ii. He proved that a part of air is used in chemical reaction during combustion. This part of air was called oxygen. It means 'acid forming'.

iii. He also proved that oxygen was the gas formed in Joseph Priestley's experiment.

iv. He also proved that the flammable air produced by Cavendish was a new gas, which he named as hydrogen, meaning 'water forming'.

Q.13. Define and explain the following with the help of examples.

i. Elements **ii. Compounds**

Ans: i. Elements:

a. *An element is defined as a substance which cannot be separated into simpler substances by any chemical process.*

eg. Gold, silver, copper, carbon, etc.

b. Out of 118 elements that have been identified till recently, most are naturally occuring and a few are prepared in the laboratory (man-made).

c. Chemists use one or two letter symbols to represent elements.

d. All the chemical symbols have first letter capital and second letter small (if present).

e. The symbols of the elements are derived either from English names or from Latin names of the elements.

eg. Aluminium – Al , Einsteinium – Es, Gold – Au (Aurum)

f. Elements contain only one type of atom. Elements are further classified as metals, non-metals, metalloids.

ii. Compounds:

a. *Compounds are defined as substances of definite compositions which can be decomposed into two or more substances by a simple chemical process.*

eg. Water, sodium chloride, sugar, alcohol, etc.

b. The properties of compounds differ from the properties of the substances and elements obtained from decomposition of the compounds.

eg. Hydrogen and oxygen are obtained from decomposition of water. Water can be used to extinguish fire whereas oxygen supports combustion and hydrogen is combustible.

c. Compounds are classified into two subclasses organic compounds and inorganic compounds.

d. Compounds contain two or more components.

Note:

Names and symbols of some elements

Element	Sym-bol	Element	Sym-bol	Element	Sym-bol	Element	Sym-bol	Element	Sym-bol
Aluminium	Al	Cadmium	Cd	Mercury	Hg	Neobium	Nb	Rhodium	Rh
Argon	Ar	Caesium	Cs	Holmium	Ho	Neodymium	Nd	Rhenium	Re
Silver	Ag	Cerium	Ce	Iodine	I	Neptunium	Np	Sulphur	S
Gold	Au	Curium	Cm	Irridium	Ir	Oxygen	O	Scandium	Sc
Actinium	Ac	Calefornium	Cf	Krypton	Kr	Osmium	Os	Selenium	Se
Americium	Am	Erbium	Er	Lithium	Li	Potassium	K	Strontium	Sr
Beryllium	Be	Einsteinium	Es	Lanthanum	La	Phosphorous	P	Sodium	Na
Boron	B	Fluorine	F	Lutetium	Lu	Lead	Pb	Technicium	Tc
Barium	Ba	Francium	Fr	Lawrencium	Lr	Palladium	Pd	Uranium	U
Bismuth	Bi	Iron	Fe	Magnesium	Mg	Platinum	Pt	Tungston	W
Carbon	C	Galium	Ga	Manganese	Mn	Promethium	Pm	Vanadium	V
Chlorine	Cl	Germanium	Ge	Molybdenum	Mo	Protoactinium	Pa	Xenon	Xe
Calcium	Ca	Gadolinium	Gd	Mendelivium	Md	Plutonium	Pu	Ytterbium	Yb
Chromium	Cr	Hydrogen	H	Nitrogen	N	Radium	Ra	Zirconium	Zr
Cobalt	Co	Helium	He	Neon	Ne	Rubidium	Rb		
Copper	Cu	Hafnium	Hf	Nickel	Ni	Ruthenium	Rn		

Q.14. Classify the following substances into elements, compounds, homogeneous mixtures and heterogeneous mixtures.
Sand in water, Sodium chloride, Nitrogen, Sodium chloride in water, Pumice stone, Air, Phenol-water system, Carbon dioxide, Gold

Ans: i. Sand in water : Heterogeneous mixture
ii. Sodium chloride : Compound
iii. Nitrogen : Element
iv. Sodium chloride in water : Homogeneous mixture
v. Pumice stone : Heterogeneous mixture
vi. Air : Homogeneous mixture
vii. Phenol-water system : Heterogeneous mixture
viii. Carbon dioxide : Compound
ix. Gold : Element

Q.15. Distinguish between
i. Mixtures and compounds. ii. Compounds and elements.

Ans: i. Mixtures and compounds:

	Mixtures	Compounds
i.	The constituents of a mixture may be present in any ratio.	The constituents of a compound are always present in a fixed ratio.
ii.	Mixtures may or may not be homogeneous in nature.	Compounds are always homogeneous in nature.
iii.	The properties of a mixture are in between those of its constituents.	The properties of a compound are entirely different from those of its constituent elements.
iv.	The constituents of a mixture can be easily separated by simple physical means.	The constituents of a compound cannot be easily separated by simple physical means but can be separated by chemical processes.
v.	The melting and boiling points of mixtures are usually not sharp.	Chemical compounds possess sharp melting and boiling points.

ii. Compounds and elements:

	Compounds	Elements
i.	A compound is a substance composed of two or more different chemical elements.	An element is a pure chemical substance made of same type of atoms.
ii.	A compound can be separated into simpler substances by chemical reactions.	Elements cannot be broken down into simpler substances.
iii.	Compounds contain different elements in a fixed ratio arranged in a defined manner through chemical bonds.	Elements are distinguished by their atomic number (number of protons in their nucleus).
iv.	A compound is represented using a formula.	An element is represented using symbols.
v.	The list of compounds is endless but can broadly be classified as ionic and covalent.	There are about 118 elements that have been identified and can be classified as metals, non-metals or metalloids.
	eg. Sodium chloride (NaCl), Sodium bicarbonate ($NaHCO_3$), etc.	**eg.** Iron, copper, silver, gold, etc.

Q.16. Define a unit.

Ans: *The arbitrarily decided and universally accepted standards used in the measurement of physical quantities are called **units**.*

eg. meter (m), kilogram (kg).

Q.17. State the need of units.

Ans: i. In chemistry, several experiments are carried out which involve observation and collection of both qualitative and quantitative data.

ii. Measurement of physical properties such as mass, length, volume, temperature, pressure, time, etc., comprise of the quantitative data.

iii. For this purpose, the magnitude or size of physical quantity is compared with a suitable standard. These units are arbitrarily chosen on the basis of universally accepted standards.

iv. To express any measured property, a number and an appropriate unit has to be used. Only number does not give any idea about the property.

Q.18. What are the various systems in which units are expressed?

Ans: Units are expressed in various systems like CGS (centimetre for length, gram for mass and second for time), FPS (foot, pound, second) and MKS (metre, kilogram, second) systems, etc.

Note:

i. During calculations, confinement to one single system of unit is advisable.

ii. NASA's Mars climate orbiter (first weather satellite for mars) was destroyed due to heat. The mission failed as there was a confusion while estimating the distance between earth and mars in miles and kilometers.

Q.19. What are SI units? Name the fundamental SI units.

Ans: SI Units:

In 1960, the general conference of weights and measures proposed revised metric system, called International system of Units i.e. SI system abbreviated from its French name Systeme Internationale d′ Units.

The seven fundamental SI units are as given below:

No.	Fundamental quantity	SI unit	Symbol
i.	Length	Metre	m
ii.	Mass	Kilogram	kg
iii.	Time	Second	s
iv.	Temperature	Kelvin	K
v.	Amount of substance	Mole	mol
vi.	Electric current	Ampere	A
vii.	Luminous intensity	Candela	cd