

SAMPLE CONTENT

MHT-CET 2021

TRIUMPH



CHEMISTRY

**MULTIPLE CHOICE
QUESTIONS
4596 MCQS**

BASED ON STD. XI & XII SYLLABUS OF MHT-CET

A chameleon basks in the sun. As its body temperature increases, the chemical reactions of its metabolism speed up!



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Written in accordance with the latest MHT-CET Paper Pattern which includes topics based on Std. XII Sci. and relevant chapters of Std. XI Sci. (Maharashtra State Board)

MHT-CET TRIUMPH CHEMISTRY

Based on Std. XI & XII Syllabus of MHT-CET

4596
MULTIPLE CHOICE
QUESTIONS

Salient Features

- ☞ Includes chapters of Std. XII and relevant chapters of Std. XI as per latest MHT-CET Syllabus
- ☞ '4596' MCQs including questions from various competitive exams
- ☞ Exhaustive subtopic wise coverage of MCQs
- ☞ Quick Review provided for each chapter
- ☞ Important Formulae provided for relevant chapters
- ☞ Includes MHT-CET 2020 Question Paper (14th October) along with Answer key
- ☞ Exhaustive coverage of various competitive exam questions till the latest year
- ☞ Evaluation Test provided at the end of each chapter
- ☞ Two Model Question Papers with answer keys and solutions provided in the form of QR Code
- ☞ Inclusions: 'Real-world applications' and 'Compilation of organic reaction based MCQs'

Scan the adjacent QR code to download Model Paper I and Solution.



Scan the adjacent QR code to download Model Paper II and Solution.



Scan the adjacent QR code to download Hints for relevant questions, Solutions to Evaluation Test and MHT-CET paper 2020 in PDF format.



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PREFACE

“Don’t follow your dreams; chase them!” - a quote by Richard Dumbrell is perhaps the most pertinent for one who is aiming to crack entrance examinations held after std. XII. We are aware of an aggressive competition a student appearing for such career defining examinations experiences and hence wanted to create books that develop the necessary knowledge, tools and skills required to excel in these examinations.

For the syllabus of **MHT-CET 2021**, 80% of the weightage is given to the syllabus for XIIth standard while only 20% is given to the syllabus for XIth standard (with inclusion of only selected topics).

We believe that although the syllabus for Std. XII and XI and MHT-CET is aligned, the outlook to study the subject should be altered based on the nature of the examination. To score in MHT-CET, a student has to be not just good with the concepts but also quick to complete the test successfully. Such *‘genius’* can be developed through sincere learning and dedicated practice.

Having thorough knowledge of basic principles, laws, concepts and their application is a prerequisite for beginning with MCQs on a given chapter in Chemistry. For physical chemistry, students must know formulae, conversion factors, units and dimensions of physical quantities involved in the chapter. For inorganic and organic chemistry, students need to focus on chemical behaviour of elements and compounds and understand the mechanism of chemical reactions. It should be kept in mind that every single line of text has potential of generating several MCQs.

As a first step to MCQ solving, students should start with elementary questions. Once a momentum is gained, complex MCQs with higher level of difficulty should be attempted. Questions from previous years as well as from other similar competitive exams should be solved to obtain an insight about plausible questions.

Competitive exams challenge the understanding of students about subject by combining concepts from different chapters in a single question. To figure these questions out, cognitive understanding of subject is required. Therefore, students should put in extra effort to practise such questions.

Such a holistic preparation is the key to succeed in the examination!

To quote Dr. A.P.J. Abdul Kalam, *“If you want to shine like a sun, first burn like a sun.”*

Our **Triumph Chemistry** book has been designed to achieve the above objectives. Commencing from basic MCQs the book proceeds to develop competence to solve complex MCQs. It offers ample practice of recent questions from various competitive examinations. It also includes hints that provide explanations and solutions to help students learn how to solve the MCQs. Each chapter ends with an Evaluation test to allow self-assessment.

Features of the book presented on the next page will explicate more about the same!

We hope the book benefits the learner as we have envisioned.

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.org

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

Best of luck to all the aspirants!

From
Publisher

Edition: First

FEATURES

Quick Review

Iron		
Cast iron	Wrought iron	Steel
Contains 4% C	Contains less than 0.2% C	Contains 0.2 - 2% C
Hard and brittle	Very soft	Neither too hard nor too soft
Uses: making pipes, manufacturing automotive parts, pots, pans, utensils, etc.	Uses: making pipes, bars for stay bolts, engine bolts and rivets, etc.	Uses: in buildings infrastructure, tools, ships, automobiles, weapons, etc.

Quick Review

Quick Review includes tables/charts to summarize the key and important chemical reactions in the chapter. This is our attempt to help students to reinforce key concepts.

