Includes Statistical Analysis of All shifts

SAMPLE CONTENT

Exam Experts

# MHT-CET PCM

# SOLVED PAPERS 2024

- Self-Assessment Score Card
- Smart Keys : Thinking Hatke & Caution

Contains 16 Authentic papers conducted in 2024

Target Publications® Pvt. Ltd.

# MHT-CET (PCM)

# SOLVED PAPERS - 2024

**All 16 papers conducted in 2024**



## Salient Features:

- **Authentic 2024 Papers:** Sixteen MHT-CET question papers for Physics, Chemistry, and Mathematics.
- **Detailed Solutions:** Includes answers and thorough explanation for all difficult questions
- **Trend analysis:**
  - **Graphs:** Visual representation of difficulty levels for papers of each shift.
  - **Tables:** Chapter-wise weightage analysis of all shifts.
- **Concept Mapping:** Each question is mapped to the respective chapter and topic/exercise in the solution section for better comprehension
- **Smart Keys:** Features *'Thinking Hatke'* and *'Caution'* to tackle questions effectively.
- **Assessment Tool:** Scorecards for self-assessment after each paper to track the progress.

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



P.O. No. 14070

**TEID: 3941**

# PREFACE

We are delighted to introduce our latest edition, '**MHT-CET (PCM) Solved Papers - 2024**', an exclusive compilation designed to assist students in their preparation for the MHT-CET exams. This edition includes 16 **authentic** exam papers conducted by the State Common Entrance Test Cell, covering:

**Subjects:** Physics, Chemistry, and Mathematics
**Exam Dates:** May 2 - May 16, 2024 (Morning and Afternoon Shifts)

This book serves as a comprehensive repository of all questions asked in the 2024 exams, offering students a central resource for their preparation.

## Core Attributes

**Detailed Solutions and Conceptual Mapping:**

- Answers and detailed solutions for each question paper.
- Step-by-step explanations to enhance problem-solving skills.
- Solutions include topic names and exercise numbers for easy reference.
- Questions requiring multiple concepts are marked as "Multifarious."

**Smart Keys and Self-Assessment:**

- **Thinking Hatke:** Encourages out-of-the-box thinking for problem-solving.
- **Caution:** Highlights common mistakes made while solving MCQs.
- **Self-Assessment Score Cards:** Facilitates thorough self-evaluation

**Statistical and Graphical Insights:**

- **Chapter Weightage Analysis:** Tables showing the number of questions per chapter for each shift.
- **Difficulty Level Breakdown:** Graphical representation of difficulty levels for all 16 papers in each subject, helping students strategize their study plans effectively.

## Key Takeaways

- **Central Repository:** All 2024 PCM question papers in one place.
- **Enhanced Understanding:** In-depth solutions to clarify concepts.
- **Strategic Preparation:** Statistical and graphical insights to guide study plans.
- **Self-Evaluation:** Tools to track and measure progress.

We are confident that '**MHT-CET (PCM) Solved Papers - 2024**' will comprehensively meet the needs of students and effectively assist them in achieving their academic goals. Although there is a possibility that the weightage to a chapter and the level of difficulty of the question paper in the future examination may vary. Solving these papers offer students conviction of their preparedness from the examination point of view.

Publisher
**Edition:** Second

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.*

## 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 Syllabus of State Council of Educational Research and Training, Maharashtra 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 JEE (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 set on
  i. the entire syllabus of Std. XII of Physics, Chemistry, Mathematics and Biology subjects prescribed by State Council of Educational Research and Training, Maharashtra and
  ii. chapters / units from Std. XI curriculum prescribed by State Council of Educational Research and Training, Maharashtra 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 of Organic 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 |

- **Language of Question Paper:**
  The medium for examination shall be English / Marathi / Urdu for Physics, Chemistry and Biology. Mathematics paper shall be in English only.
- **Duration of Online Computer Based Test (CBT):**
  The duration of the examination for PCB is 180 minutes and PCM is 180 minutes.
  a. **For PCM** - This paper is having 2 Groups of Physics-Chemistry and Mathematics with total 180 Minutes Duration, first 90 minutes Physics and Chemistry will be enabled and only after completion of first 90 minutes' time Physics-Chemistry group will be auto submitted and Mathematics group will be enabled with 90 minutes' duration.
  b. **For PCB** - This paper is having 2 Groups of Physics-Chemistry and Biology with total 180 Minutes Duration, first 90 minutes Physics and Chemistry will be enabled and only after completion of time response for Physics-Chemistry group will be auto submitted and Biology group will be enabled with 90 minutes' duration.

