SAMPLE CONTENT

# PERFECT CHEMISTRY Vol. II

## Std. XII Sci.

As per the new textbook prescribed by Maharashtra State Board

**Optical isomers:**
The horns of African gazelle show chirality and are mirror images of each other!

Target Publications® Pvt. Ltd.

**Written as per the latest textbook prescribed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune.**

PERFECT

# CHEMISTRY (Vol. II)

## Std. XII Sci.

### Salient Features

- Written as per the new textbook
- Subtopic-wise segregation for powerful concept building
- Complete coverage of Textual Exercise Questions and Intext Questions
- Extensive coverage of New Type of Questions
- 'Apply Your Knowledge' section for application of concepts
- 'Quick Review' at the end of every chapter facilitates quick revision
- 'Competitive Corner' presents questions from prominent competitive examinations
- Reading Between the Lines, Enrich Your Knowledge, Gyan Guru, Connections, NCERT Corner are designed to impart holistic education
- Topic Test at the end of each chapter for self-assessment
- Video/pdf links provided via QR codes for boosting conceptual retention

Printed at: **India Printing Works,** Mumbai



Balbharati Registration No.: 2018MH0022

TEID:1400

P.O. No. 00694

# PREFACE

**Perfect Chemistry Std. XII, Vol. II** is intended for every Maharashtra State Board aspirant of Std. XII, Science. The scope, sequence, and level of the book are designed to match the new textbook issued by the Maharashtra State board.

At this crucial juncture in their lives, when the students are grappling with the pressures of cracking a career-defining board examination, we wanted to create a book that not only develops the necessary knowledge, tools, and skills required to excel in the examination, but also enables students to appreciate the beauty of the subject and piques their curiosity.

We believe that students respond favourably to meaningful content, if it is presented in a way that is easy to read and understand, rather than being mired down with facts and information. Consequently, we have always placed the highest priority on writing clear and lucid explanations of fundamental concepts. Moreover, special care has been taken to ensure that the topics are presented in a logical order. The coherent Question/Answer approach helps students expand their horizon of understanding of the concepts.

The primary purpose of this book is to assist the students in preparing for the board examination. However, this is closely linked to other goals: to exemplify how important and how incredibly interesting chemistry is and to help the student become an expert thinker and problem solver.

The scope of the book extends beyond the State Board examination as it also offers a plethora of Multiple Choice Questions (MCQs) in order to familiarize the students with the pattern of competitive examinations.

In addition, the chapter-test have been carefully crafted to focus on concepts, thus providing the students with a quick opportunity for self-assessment and giving them an increased appreciation of chapter-preparedness.

We believe that the study of chemistry helps in the understanding of many fascinating and important phenomena. In this vein, we have put an effort to relate chemistry to real-world events in order to show students that chemistry is a vibrant, constantly evolving science that has relevance in our modern world. We hope this book becomes a valuable tool for you and helps you to not only understand the concepts of chemistry but also to see the world from a molecular point of view.

*Our **Perfect Chemistry Std. XII, Vol. II** adheres to our vision and achieves several goals: **building concepts, recapitulation, self-study, self-assessment** and **student engagement**—all while encouraging students toward cognitive thinking.*

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.
Please write to us on: mail@targetpublications

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

*Best of luck to all the aspirants!*

From,
Publisher

**Edition:** First

# FEATURES

## Sub-topic wise Segregation

Every chapter is segregated sub-topic wise. A subtopic encompasses textual content in the format of Question-Answers. *Textual Exercise questions, Intext questions, 'Can you recall', 'Can you recall', 'Try this', 'Observe and Discuss', 'Use your brain power'* and *'Activity'* are placed aptly amongst various additional questions in accordance with the flow of subtopic.

*This is our attempt to enable easy assimilation of concept and lay strong foundation for understanding as well as writing answers in exam.*

**15.2 Classification of polymers**

**Q.6. What are the different ways of classification of polymers?**

**Ans: Polymers are classified in a number of ways as mentioned below:**

i. Classification based on source
ii. Classification based on chemical structure of polymers
iii. Classification based on mode of polymerization
iv. Classification based on molecular forces
v. Classification based on type of monomers
vi. Classification based on biodegradability

## Reading between the lines

**Reading between the lines** provides elaboration of missing fragments of concept which is essential for complete understanding of the concept.