Formulae

Formulae includes all of the key formulae in the chapter. This is our attempt to make tools of formulae accessible for students while solving problems and revise a vast minute at a glance.

Formulae

- Number of neutrons = $A - Z$**

where,
A = mass number
Z = atomic number

- Frequency (ν) = $\frac{c}{\lambda}$**

Where,
 ν = Frequency of electromagnetic radiation
c = Speed of light = $3 \times 10^8 \text{ m s}^{-1}$
 λ = Wavelength of electromagnetic radiation

Classical Thinking

1.1 Introduction

- Coordination compounds contain ligands attached to central metal atom/ion through _____ bonds.
(A) covalent (B) ionic
(C) coordinate (D) metallic

Classical Thinking

Classical Thinking section encompasses straight forward questions including knowledge based questions.

This is our attempt to revise chapter in its basic form and warm up students to deal with complex MCQs.

FEATURES

Critical Thinking

Critical Thinking section encompasses challenging questions which test understanding, rational thinking and application skills of students.
This is our attempt to take students from beginner to proficient level in smooth steps.

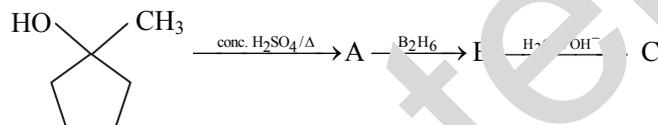


Critical Thinking



11.4 Alcohols and phenols

50. Product C in the following sequence is _____



- (A) 1-methylcyclopentane
- (B) 2-methylcyclopentanol
- (C) 2-methylcyclopentane
- (D) cyclohexane



Competitive Thinking



4.8 Enthalpy (H)

13. $\text{A}_{(\text{g})} + 2\text{B}_{(\text{g})} \longrightarrow 2\text{C}_{(\text{g})} + 3\text{D}_{(\text{g})}$ for the above reaction the value of ΔH is 19.0 kcal at 25°C. The value of ΔU in kcal is _____ (Given $R = 2.0 \text{ cal K}^{-1} \text{ mol}^{-1}$)

[MHT CET 2019]

- (A) 19.8 kcal
- (B) 20.8 kcal
- (C) 18.8 kcal
- (D) 17.8 kcal

Competitive Thinking

Competitive Thinking section encompasses questions from various competitive examinations like MHT CET, JEE, AIPMT/NEET-UG, etc.

This is our attempt to give students practice of competitive questions and advance them to acquire knack essential to solve such questions.

Subtopic wise segregation

Every section is **segregated sub-topic wise**.

This is our attempt to cater to individualistic pace and preferences of studying a chapter in students and enable easy assimilation of questions based on the specific concept.

Subtopics

- 11.1 Introduction
- 11.2 Adsorption
- 11.3 Types of adsorption
- 11.4 Factors affecting adsorption of gases on solids

FEATURES



Miscellaneous

41. Identify the CORRECT statements.
- (I) The mass of one mole of a substance in grams is called its molar mass.
 - (II) The formula mass of a substance is the sum of atomic masses of the atoms present in the formula.
 - (III) One mole is the amount of a substance that contains as many entities or particles as there are atoms in exactly 12 g of the carbon-12 isotope.
- (A) I, II (B) II, III
(C) I, III (D) I, II, III

Miscellaneous

Every section, in general, ends with a sub-topic; miscellaneous.

Miscellaneous incorporates MCQs whose solutions require knowledge of concepts covered in different sub-topics of same chapter or from different chapters.

This is our attempt to develop cognitive thinking in the students essential to solve questions involving fusion of multiple key concepts.

Evaluation test

Evaluation Test covers questions from chapter for self-evaluation purpose.

This is our attempt to provide the students with a practice test and help them assess their range of preparation of the chapter.



Evaluation Test

1. Which of the following cell the chemicals consumed during current generation CANNOT be regenerated?
- (A) Lead storage cell (B) Dry cell
(C) Mercury cell (D) NICAD cell

Straight or curly?

Hair is primarily composed of keratin, a protein, which grows from a sac called the follicle. Cells in the hair follicle generate keratin, and various other proteins, which become part of the hair shaft. These proteins contain sulfur atoms, and when two of these sulfur atoms bond up and bond, they form a disulfide bond. If the two sulfur atoms in the same protein are at a distance, and join to form the disulfide bond, the protein will bend.

The greater the number of links, the curlier the hair, and the fewer the number of links, the straighter the hair.



Real-world applications

Each chapter includes **real-world applications or examples** related to the concept discussed.

This is our attempt to link learning to the life and make students conscious of how Chemistry is related to everything we see, feel, touch and taste.