**[Note:** Candidate should note that if he/she is appearing for both the groups i.e., PCM and PCB, the Percentile / Percentage score of Physics or Chemistry will not be interchanged among the groups.**]**

# INDEX

# PHYSICS

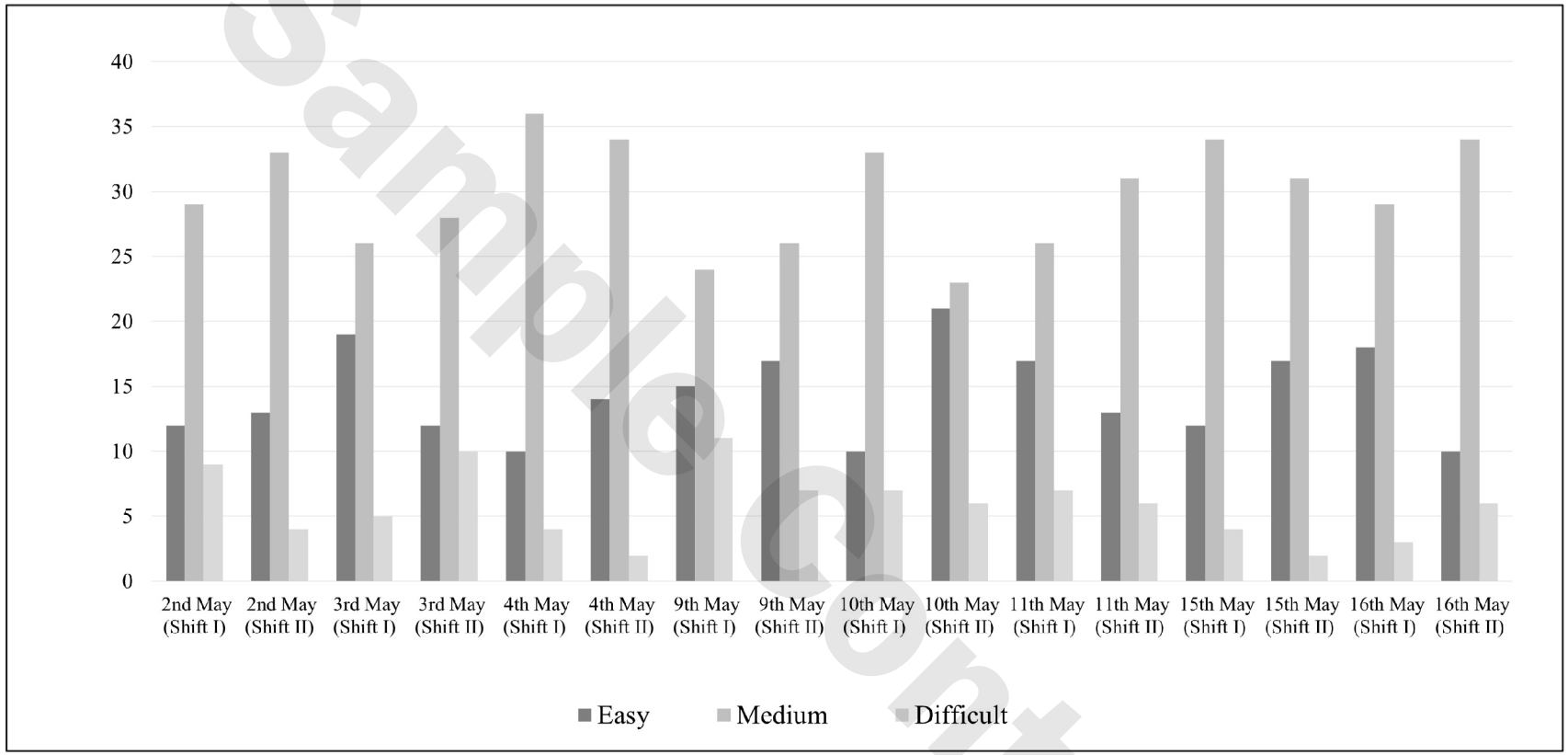
## Chapter-wise Analysis of MHT-CET 2024 Exam Papers