*This is our attempt to help students to understand the underlying concept behind an answer.*

**Reading between the lines**

*Both these compounds contain same alkyl groups.*

*i. When dissolved in water, 'H' atom of –OH group of alcohol forms intermolecular 'H' bonding with 'O' atom of water.*

*ii. Similarly, when amine is dissolved in water, 'H' atoms of $–NH_2$ group of amine forms intermolecular 'H' bonding with 'O' atom of water. Hence, both these compounds are soluble in water.*

*iii. But 'O' atom is more electronegative than 'N' atom. Therefore, N–H bonds in amines are less polar than O–H bond in alcohols. As a result, alcohol forms stronger H-bonds with water as compared to amines. Hence, alcohols are more soluble in water than amine.*

## NCERT Corner

### DNA Fingerprinting:

i. It is known that every individual has unique fingerprints. These occur at the tips of the fingers and have been used for identification for a long time but these can be altered by surgery.

ii. A sequence of bases on DNA is also unique for a person and information regarding this is called DNA fingerprinting. It is same for every cell and cannot be altered by any known treatment.

iii. DNA fingerprinting is now used
   a. in forensic laboratories for identification of criminals.
   b. to determine paternity of an individual.
   c. to identify the dead bodies in any accident by comparing the DNA's of parents or children.
   d. to identify racial groups to rewrite biological evolution.

### NCERT Corner

**NCERT Corner** covers information from NCERT textbook relevant to topic.
*This is our attempt to bridge the gap between NCERT curriculum and State board textbook, thereby benefitting students in their preparation of National level competitive examinations.*

### Connections

**Connections** enable students to interlink concepts covered in different chapters.
*This is our attempt to encourage students to appreciate the subject as a whole.*

### Connections

*In chapter 10: Halogen Derivatives, you studied in details about the reactions of alcohols with hydrogen halides and phosphorous halides.*

### QR Code

**QR code** provides access to a video/pdf in order to boost understanding of a concept or activity.
*This is our attempt to facilitate learning with visual aids.*

***[Note:** Students can scan the adjacent QR code to view three-dimensional models of 2-chlorobutane and its mirror image.]*

## Enrich Your Knowledge

**Enrich Your Knowledge** presents fascinating information about the concept covered.
*This is our attempt to create interest in the students about the concept.*

### Enrich Your Knowledge

A large number of applications of polymers depend upon their mechanical properties such as tensile strength, elasticity, toughness etc. These mechanical properties depend upon intermolecular forces like van der Waals forces, hydrogen bonds and dipole-dipole interaction existing in the macromolecules. Depending upon intermolecular forces, the polymers are classified into four groups:

i. Elastomers
ii. Fibres
iii. Thermoplastic polymers
iv. Thermosetting polymers

### *GG - Gyan Guru*

***Dimethyl ether: Promising fuel!***

*Dimethyl ether is the promising alternative fuel for the future. It is a liquid fuel and can be compressed to large volume in the engine.*

*The advantages of dimethyl ether over conventional fuel include decrease in emission of pollutants and hazardous substances. Its production and transportation is relatively easier which makes it cost effective.*

## GG - Gyan Guru

**Gyan Guru** illustrates real life applications or examples related to the concept discussed.
*This is our attempt to link learning to the life.*

## Apply Your Knowledge

**Apply Your Knowledge** includes challenging questions.
*This is our attempt to take students one step further and challenge their conceptual understanding.*

### Apply Your Knowledge

**Q.112. Drugs for diseases are available in various forms in the market. Those drugs which are encapsulated should be bio-compatible, affordable and non-toxic for administration and also for disposal. Encapsulation (made up of a polymer) should also allow controlled release of drugs to their specific site and should be degraded to their monomers in human body. At the same time, the polymer should be bio-degradable so that it can be used as an alternative to non-biodegradable polymer.**

**Now as a student of chemistry, answer the following questions.**

**i. Which polymers, do you think, can be used for controlled release of a drug?**

**ii. Write the reaction involved in the preparation of any one biodegradable polymer.**

**Ans:**

i. PHBV, nylon 2-nylon 6, etc. are some of the biodegradable polymers which can be used for controlled release of a drug.

ii. *Refer Q.105 or Q.106.*

## Quick Review

➢ **Classification of amines:**

**Classification of amines**

- **Aliphatic amines**
- **Aromatic amines**

### Quick Review

**Quick review** includes tables/ flow chart to summarize the key points in chapter.
*This is our attempt to help students to reinforce key concepts.*

## Exercise

**12.1 Introduction**

1. Carboxylic acids are distinct from aldehydes and ketones. Why?

**Ans:** *Refer Q.3. (ii)*

**12.2 Classification of aldehydes, ketones and carboxylic acids**

2. Give two examples of following:

i. Aliphatic aldehydes

ii. Aromatic aldehydes

**Ans:** *Refer Q.5.*

### Exercise

**Exercise** includes subtopic-wise additional questions and problems.
*This is our attempt to provide additional practice to students to gauge their preparation.*

## Multiple Choice Questions

*27. The best method for preparation of alkyl fluorides is _____.