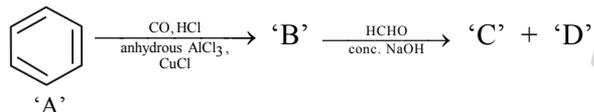
FEATURES

Organic Reactions

Organic Reactions – is a compilation of questions based on various organic chemistry concepts and reactions.

This is our attempt to help the students develop a strong understanding of organic chemistry.

22. Predict the products in the following reactions.



- (A) Benzoic acid, benzyl alcohol, sodium formate
 (B) Benzaldehyde, sodium benzoate, methanol
 (C) Benzoic acid, sodium benzoate, methanol
 (D) Benzaldehyde, benzyl alcohol, sodium formate

MHT-CET PAPER PATTERN

- There will be three papers of Multiple Choice Questions (MCQs) in ‘Mathematics’, ‘Physics and Chemistry’ and ‘Biology’ of 100 marks each.
- Duration of each paper will be 90 minutes.
- Questions will be based on the syllabus prescribed by Maharashtra State Board of Secondary and Higher Secondary Education with approximately 20% weightage given to Std. XI and 80% weightage will be given to Std. XII curriculum.
- Difficulty level of questions will be at par with CBSE (Main) for Mathematics, Physics, Chemistry and at par with NEET for Biology.
- There will be no negative marking.
- Questions will be mainly application based.
- Details of the papers are as given below:

Paper	Subject	Approximate No. of Multiple Choice Questions (MCQs) based on		Mark(s) Per Question	Total Marks
		Std. XI	Std. XII		
Paper I	Mathematics	10	40	2	100
Paper II	Physics	10	40	1	100
	Chemistry	10	40		
Paper III	Biology	20	80	1	100

- Questions will be based on
 - the entire syllabus of Std. XII of 2021 of Physics, Chemistry, Mathematics and Biology subjects excluding portion which is deleted by Maharashtra Bureau of Textbook Production and Curriculum Research, Pune, and
 - chapters / units from Std. XI curriculum as mentioned below:

Sr. No.	Subject	Chapters / Units of Std. XI
1	Physics	Motion in a plane, Laws of motion, Gravitation, Thermal properties of matter, Sound, Optics, Electrostatics, Semiconductors
2	Chemistry	Some Basic Concepts of Chemistry, Structure of Atom, Chemical Bonding, Redox Reactions, Elements of Group 1 and Group 2, States of Matter: Gaseous and Liquid States, Basic Principles and techniques of Chemistry, Adsorption and Colloids, Hydrocarbons
3	Mathematics	Trigonometry - II, Straight Line, Circle, Measures of Dispersion, Probability, Complex Numbers, Permutations and Combinations, Functions, Limits, Continuity
4	Biology	Biomolecules, Respiration and Energy Transfer, Human Nutrition, Excretion and osmoregulation

CONTENTS

Sr. No.	Textbook Chapter No.	Chapter Name	Page No.
Std. XI			
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Std. XII			
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Note: Subjects/Questions belonging to the reduced syllabus for year 2020-21 are represented with R mark. Questions of Standard XI are indicated by '' in each Model Question Paper.*

Disclaimer

This reference book is transformative work based on Std. XI and XII Chemistry Textbook; Reprint 2019 and First edition: 2020 respectively, published by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune. We the publishers are making this reference book which constitutes as fair use of textual contents which are transformed by adding and elaborating, with a view to simplify the same to enable the students to understand, memorize and reproduce the same in examinations.

This work is purely inspired upon the course work as prescribed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune. Every care has been taken in the publication of this reference book by the Authors while creating the contents. The Authors and the Publishers shall not be responsible for any loss or damages caused to any person on account of errors or omissions which might have crept in or disagreement of any third party on the point of view expressed in the reference book.

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16 Green Chemistry and Nanochemistry

Subtopics

- 16.1 Introduction
- 16.2 Sustainable development
- 16.3 Principles of green chemistry
- 16.4 The role of green chemistry
- 16.5 Introduction to nanochemistry
- 16.6 Characteristic features of nanoparticles
- R** 16.7 Synthesis of nanomaterials
- 16.8 History of nanotechnology
- 16.9 Applications of nanomaterials
- 16.10 Nanoparticles and nanotechnology

[Note: In addition to the subtopic marked **R**, the textbook topics 'Fig 16.1–Macro-materials to atoms', 'Fig 16.2–Scale of Nanomaterials', '16.6.4–Thermal properties: melting point', '16.6.5–Mechanical Property', '16.6.6–Electrical conductivity', '16.7.4–Photographs of Instruments' are also a part of reduced syllabus for 2020-21.]