| Ch. no. | Std. | Chapter name | 2nd May (Shift I) | 2nd May (Shift II) | 3rd May (Shift I) | 3rd May (Shift II) | 4th May (Shift I) | 4th May (Shift II) | 9th May (Shift I) | 9th May (Shift II) | 10th May (Shift I) | 10th May (Shift II) | 11th May (Shift I) | 11th May (Shift II) | 15th May (Shift I) | 15th May (Shift II) | 16th May (Shift I) | 16th May (Shift II) | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 11th | Motion in a Plane | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 2 | 1 | 2 | **19** |
| 4 | 11th | Laws of Motion | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 2 | 2 | 1 | 1 | **19** |
| 5 | 11th | Gravitation | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | **33** |
| 7 | 11th | Thermal Properties of Matter | 2 | 1 | 0 | 1 | 1 | 0 | 2 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **15** |
| 8 | 11th | Sound | 1 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | **15** |
| 9 | 11th | Optics | 2 | 2 | 2 | 2 | 4 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | **33** |
| 10 | 11th | Electrostatics | 1 | 1 | 1 | 2 | 0 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | **20** |
| 14 | 11th | Semiconductors | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | **17** |
| 1 | 12th | Rotational Dynamics | 2 | 2 | 3 | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 4 | 2 | **44** |
| 2 | 12th | Mechanical Properties of Fluids | 3 | 3 | 4 | 3 | 3 | 3 | 2 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | **49** |
| 3 | 12th | Kinetic Theory of Gases and Radiation | 2 | 3 | 3 | 3 | 3 | 4 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | **39** |
| 4 | 12th | Thermodynamics | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | **37** |
| 5 | 12th | Oscillations | 3 | 4 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | **47** |
| 6 | 12th | Superposition of Waves | 3 | 2 | 2 | 3 | 4 | 3 | 5 | 5 | 3 | 3 | 3 | 3 | 3 | 2 | 0 | 3 | **47** |
| 7 | 12th | Wave Optics | 3 | 3 | 4 | 3 | 1 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | **49** |
| 8 | 12th | Electrostatics | 3 | 3 | 2 | 2 | 4 | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | **42** |
| 9 | 12th | Current Electricity | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | **32** |
| 10 | 12th | Magnetic Fields due to Electric Current | 2 | 2 | 2 | 2 | 5 | 2 | 1 | 2 | 2 | 4 | 2 | 3 | 3 | 2 | 2 | 3 | **39** |
| 11 | 12th | Magnetic Materials | 1 | 1 | 2 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | **13** |
| 12 | 12th | Electromagnetic Induction | 2 | 3 | 4 | 3 | 2 | 3 | 4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | **46** |
| 13 | 12th | AC Circuits | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | **50** |
| 14 | 12th | Dual Nature of Radiation and Matter | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | **33** |
| 15 | 12th | Structure of Atoms and Nuclei | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | **31** |
| 16 | 12th | Semiconductor Devices | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | **31** |
| | | **Total** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **800** |

# PHYSICS

## Difficulty level-wise Analysis of MHT-CET 2024 Exam Papers




**E – Easy:** Questions whose answers can be directly and easily answered by the information given in Std. XI and XII Textbooks.
**M – Medium:** These questions require students to identify and apply the appropriate concepts which they studied from Std. XI and XII Textbooks.
**D – Difficult:** The most Challenging Questions that require application of various concepts and encourage students to think beyond the information given in the textbooks.

**Analysis**

- **Analysis of questions by difficulty level:** Although the proportion of easy, medium, and difficult questions varies amongst the sixteen papers, the number of easy and medium questions is almost equal, with a few difficult questions.
  This indicates that the entrance exam emphasizes on thorough reading and grasping of textual content as well as understanding and application of concepts.
  Students are advised to study the chapters minutely and focus on the application of formulae and concepts while preparing for the entrance exam.