(A) Finkelstein reaction

(B) Swartz reaction

(C) Free radical fluorination

(D) Sandmeyer's reaction

### Multiple Choice Questions

**Multiple Choice Question** includes textual as well as additional MCQs.
*This is our attempt to give students practice of MCQs and prepare them thoroughly for board examination.*

## Competitive Corner

**Competitive Corner** presents latest questions from prominent [NEET (UG), JEE (Main), NEET (ODISHA), MHT CET] competitive exams based entirely on the syllabus covered in the chapter.
*This is our attempt to introduce students to MCQs asked in competitive exams.*

## Competitive Corner

4. In the following compounds, the decreasing order of basic strength will be _____.
**[JEE (Main) 201 ]**
(A) $(C_2H_5)_2NH > NH_3 > C_2H_5NH_2$
**(B) $(C_2H_5)_2NH > C_2H_5NH_2 > NH_3$**
(C) $C_2H_5NH_2 > NH_3 > (C_2H_5)_2NH$
(D) $NH_3 > C_2H_5NH_2 > (C_2H_5)_2NH$

**Hint:** In alkylamines, +I effect of alkyl groups increases the electron density on nitrogen atom. This increases the ease with which lone pair of electrons can be donated. Hence, ammonia will be least basic and $(C_2H_5)_2NH$ will be most basic.

## Topic Test

**Topic Test** covers questions from chapter for self-evaluation purpose.
*This is our attempt to provide the students with revision and help them assess their knowledge of chapter.*

**Time: 1 Hour 30 Min** | **TOPIC TEST** | **Total Marks: 25**

**SECTION A**

**Q.1. Select and write the correct answer: [04]**

i. _____ is a reinforced material that is used in tyres of cars to increase the life of tyre.
(A) Carbon black
(B) Gold
(C) Graphite
(D) Fumed silica

# CONTENTS



**[Reference:** Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04**]**

**Note:** 1. * mark represents Textual question.

2. # mark represents Intext question.

3. + mark represents Textual examples.

4. ☲ symbol represents textual questions that need external reference for an answer.

# 16 Green Chemistry and Nanochemistry

**Contents and Concepts**



## 16.1 Introduction

**Q.1. Can you recall?** *(Textbook page no. 340)*

**i. What do you mean by environment?**

**Ans:** The physical, chemical and biological factors which influence an organism collectively is called as environment.

**ii. Which are the factors affecting the environment?**

**Ans:**

a. The factors affecting the environment are natural and artificial factors.

b. Natural factors such as earthquakes, volcanoes, droughts, etc., can adversely affect the environment.

c. Also, artificial or man-made factors like environmental pollution caused due to population explosion, fast industrialization, and indiscriminate use of natural resources, deforestation and unplanned urbanization can harm the environment.

d. Biotic and abiotic factors are related to each other in an ecosystem, and if any of the factors is changed or removed, it can affect the entire ecosystem.

**Reading between the lines**

*i. Biotic factors include producers, consumers and decomposers.*

*ii. Abiotic factors are non-living components i.e. water, sunlight, temperature, oxygen, soil, pH, etc.*

*iii. Changes in biotic and abiotic factors can have drastic effects on the environment. For example, if plants (producers) in an ecosystem do not receive adequate sunlight, they eventually will die, thereby disturbing the entire food chain. Due to lack of availability of food even the consumers will die. This ultimately creates an imbalance in the environment as consumers rely on producers for their food.*

**iii. What is pollution? Which are the types of pollution?**

**Ans:**

a. *Unnecessary and unacceptable changes in the environment due to natural events or human activities is known as* ***pollution****.*

OR

*Direct or indirect changes in physical, chemical and biological properties of air, water and soil that are harmful to humans and other living beings is called as* ***pollution****.*

b. There are three main types of pollution: Air pollution, water pollution and soil pollution.

**iv. Why it occurs?**

**Ans: Following are the components and causes of different types of pollution:**

| | Air pollution | Water pollution | Soil pollution |
|---|---|---|---|
| **Components** | Gases: $CO_2$, CO, Hydrocarbons, sulfur, $NO_x$, hydrogen sulphides, etc. Solid: dust, ash, carbon, lead, asbestos, etc. | Oil and derivatives; carbonic compounds; heavy metals like mercury, lead, cadmium, etc., silt and sediments; pathogens. | Organic chemicals, pesticides, radioactive materials, oils and tar. |
| **Causes** | Emissions released from chemical industries, automobiles, burning of garbage, burning of fuels like coal, petroleum, etc. | Releases of industrial wastes, domestic waste, sewage, chemicals discharged from industries, into water bodies. Pesticides used in agriculture also reach water bodies. | Emissions released from chemical industries, mining, biomedical wastes; Excessive uses of pesticides and fertilizers; dumping of domestic waste, etc. |

***Q.2. Define green chemistry.**

**Ans:** ***Green chemistry*** *is the use of chemistry for pollution prevention by environmentally conscious design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances.*

**Q.3. What is green chemistry? Explain its importance.**

**Ans:**

i. Green Chemistry is an approach to chemistry that aims to maximize efficiency and minimize hazardous effects on human health and environment.

ii. The concept of green chemistry was coined by **Paul T. Anastas**.

iii. ***Green chemistry*** *is the use of chemistry for pollution prevention by environmentally conscious design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances.*

iv. Due to increase in human population and the industrial revolution, energy crisis and environmental pollution are highlighted major global problems in the 21st century. To reduce the impact of energy crisis, pollution and to save natural resources, we need to implement 12 principles of green chemistry enunciated by Paul Anastas wherever possible.