The toxicity of Benzene

Benzene (C_6H_6) is widely used as a solvent in synthesis of various organic compounds. It is present in gasoline, automobile emissions as well as cigarette smoke. It has been categorised as air pollutant and a known carcinogen. Chronic exposure to benzene leads to leukemia and aplastic anemia (involves bone marrow damage). Industrial workers are more prone to develop leukemia when are exposed to benzene (around 1 ppm) in atmosphere for long time. Thus, study of Green chemistry is important in designing safer chemicals.



Warning
Harmful
chemicals



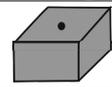
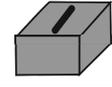
Quick Review

- **The 12 principles of green chemistry.**
 - 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

- **Formula of atom economy:**

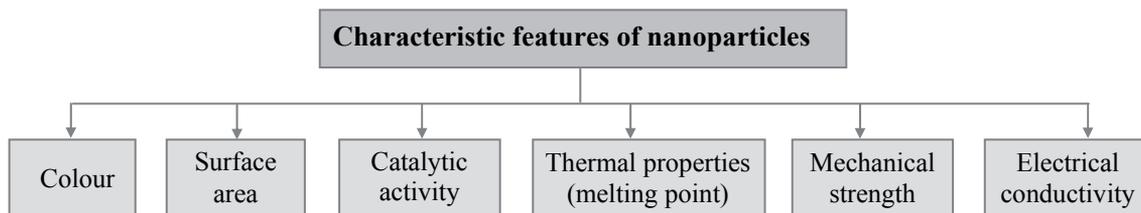
$$\% \text{ atom economy} = \frac{\text{Formula weight of the desired product}}{\text{Sum of formula weight of all the reactants used in the reaction}} \times 100$$

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

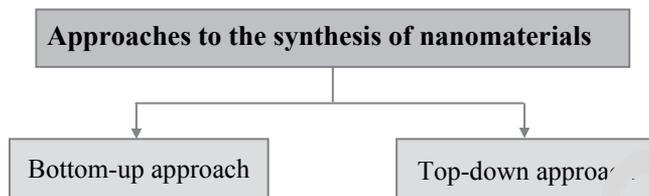
Nanomaterial Dimension	Nanomaterial Type	Example
All three dimensions < 100 nm	Nanoparticles, Quantum dots, nanoshells, nanorings, microcapsules	
Two dimensions < 100 nm	Nanotubes, fibres, nanowires	
One dimension < 100 nm	Thin films, layers and coatings	



➤ **Characteristic features of nanoparticles:**



➤ **Synthesis of nanomaterials:**



➤ **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



Classical Thinking



16.1 Introduction

- Green chemistry is an approach of chemistry that aims to _____ and _____ on human health and environment.
 - maximize efficiency, maximize hazardous effects
 - maximize efficiency, minimize hazardous effects
 - minimize efficiency, minimize hazardous effects
 - minimize efficiency, maximize hazardous effects
- 12 principles of green chemistry aim _____.
 - to minimize the problems of energy crisis
 - to reduce the impact of pollution
 - to save natural resources
 - (I) and (II)
 - (I) and (III)
 - (II) and (III)
 - (I), (II) and (III)



16.2 Sustainable development

- The development that meets the needs of present without compromising the ability of future generations to meet their own need is known as _____.
 - continuous development
 - sustainable development
 - true development
 - irrational development



16.3 Principles of green chemistry

- Identify the INCORRECT statement from the following.
 - ZWT stands for zero water treatment.
 - Waste product of one system can be used as the raw material for other system.
 - Prevention of waste is more important rather than cleaning up and treating waste after it has been created.
 - Effluent coming out from cleansing of machinery parts may be used as coolant water in thermal power station.



5. The formula for percentage atom economy is:
- (A) % atom economy = $\frac{\text{Formula weight of the desired product}}{\text{Sum of formula weights of all the products formed}} \times 100$
- (B) % atom economy = $\frac{\text{Formula weight of the byproducts formed}}{\text{Sum of formula weight of all the reactants used in the reaction}} \times 100$
- (C) % atom economy = $\frac{\text{Formula weight of the desired product}}{\text{Sum of formula weight of all the reactants used in the reaction}} \times 100$
- (D) % atom economy = $\frac{\text{Sum of formula weight of all the reactants used in the reaction}}{\text{Formula weight of the desired product}} \times 100$
6. Identify the INCORRECT statement from following.
- (A) Bottom ash of thermal power station can be used as a raw material for cement and brick industry.
- (B) Green chemistry plays an important role in sustainable development.
- (C) Good atom economy means most of the atoms of the reactants are incorporated in the desired products.
- (D) BHC insecticide has been replaced with DDT.
7. Drath and Frost developed a green technology for the synthesis of adipic acid from _____.
- (A) ribose (B) glucose
(C) fructose (D) sucros
8. _____ can be categorised as benign solvent.
- (A) Dichloromethane
(B) Water
(C) Chloroform
(D) Carbon tetrachloride
9. Which of the following can be categorised as green solvents?
- i. Supercritical CO₂ ii. CH₂Cl₂
iii. Water iv. CCl₄
v. CHCl₃
- (A) i, ii, iii (B) i, iii
(C) i, iv (D) ii, iv
10. The catalyst used in the hydrogenation of oils is _____.
- (A) Mo/Fe
(B) Ziegler-Natta catalyst
(C) Ni
(D) Co-Th alloy
11. Fischer-Tropsch process involves the use of _____ as a catalyst.
- (A) Ziegler-Natta catalyst
(B) Molybdenum in presence of iron
(C) Platinised asbestos
(D) Co-Th alloy