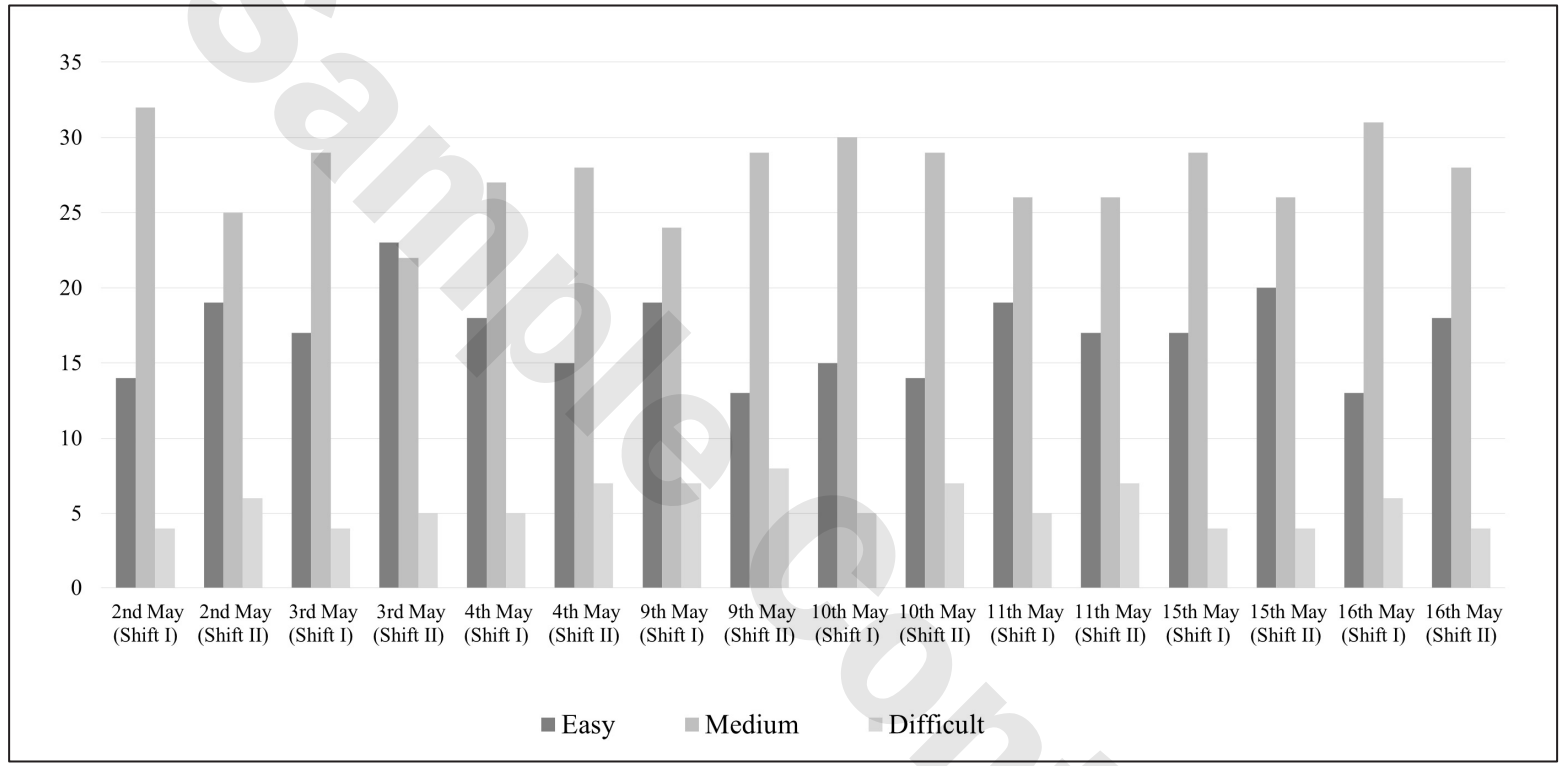
# CHEMISTRY

## Chapter-wise Analysis of MHT-CET 2024 Exam Papers

| Ch. no. | Std. | Chapter name | 2nd May (Shift I) | 2nd May (Shift II) | 3rd May (Shift I) | 3rd May (Shift II) | 4th May (Shift I) | 4th May (Shift II) | 9th May (Shift I) | 9th May (Shift II) | 10th May (Shift I) | 10th May (Shift II) | 11th May (Shift I) | 11th May (Shift II) | 15th May (Shift I) | 15th May (Shift II) | 16th May (Shift I) | 16th May (Shift II) | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11th | Some Basic Concepts of Chemistry | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **18** |
| 4 | 11th | Structure of Atom | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | **29** |
| 5 | 11th | Chemical Bonding | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **19** |
| 6 | 11th | Redox Reactions | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **16** |
| 8 | 11th | Elements of Group 1 and Group 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | **19** |
| 10 | 11th | States of Matter: Gaseous and Liquid States | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | **16** |
| 11 | 11th | Adsorption and Colloids | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **16** |
| 14 | 11th | Basic Principles of Organic Chemistry | 2 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **15** |
| 15 | 11th | Hydrocarbons | 0 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 0 | 2 | 0 | 3 | 1 | 1 | 0 | 1 | **17** |
| 1 | 12th | Solid State | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | **48** |
| 2 | 12th | Solutions | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | **48** |
| 3 | 12th | Ionic Equilibria | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | **46** |
| 4 | 12th | Chemical Thermodynamics | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | **47** |
| 5 | 12th | Electrochemistry | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | **48** |
| 6 | 12th | Chemical Kinetics | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | **48** |