**Enrich Your Knowledge**

Paul T. Anastas (Born on March 10, 1962) is the director of Yale university's Center for green chemistry and green engineering. He is known as father of green chemistry.

## 16.2 Sustainable development

***Q.4. Define 'sustainable development'.**

**Ans:** ***Sustainable development*** *is development that meets the needs of the present, without compromising the ability of future generations to meet their own need.*

**Q.5. How can we achieve sustainable development?**

**Ans:** We can achieve sustainable development by adapting the twelve principles of green chemistry.

## 16.3 Principles of green chemistry

**Q. List the 12 principles of green chemistry.**

**Ans: The 12 principles of green chemistry are as follows:**

i. Prevention of waste or by products
ii. Atom economy
iii. Less hazardous chemical synthesis
iv. Designing safer chemicals
v. Use of safer solvent and auxiliaries
vi. Design for energy efficiency
vii. Use of renewable feed stocks
viii. Reduce derivatives (Minimization of steps)
ix. Use of catalysis
x. Design for degradation
xi. Real-time analysis pollution prevention
xii. Safer chemistry for accident prevention

**Q.7. With the help of suitable examples explain in detail all the 12 principles of Green Chemistry.**

**Ans:** The sustainable development can be achieved by adapting following 12 Principles of Green Chemistry:

**i. Prevention of waste or by products:** According to this principle of green chemistry, priority is given for the prevention of waste rather than cleaning up and treating waste after it has been generated.

**Illustration:** To develop zero waste technology (ZWT).

As per ZWT, in a chemical synthesis, waste product should be zero or minimum.

It also aims to use the waste product of one system as the raw material for other system.

For example:

a. Bottom ash of thermal power station can be used as a raw material for cement and brick industry.

b. Effluent coming out from cleansing of machinery parts may be used as coolant water in thermal power station.

**ii. Atom economy:**

**a.** ***Atom economy*** *is a measure of the amount of atoms from the starting materials that are present in the useful products at the end of the chemical process.*

b. Good atom economy means most of the atoms of the reactants are incorporated in the desired products and only small amounts of unwanted by-products are formed and hence lesser problem of waste disposal.

**Illustration:** The concept of atom economy gives the measure of the unwanted product produced in a particular reaction.

$$\% \text{ atom economy} = \frac{\text{Formula weight of the desired product}}{\text{Sum of formula weight of all the reactants used in the reaction}} \times 100$$

For example: Conversion of Butan-1-ol to 1-bromobutane

$$CH_3CH_2CH_2CH_2OH + NaBr + H_2SO_4 \longrightarrow CH_3CH_2CH_2CH_2Br + NaHSO_4 + H_2O$$

$$\% \text{ atom economy} = \frac{\text{mass of } (4C + 9H + 1Br) \text{ atoms}}{\text{mass of } (4C + 12H + 5O + 1Br + 1Na + 1S) \text{ atoms}} \times 100$$

$$= \frac{137 \text{ u}}{275 \text{ u}} \times 100 = 49.81\%$$

**iii. Less hazardous chemical synthesis:** According to this principle of green chemistry, designed chemical reactions and synthesis routes should be as safe as possible to avoid formation of hazardous waste from chemical processes.

**Illustration:**

Earlier Dichlorodiphenyltrichloroethane (DDT) was used as insecticide and which was effective in controlling diseases like typhoid and malaria carrying mosquitoes. It was realized that DDT is harmful to living things. Nowadays, benzene hexachloride (BHC) is used as insecticide. One of the γ-isomer (gamma) of BHC is called gammexane or lindane.

**iv. Designing safer chemicals:** This principle of green chemistry aims at developing products that are less toxic or which require less toxic raw materials.

**Illustration:**

In chemical industries workers are exposed to toxic environment. Safer chemicals must be designed in order to prevent the workers from exposure to toxicity.

For example:

Adipic acid is widely used in polymer industry. Benzene is the starting material for the synthesis of adipic acid but benzene is carcinogenic and benzene being volatile organic compound (VOC) pollutes air.

In green technology developed by Drath and Frost, adipic acid is enzymatically synthesised from glucose.