12. Polar fleece is prepared using _____.
- (A) polyethylene terephthalate
(B) high density polyethylene
(C) polypropylene
(D) polystyrene
13. Which of the following is believed to contain phthalates that interfere with hormone development?
- (A) PETE (B) HDPE
(C) PVC (D) PS
14. Match the following.

	Principles of green chemistry	Purpose
i.	Design for energy efficiency	To minimize the risk of explosions, etc.
ii.	Use of renewable resources	To reduce bioaccumulation
iii.	Design for degradation	c. To reduce overexploitation of nonrenewable resources
iv.	Safer chemistry for accident prevention	d. To minimize the use of energy

- (A) i – c, ii – d, iii – b, iv – a
(B) i – d, ii – c, iii – b, iv – a
(C) i – c, ii – a, iii – d, iv – b
(D) i – b, ii – c, iii – d, iv – a



16.4 The role of green chemistry

15. Identify the CORRECT statement(s) from following.
- (I) The green chemistry helps to increase capital expenditure.
- (II) The green chemistry helps to reduce the use or generation of hazardous substances.
- (III) The green chemistry promotes manufacturing process to maximize any negative environmental effects.
- (IV) Green chemistry is not useful in the protection of ozone layer.
- (A) Only II, IV (B) Only I, II
(C) Only II (D) I, II and IV



16.5 Introduction to nanochemistry

16. 1 nanometer = _____ m
- (A) 10⁻³ (B) 10⁻⁶
(C) 10⁻⁹ (D) 10⁻¹²



17. The size of nanomaterials ranges between _____.
- (A) 1 nm to 100 nm
(B) 0.01 nm to 0.001 nm
(C) 1 nm to 10 nm
(D) 1 nm to 1000 nm
18. Identify the INCORRECT statement regarding nanomaterials.
- (A) The properties of nanomaterials change as a function of size.
(B) Nanomaterials possess unique magnetic and electrical properties.
(C) Nanomaterials are larger than bacteria and cells but smaller than a tennis ball.
(D) The term nano in Greek means dwarf.
19. Nanorods is an example of _____ nanostructure.
- (A) zero-dimensional
(B) one-dimensional
(C) two-dimensional
(D) three-dimensional
20. Which of the following nanomaterial has two dimensions < 100 nm?
- (A) Nanowires (B) Nanorings
(C) Microcapsules (D) Thin films
21. Which of the following is matched INCORRECTLY?
- i. All three dimensions < 100 nm: Quantum dots
ii. Two dimensions < 100 nm: Nanosheets
iii. One dimension < 100 nm: Thin films
- (A) i, ii (B) Only ii
(C) i, iii (D) Only iii

16.6 Characteristic features of nanoparticles

22. The colour observed in case of elemental gold at bulk is different than that of gold particles at nanoscale. This can be categorised as _____ property of nanomaterial.
- (A) catalytic (B) electrical
(C) optical (D) thermal
23. _____ provides more number of reaction sites that leads to higher chemical reactivity of nanoparticles.
- (A) Colour
(B) High surface area to volume ratio
(C) Thermal property
(D) Electrical conductivity
24. When bulk material is sub divided into a group of individual nanoparticles, then the total volume _____, with _____ in collective surface area.
- (A) increases, increase
(B) remains the same, increase

- (C) decreases, increase
(D) remains the same, decrease

25. Which of the following nanoparticles is effectively used in photocatalysis?
- (A) Platinum metal
(B) Palladium metal
(C) Zinc oxide
(D) Gold metal
26. Nanomaterial-based catalysts _____
- (A) are homogeneous catalysts
(B) show decreased catalytic activity
(C) have smaller surface area as compared to bulk form
(D) can be recycled