| 7 | 12th | Elements of Groups 16, 17 and 18 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | **27** |
| 8 | 12th | Transition and Inner Transition Elements | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | **34** |
| 9 | 12th | Coordination Compounds | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | **32** |
| 10 | 12th | Halogen Derivatives | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 4 | 3 | 5 | 1 | 3 | 3 | 3 | 3 | **45** |
| 11 | 12th | Alcohols, Phenols and Ethers | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 4 | 3 | **47** |
| 12 | 12th | Aldehydes, Ketones and Carboxylic Acids | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 3 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | **52** |
| 13 | 12th | Amines | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | **32** |
| 14 | 12th | Biomolecules | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | **32** |
| 15 | 12th | Introduction to Polymer Chemistry | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | **31** |
| 16 | 12th | Green Chemistry and Nanochemistry | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | **18** |
| | | **Total** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **800** |

# CHEMISTRY

## Difficulty level-wise Analysis of MHT-CET 2024 Exam Papers

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**D – Difficult:** The most Challenging Questions that require application of various concepts and encourage students to think beyond the information given in the textbooks.

### Analysis

- **Analysis of questions by difficulty level:** Although the proportion of easy, medium, and difficult questions varies amongst the sixteen papers, the quantity of easy and medium questions is nearly equal, with a few difficult questions.
  This demonstrates that the entrance exam places a strong emphasis on careful reading, comprehension of the text, and application of principles. When studying for the entrance exam, it is advisable that students pay close attention to each chapter, concentrate on comprehending various chemical reactions, and practice solving numerical problems.