**v. Use of safer solvent and auxiliaries:** This principle of green chemistry involves the use of safer solvent and minimizing the total amount of solvents and auxiliary substances used for any given step of reaction. This is because solvents and auxiliary substances make up a large percentage of the total waste created.

**Illustration:**

a. The main aim behind this principle is to use green solvents.

For example, water or supercritical $CO_2$ in place of volatile halogenated organic solvents (such as $CH_2Cl_2$, $CHCl_3$, $CCl_4$) for chemical synthesis and other purposes.

b. Solvents as chemicals that dissolve solutes and form solutions, facilitate many reactions.

c. Water is a safe benign solvent while dichloromethane is hazardous.

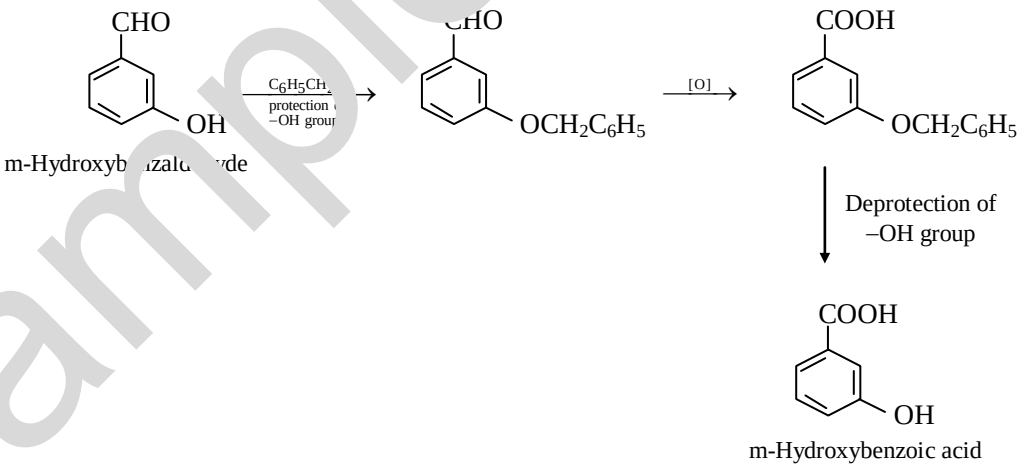
d. Use of toxic solvent affects millions of workers every year and has implications for consumers and the environment as well. Many solvents are used in high volumes and many are volatile organic compounds. Their use creates large amounts of waste, air pollution and other health impacts.

e. Finding safer, more efficient alternatives or removing solvents altogether is one of the best ways to improve a process or product.

**vi. Design for energy efficiency:** According to this principle of green chemistry, chemical synthesis should be designed to minimize the use of energy by carrying out reactions at room temperature and pressure.
This can be achieved by use of proper catalyst, microorganisms for organic synthesis, renewable materials, etc.
**Illustration:**
The biocatalyst can work at the ambient condition. Similarly, in chemical synthesis, refluxing conditions require less energy, improving the technology of heating system, use microwave heating, etc.

**vii. Use of renewable feedstocks:** The perspective of this principle of green chemistry is largely toward petrochemicals. Use chemicals which are made from renewable (plant based) sources rather than other non-renewable sources for such as crude oil.
**Illustration:**
a. Overexploitation of non-renewable feedstocks will deplete the resources and future generation will be deprived and also puts burden on the environment.
b. On the other hand, use of renewable resources such as agricultural or biological products ensures the sharing of resources by future generation.
c. This practice generally does not put much burden on environment as products and waste are generally biodegradable.

**viii. Reduce derivatives (Minimization of steps):** In organic synthesis protecting or blocking groups are commonly used.
According to this principle of green chemistry, unnecessary derivatization, for example, installation / removal of use of protecting groups should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.
**Illustration:**
a. In organic synthesis, protection of some functional group is required. Again, the deprotection of functional group is required at the end.
For example: Synthesis of m-hydroxybenzoic acid from m-hydroxybenzaldehyde.
b. In such cases, atom economy is also less.
c. The green chemistry principle aims to develop the methodology where unnecessary steps should be avoided. This can be done if possible by using practicable biocatalytic reactions, which very often need no protection of selective groups.




**ix. Use of catalysis:** Catalysis is the process of increasing the rate of a chemical reaction by adding a substance known as a catalyst, which is not consumed in the catalyzed reaction and can continue to act repeatedly. Thus, the use of catalyst in the chemical reaction speeds up its rate and also helps to increase selectivity, minimize waste and reduce reaction times and energy demands.
For example, In the contact process of industrial production of sulfuric acid; sulphur dioxide and oxygen from the air react reversibly over a solid catalyst of platinised asbestos.

**x. Design for degradation:** According to this principle of green chemistry, chemicals are designed in such way that they degraded and can be discarded easily. It is ensured that both chemicals and their degradation products are not toxic, bioaccumulative or environmentally persistent.