16.7 Synthesis of nanomaterials

27. The diameter of colloidal particles ranges between _____.
- (A) 1 nm to 100 nm
(B) 100 nm to 1000 nm
(C) 100 nm to 10000 nm
(D) 0.01 nm to 100 nm
28. Sol-gel process is based on _____ reactions.
- (A) inorganic polymerization
(B) organic decomposition
(C) inorganic precipitation
(D) organic precipitation
29. Gelation resulting from the formation of an oxide involves _____.
- (A) hydrolysis
(B) polycondensation reaction
(C) drying
(D) thermal decomposition
30. Aging of the gel means the gel transforms into a _____.
- (A) gaseous state (B) liquid
(C) solid mass (D) oily liquid
31. Which of the following information about nanoparticles can be obtained using UV-visible spectrophotometer?
- (A) Preliminary confirmation of formation of nanoparticles
(B) Crystal structure
(C) Morphology
(D) Binding nature
32. X-ray diffraction gives all the information regarding nanoparticles EXCEPT the _____.
- (A) particle size (B) crystal structure
(C) binding nature (D) geometry
33. Information about morphology of nanomaterial can be obtained using _____.
- (A) TEM (B) XRD
(C) SEM (D) FTIR



16.8 History of nanotechnology

34. Match the following.

	Column I		Column II
i.	Ruby red colour of some ancient glass paintings	a.	Spherical metallic nanoparticles
ii.	Decorative glaze on medieval pottery	b.	Fumed silica
iii.	Tyres of car	c.	Gold and silver nanoparticles
iv.	Sealants	d.	Carbon black

- (A) i – d, ii – a, iii – b, iv – c
 (B) i – b, ii – c, iii – d, iv – a
 (C) i – c, ii – a, iii – d, iv – b
 (D) i – c, ii – d, iii – b, iv – a

16.9 Applications of nanomaterials

35. Nanoparticles can be used to make _____.

- (A) scratchproof sunglasses
 (B) sunscreen
 (C) crack resistant paints
 (D) all of the above

36. Lotus effect is used _____.

- (A) in water purification techniques
 (B) in electronic devices like MEMS
 (C) in self-cleaning windows
 (D) in making stronger and lighter surfaces

16.10 Nanoparticles and nanotechnology

37. Identify the INCORRECT statement from the following regarding nanotechnology.

- (A) It can bring revolution in electronics and computing.
 (B) It will make solar power more economical.
 (C) It can be used in treatment of life threatening diseases.
 (D) It is pollution free.

Miscellaneous

38. Find the INCORRECT statement.

- (A) The melting point of nanomaterial changes drastically and depends on size.
 (B) The term nanotechnology was defined by professor Nario Taniguchi in 1974.

- (C) Nanoparticles can contribute to stronger, lighter, cleaner and smarter surfaces and systems.
 (D) Very low surface-to-volume ratio is an important characteristic of nanoparticles.

39. All the following statements are CORRECT, EXCEPT:

- (A) Nanoparticles of ZnO and TiO₂ present in sunscreens protect the skin from harmful UV rays.
 (B) Nanoparticles can cause lung damage.
 (C) A zero dimensional structure is one in which all three dimensions are in the nanoscale.
 (D) One nanometer is one millionth of a meter.

Decaffeination



Decaffeination process involves the removal of caffeine from coffee beans. The cheaper industrial coffee extraction method involves the use of organic solvents such as dichloromethane. Dichloromethane was found to extract some of the key flavours to some extent. Decaffeination/extraction using CO₂ at supercritical temperatures and pressures found to be a better method because it extracts caffeine without simultaneously extracting the flavour, as dichloromethane does. That is, it maintains the original flavour of the coffee. Also, it was one of the first commercial chemical processes to be employed using a benign solvent. Once the decaffeination is over, the solvent CO₂ can be recycled. Whereas, dichloromethane is an organic solvent which should not be released in the environment.

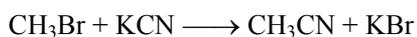


Critical Thinking



16.3 Principles of green chemistry

1. The CORRECT formula to calculate the percentage atom economy for the conversion of methyl bromide to methyl cyanide is:



(A) % atom economy =

$$\frac{\text{mass of } (1\text{C} + 3\text{H} + 1\text{Br}) + (1\text{K} + 1\text{C} + 1\text{N}) \text{ atoms}}{\text{mass of } (2\text{C} + 3\text{H} + 1\text{N}) \text{ atoms}} \times 100$$

(B) % atom economy =

$$\frac{\text{mass of } (2\text{C} + 3\text{H} + 1\text{N}) \text{ atoms}}{\text{mass of } (2\text{C} + 3\text{H} + 1\text{Br} + 1\text{K} + 1\text{N}) \text{ atoms}} \times 100$$

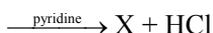
(C) % atom economy =

$$\frac{\text{mass of } (1\text{K} + 1\text{Br}) \text{ atoms}}{\text{mass of } (2\text{C} + 3\text{H} + 1\text{Br} + 1\text{K} + 1\text{N}) \text{ atoms}} \times 100$$

(D) % atom economy =

$$\frac{\text{mass of } (2\text{C} + 3\text{H} + 1\text{N}) \text{ atoms}}{\text{mass of } (1\text{C} + 3\text{H} + 1\text{Br}) \text{ atoms}} \times 100$$

2. Salicylic acid + Acetyl chloride



The % atom economy for the preparation of 'X' will be _____.