**Illustration:**
The aim of this principle is that the waste product should degrade automatically to clean the environment. Thus, the biodegradable polymers and pesticides are always preferred.
To make separation easier for the consumer, an international plastic recycle mark is printed on larger items.

xi. **Real-time analysis pollution prevention:** This principle of green chemistry focuses on developing analytical methods which allow real-time, in process monitoring and control prior to the formation of hazardous substances.
**Illustration:**
Analytical methodologies should be developed or modified, so that continuous monitoring of the manufacturing and processing units is possible. This is very much important for the chemical industries and nuclear reactors.

xii. **Safer chemistry for accident prevention:** According to this principle of green chemistry, we need to develop chemical processes that are safer and minimize the risk of accidents.
**Illustration:**
The substances to be used in a chemical reaction should be selected in such a way that they can minimize the occurrence of chemical accidents, explosions, fire and emission.
For example, if the chemical process works with the gaseous substances, then the possibility of accidents including explosion is relatively higher compared to the system working with non-volatile liquid and solid substances.

***Q.8. Explain any three principles of green chemistry.**
**Ans:** *Refer Q.7.(Any three principles of green chemistry).*

***Q.9. Explain atom economy with suitable example.**
**Ans:** *Refer Q.7.(ii).*

***Q.10. Write the formula to calculate % atom economy.**
**Ans:** *Refer Q.7.(ii).(Formula).*

***Q.11. Name the γ-isomer of BHC.**
**Ans:** Gammexane or Lindane

***Q.12. How will you illustrate the use of safer solvent and auxiliaries?**
**Ans:** *Refer Q.7.(v).*

***Q.13. How will you illustrate the principle, minimization of steps?**
**Ans:** *Refer Q.7.(viii).*

***Q.14. Define catalyst. Give two examples.**
**Ans:** *A **catalyst** is a substance that increases the rate of chemical reaction without being consumed in the process.*
**e.g.** i. In the contact process of industrial production of sulfuric acid; sulphur dioxide and oxygen from the air react reversibly over a solid catalyst of platinised asbestos.
ii. Hydrogenation with nickel as catalyst is used to convert inedible oils into solid fat for the production of margarine.

**#Q.15. Complete the chart.**

| | Reaction | Name of catalyst used |
|---|---|---|
| i. | Hydrogenation of oil (Hardening) | --- |
| ii. | Haber's process of manufacture of ammonia | --- |
| | Manufacture of HDPE polymer | --- |
| iv. | Manufacture of $H_2SO_4$ by contact process | --- |
| v. | Fischer-Tropsch process (Synthesis of gasoline) | --- |

**Ans:**

| | Reaction | Name of catalyst used |
|---|---|---|
| i. | Hydrogenation of oil (Hardening) | Nickel |
| ii. | Haber's process of manufacture of ammonia | Mo/Fe |
| iii. | Manufacture of HDPE polymer | Ziegler-Natta catalyst |
| iv. | Manufacture of $H_2SO_4$ by contact process | Platinised asbestos |
| v. | Fischer-Tropsch process (Synthesis of gasoline) | Co-Th alloy |

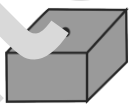
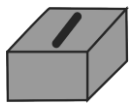
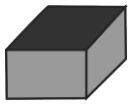
Page no. **286** to **294** are purposely left blank.

c. Polymeric nanoparticles are used as carriers for controlled and sustained delivery of drugs.
d. Nano crystalline materials: These are manufactured to act as substitutes for the materials which have poor characteristics like bioavailability, solubility, etc.
e. Metallic nanoparticles are emerging as new carrier and contrast agents in cancer treatment. These metallic nanoparticles have been used for imaging of tumour cells by means of active and passive targeting. Recent advances have opened the way to site-specific targeting and drug delivery by these nanoparticles.

***[Note:** Students are expected to find out additional information on their own.]*

## Quick Review

- **Types of nanomaterials according to dimensions:**

| Nanomaterial Dimension | Nanomaterial Type | Example |
|---|---|---|
| All three dimensions < 100 nm | Nanoparticles, Quantum dots, nanoshells, nanorings, microcapsules |  |
| Two dimensions < 100 nm | Nanotubes, fibres, nanowires |  |
| One dimension < 100 nm | Thin films, layers and coatings |  |

- **Characteristic features of nanoparticles:**

**Characteristic features of nanoparticles**

- Colour
- Surface area
- Catalytic activity
- Thermal properties (melting point)
- Mechanical strength
- Electrical conductivity

- **Synthesis of nanomaterials:**

**Approaches to the synthesis of nanomaterials**

- Bottom-up approach
- Top-down approach

- **Techniques used for analysis or characterization of nanomaterials:**

| Name of technique | Information obtained |
|---|---|
| UV-visible spectroscopy | Preliminary confirmation of formation of nanoparticles |
| X-ray diffraction (XRD) | Particle size, crystal structure, geometry |
| Scanning Electron Microscopy (SEM) | Structure of surface of material i.e. morphology |
| Transmission Emission Microscopy (TEM) | Particle size |
| Fourier Transform Infrared Spectroscopy (FTIR) | Absorption of functional groups and binding nature |

## Exercise

### 16.1 Introduction

1. Define the term: Green chemistry.
**Ans:** *Refer Q.2.*

### 16.3 Principles of green chemistry

2. Write the 12 principles of green chemistry.
**Ans:** *Refer Q.6.*

3. Explain the following principle of green chemistry:
'Prevention of waste or by products'
**Ans:** *Refer Q.7.(i).*

4. Define atom economy.
**Ans:** *Refer Q.7.(ii-a).*

5. How will you illustrate the principle, Safer chemistry for accident prevention?
**Ans:** *Refer Q.7.(xii).*

### 16.4 The role of green chemistry

6. Explain the role of Green chemistry (Any four).
**Ans:** *Refer Q.16.*

### 16.5 Introduction to nanochemistry

7. Define the term: Nanoscience.
**Ans:** *Refer Q.18.(i).*

8. Give two examples of zero dimensional nanostructures.
**Ans:** *Refer Q.22.(i).*

### 16.6 Characteristic features of nanoparticles

9. Describe any three characteristic features of nanoparticles.
**Ans:** *Refer Q.25.*

10. Write a note on catalytic activity of nanoparticles.
**Ans:** *Refer Q.25.(ii).*

### 16.7 Synthesis of nanomaterials

11. Explain bottom-up approach in the synthesis of nanomaterials.
**Ans:** *Refer Q.28.(i).*

12. Explain top-down approach in the synthesis of nanomaterials.
*Refer Q.28.(ii).*

13. Explain in detail the wet chemical synthesis of nanomaterials.
**Ans:** *Refer Q.29.*

14. What information are obtained about nanomaterials using XRD and FTIR?
**Ans:** *Refer Q.31.*

### 16.9 Applications of nanomaterials

15. Explain any two applications of nanotechnology.
**Ans:** *Refer Q.40.*

### 16.10 Nanoparticles and nanotechnology

16. Write any two advantages of nanotechnology.
**Ans:** *Refer Q.43.*

17. Explain any two disadvantages of nanotechnology.
**Ans:** *Refer Q.44.*

## Multiple Choice Questions

*1. The concept of green chemistry was coined by _____.
(A) Born Haber (B) Nario Taniguchi
(C) Richard Feynman (D) Paul T. Anastas

*2. The development that meets the needs of present without compromising the ability of future generations to meet their own need is known as _____.
(A) continuous development
(B) sustainable development
(C) true development
(D) irrational development

*3. Which of the following is γ-isomer of BHC?
(A) DDT (B) Lindane
(C) Chloroform (D) Chlorobenzene

4. The size of nanomaterials ranges between _____.
(A) 100 nm to 1000 nm
(B) 0.01 nm to 100 nm
(C) 1 nm to 10 nm
(D) 1 nm to 100 nm

*5. The prefix 'nano' comes from _____.
(A) French word meaning billion
(B) Greek word meaning dwarf
(C) Spanish word meaning particle
(D) Latin word meaning invisible

6. Which of the following property of nanomaterials play significant role in providing more number of reaction sites?
(A) Electrical conductivity
(B) Thermal property
(C) High surface area to volume ratio
(D) Colour

7. Which of the following step is NOT involved in sol-gel process?
(A) Hydrolysis
(B) Hydrogenation
(C) Polycondensation
(D) Thermal decomposition

*8. Which of the following information is given by FTIR technique?
(A) Absorption of functional groups
(B) Particle size
(C) Confirmation of formation of nanoparticles
(D) Crystal structure

9. Ruby red colour of some ancient glass paintings is due to _____ and _____ nanoparticles trapped in glass matrix.
(A) gold, titanium (B) gold, silver
(C) silver, zinc (D) gold, zinc

10. Carbon nanotubes are made up of _____ sheets with nano-sized diameter.
(A) silver (B) silicon
(C) graphite (D) fumed silica

11. The term '_____' was defined by Tokyo Science University Professor, Nario Taniguchi in 1974.
(A) Green Chemistry
(B) Catalyst
(C) Nanotechnology
(D) Nanochemistry

## Answers to Multiple Choice Questions

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | (D) | 2. | (B) | 3. | (B) | 4. | (D) |
| 5. | (B) | 6. | (C) | 7. | (B) | 8. | (A) |
| 9. | (B) | 10. | (C) | 11. | (C) | | |