(A) $\frac{216.5}{180} \times 100$ (B) $\frac{38}{180} \times 100$

(C) $\frac{180}{216.5} \times 100$ (D) $\frac{20}{130} \times 100$

3. Phenol + Zn $\xrightarrow{\Delta}$ $\xrightarrow{\text{Cl}_2, \text{light}}$ Y

γ -isomer of 'Y' is called _____.

- (A) cumene (B) lindane
(C) freon-2 (D) chlorobenzene

4. Sodium azoate + NaOH $\xrightarrow[\Delta]{\text{CaO}}$ X

'X' is used as a raw material for the preparation of adipic acid. Identify 'X'.

- (A) Toluene (B) Benzene
(C) Cyclohexane (D) Benzoic acid

5. The green technology developed by Drath and Frost is used for the synthesis of _____.

- (A) $\text{HOOC} - (\text{CH}_2)_4 - \text{COOH}$
(B) $\text{CH}_3 - (\text{CH}_2)_4 - \text{COOH}$
(C) $\text{HOOC} - \text{COOH}$
(D) $\text{CH}_2 = \text{CH} - \text{COOH}$

6. Match the following.

	Reaction		Catalyst employed
i.	Commercial preparation of phenol	a.	Anhydrous AlCl_3
ii.	Friedel Craft's reaction	b.	Platinised asbestos
iii.	Manufacture of HDP polymer	c.	Co-nickel catalyst
iv.	Manufacture of H_2SO_4 by contact process	d.	Ziegler Natta catalyst

- (A) i - b, ii - d, iii - c, iv - a
(B) i - d, ii - c, iii - b, iv - a
(C) i - c, ii - d, iii - a, iv - b
(D) i - d, ii - a, iii - c, iv - b

7. Which of the following is INCORRECT?

- (A) Polyethylene terephthalate is recycled to make furniture.
(B) High density polyethylene is recycled to make detergent bottles.
(C) Polystyrene is used in making microwavable food trays.
(D) Polypropylene is used in making ketchup bottles.

8. Identify the CORRECT statement from following.

- (I) The possibility of accidents including explosion is relatively higher for chemical processes involving non-volatile liquids as compared to gaseous substances.
(II) Real-time analysis of analytical methodologies is important for the chemical industries and nuclear reactors.
(III) Design for degradation is most important to ensure the bioaccumulation of particular chemical or substance.
(IV) Increasing energy requirement of particular reaction can be minimized by the use of proper catalyst, microorganisms or renewable materials.
(A) I, III (B) II, III, IV
(C) I, III, IV (D) II, IV



16.5 Introduction to nanochemistry

9. One and two dimensional nanostructures are one in which _____ dimension(s) respectively are in the nanoscale.

- (A) two and one
(B) one and two
(C) two and three
(D) one and three



10. Which of the following nanomaterials does NOT have all the three dimensions < 100 nm?
(A) Quantum dots
(B) Nanorings
(C) Microcapsules
(D) Nanowires

16.6 Characteristic features of nanoparticles

11. Surface area _____ with _____ in particle size which in turn increases catalytic activity of nanoparticles.
(A) increases, increase
(B) increases, decrease
(C) decreases, decrease
(D) remains constant, decrease
12. Nanoparticles of which of the following will effectively carry out conversion given below:
But-1-ene \longrightarrow n-Butane
(A) TiO_2 (B) ZnO
(C) Pd metal (D) Gold

16.7 Synthesis of nanomaterials

13. All the following statements are CORRECT, EXCEPT:
(A) The synthesis of nanoparticles by colloidal dispersion involves bottom-up approach.
(B) Sols are dispersions of colloidal particles in a gas.
(C) In the top-down approach, nanomaterials are synthesized from bulk material by breaking the material.
(D) Sol-gel process is widely employed to prepare oxide materials.
14. Which of the following instruments can be employed for the preliminary confirmation of formation of nanoparticles?
(A) UV-visible spectrophotometer
(B) X-ray diffractometer
(C) Transmission Electron Microscope
(D) Fourier Transform Infrared Spectrophotometer