**Time: 1 Hour 30 Min** **TOPIC TEST** **Total Marks: 25**

## SECTION A

**Q.1. Select and write the correct statement.** **[04]**

i. _____ is a nanostructured material that is used in tyres of car to increase the life of tyre.
(A) Carbon black (B) Gold
(C) Graphite (D) Fumed silica

ii. Earlier _____ was used as insecticide and which was effective in controlling diseases like malaria and typhoid carrying mosquitoes.
(A) benzene pentachloride (B) dichlorodiphenyltrichloroethane
(C) 1-Bromobutane (D) m-hydroxybenzoic acid

iii. In green technology developed by Prath and Frost, _____ is enzymatically synthesised from glucose.
(A) adipic acid (B) benzene
(C) lindane (D) sucrose

iv. Which of the following information is given by FTIR technique?
(A) Absorption of functional groups (B) Particle size
(C) Confirmation of formation of nanoparticles (D) Crystal structure

**Q.2. Answer the following** **[03]**

i. Define nanotechnology.

ii. Name the four basic steps involved in sol-gel process.

iii. Sumit prepared a nanomaterial in laboratory. Name the technique he can use for the preliminary confirmation of formation of nanoparticles.

## SECTION B

**Attempt any Four:** **[08]**

Q.3. Lotus is an example of self-cleaning. Explain.

Q.4. Give full form of the names for the following instruments:
i. STM ii. SEM

Q.5. What is meant by the term sol and gel?

Q.6. Draw the schematic illustration showing two approaches used in the preparation of nanoparticles.

Q.7. Explain the role of nanotechnology in water purification techniques.

Q.8. Complete the chart.

| | Reaction | Name of catalyst used |
|---|---|---|
| i. | Hydrogenation of oil (Hardening) | ------- |
| ii. | Fischer-Tropsch process (Synthesis of gasoline) | ------- |
| iii. | Manufacture of HDPE polymer | ------- |
| iv. | Manufacture of $H_2SO_4$ by contact process | ------- |

## SECTION C

**Attempt any Two:** **[06]**

Q.9. Explain the following principle of green chemistry with suitable illustration:
'Use of safer solvent and auxiliaries'

Q.10. What are zero, one and two dimensional nanoscale system?

Q.11. What are the disadvantages of nanoparticles and nanotechnology?

## SECTION D

**Attempt any One:** **[04]**

Q.12. i. Define nanomaterial.
ii. Explain catalytic activity and thermal properties of nanomaterials with examples.

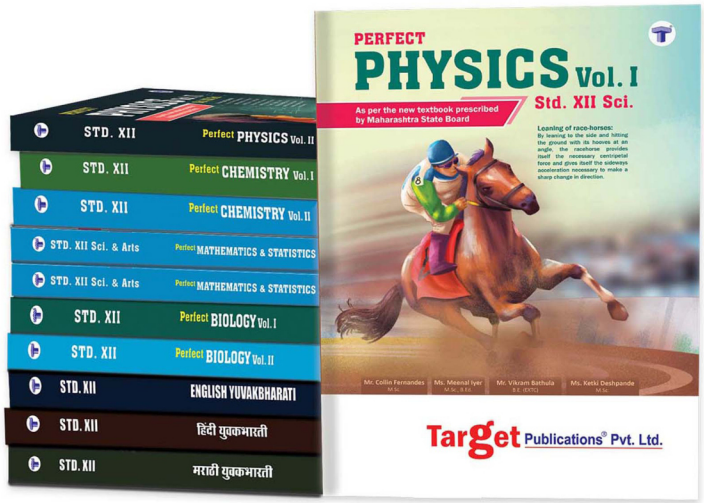
Q.13. i. Define green chemistry.
ii. Explain atom economy with suitable example.

*Download the answers of the Topic Test by scanning the given* ***Q.R. Code.***

# Std. XII

## Perfect Science

For students who want to excel in board exams and simultaneously study for entrance exams




### Available Subjects:

- Perfect Physics Vol. I
- Perfect Physics Vol. II
- Perfect Chemistry Vol. I
- Perfect Chemistry Vol. II
- Perfect Mathematics & Statistics Part - I
- Perfect Mathematics & Statistics Part - II
- Perfect Biology Vol. I
- Perfect Biology Vol. II
- English Yuvakbharati
- Hindi Yuvakbharati
- Marathi Yuvakbharati

BUY NOW

## Salient Features

- Sub-topic wise segregation for powerful concept building
- Complete coverage of textual exercise questions, intext questions and numericals
- Extensive coverage of new type of questions
- NCERT Corner, Gyan Guru, Reading between the lines, Smart Check, Smart Recap are designed to impact holistic education
- Competitive Corner presents questions from prominent competitive examinations

Target Publications® Pvt. Ltd.

88799 39712 / 13 / 14 / 15

mail@targetpublications.org

www.targetpublications.org