15. Match the following.

	Technique		Information
i.	XRD	a.	Particle size
ii.	SEM	b.	Particle size, crystal structure and geometry
iii.	TEM	c.	Absorption of functional groups and binding nature
iv.	FTIR	d.	Structure of surface of the material

- (A) i - b, ii - d, iii - a, iv - c
(B) i - c, ii - d, iii - b, iv - a

- (C) i - d, ii - a, iii - b, iv - c
(D) i - b, ii - c, iii - d, iv - a

16.8 History of nanotechnology

16. Lustre found on medieval pottery is due to _____.
(A) gold and silver nanoparticles
(B) certain spherical metallic nanoparticles
(C) carbon black
(D) fumed silica

Miscellaneous

17. Identify the CORRECT statement from following.
(A) Commercially DDT is known as lindane.
(B) DDT is dichlorodiphenyltrichloroethane.
(C) DDT was used as an insecticide.
(D) A molecule of DDT contains total of five Cl-atoms.
18. Identify the reactions from following which involve protection and deprotection of functional groups.
(A) m-Hydroxybenzaldehyde to m-hydroxybenzoic acid
(B) Aniline to p-bromoaniline
(C) Aniline to p-nitroaniline
(D) All of these
19. Identify the CORRECT statements from following.
(I) Silver nanoparticles act as highly effective bacterial disinfectant.
(II) The leaves of lotus plant are superhydrophilic.
(III) Invention of UV-visible spectrophotometer led to the discovery of fullerenes in 1986.
(IV) Sol-gel processes are used in the motor vehicle industry to produce water repellent coatings for wind screens.
(A) I, II (B) II, III
(C) I, III, IV (D) I, IV



Answer Key



Classical Thinking

1. (B) 2. (D) 3. (B) 4. (A) 5. (C) 6. (D) 7. (B) 8. (B) 9. (B) 10. (D)
 11. (D) 12. (A) 13. (C) 14. (B) 15. (C) 16. (C) 17. (A) 18. (C) 19. (B) 20. (A)
 21. (B) 22. (C) 23. (B) 24. (B) 25. (C) 26. (D) 27. (B) 28. (A) 29. (B) 30. (C)
 31. (A) 32. (C) 33. (C) 34. (C) 35. (D) 36. (C) 37. (D) 38. (D) 39. (D)



Critical Thinking

1. (B) 2. (C) 3. (B) 4. (B) 5. (A) 6. (C) 7. (C) 8. (A) 9. (A) 10. (D)
 11. (B) 12. (C) 13. (B) 14. (A) 15. (A) 16. (B) 17. (D) 18. (D) 19. (D)



Evaluation Test

- Which of the following nanostructured material is used in tyres of car to increase the life of tyre?
 (A) Carbon black (B) Gold
 (C) Ruby (D) Fumed silica
- Which of the following information is given by UV-visible spectroscopy?
 (A) Absorption of functional groups
 (B) Preliminary confirmation of formation of nanoparticles
 (C) Morphology
 (D) Crystal structure
- To detect the binding nature of nano material which of the following technique need to be employed?
 (A) XRD (B) SEM
 (C) TEM (D) FTIR
- Gelation process which occurs during the wet chemical synthesis of nanomaterials is the result of _____.
 (A) Hydrolysis reaction
 (B) Polycondensation reaction
 (C) Drying
 (D) Thermal decomposition
- _____ was used as insecticide which was effective in controlling diseases like malaria and typhoid.
 (A) Freons (B) DDT
 (C) Cumene (D) Adipic acid
- Which of the following can be categorised as two dimensional nanostructure?
 (A) Nanoparticles (B) Nanowires
 (C) Thin films (D) Nano rods
- Which of the following plastic material contains phthalates that interfere with hormonal development?
 (A) PETE (B) PP
 (C) PVC (D) PS
- The catalyst used in the manufacture of HDPE polymer is _____.
 (A) Mo/Fe
 (B) Ziegler-Natta catalyst
 (C) Platinised asbestos
 (D) Co-Th alloy
- Which of the following is prepared by Drath and Frost process?
 (A) Hexanoic acid
 (B) Hexanedioic acid
 (C) Pentanoic acid
 (D) Ethane-1,2-dioic acid
- Which of the following nanomaterial has all three dimensions < 100 nm?
 (A) Nanowires (B) Nanorings
 (C) Nanotubes (D) Thin films



Answers to Evaluation Test

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



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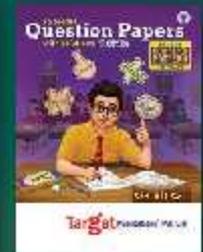
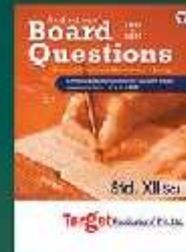
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