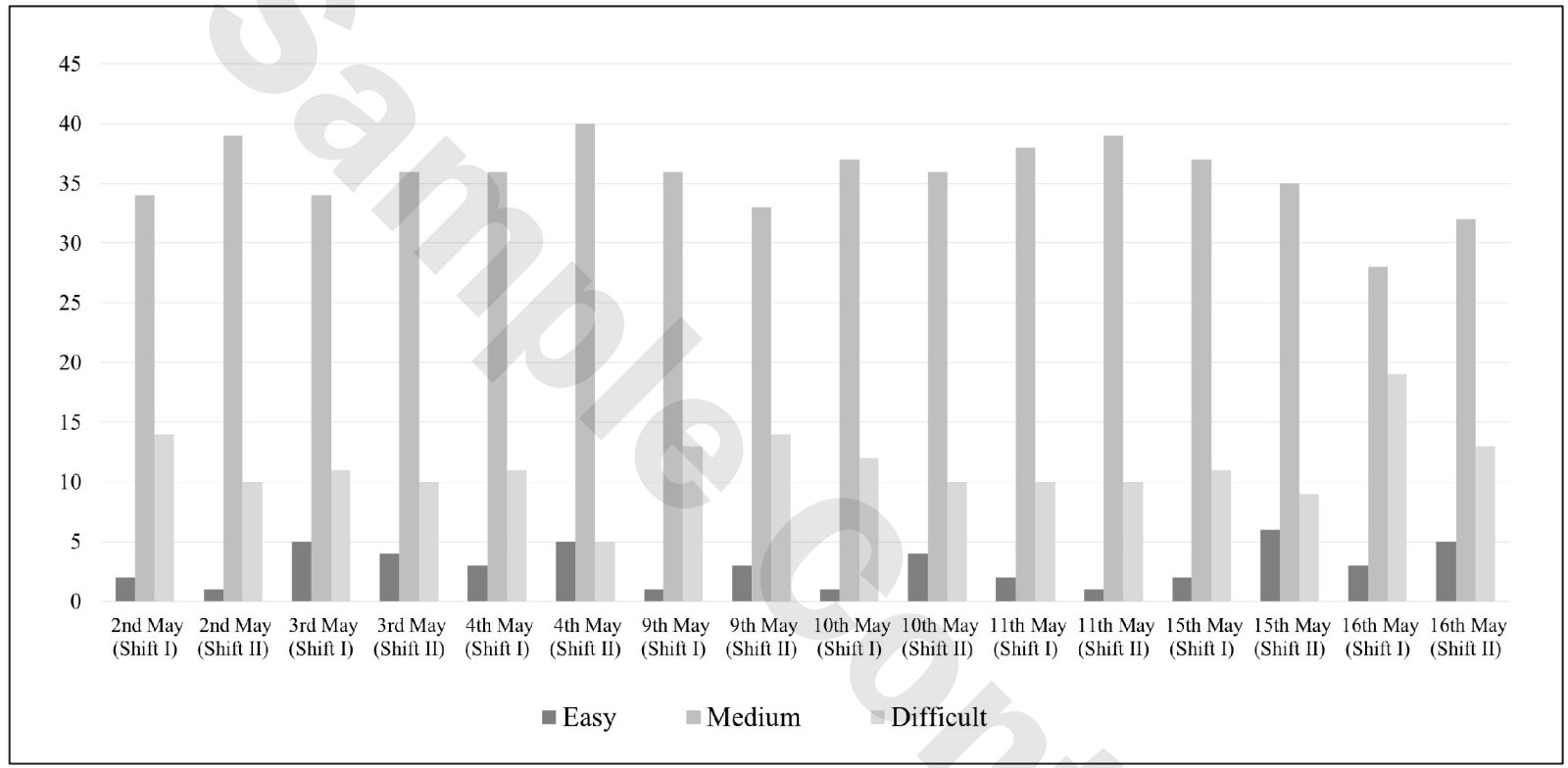
# MATHEMATICS

## Chapter-wise Analysis of MHT-CET 2024 Exam Papers

| Ch. no. | Std. | Chapter name | 2nd May (Shift I) | 2nd May (Shift II) | 3rd May (Shift I) | 3rd May (Shift II) | 4th May (Shift I) | 4th May (Shift II) | 9th May (Shift I) | 9th May (Shift II) | 10th May (Shift I) | 10th May (Shift II) | 11th May (Shift I) | 11th May (Shift II) | 15th May (Shift I) | 15th May (Shift II) | 16th May (Shift I) | 16th May (Shift II) | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 11th | Trigonometry - II | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 0 | 2 | 1 | 1 | 1 | **15** |
| 5 | 11th | Straight Line | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | **17** |
| 6 | 11th | Circle | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **16** |
| 8 | 11th | Measures of Dispersion | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **16** |
| 9 | 11th | Probability | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **15** |
| 1 | 11th | Complex Numbers | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **15** |
| 3 | 11th | Permutations and Combinations | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| 6 | 11th | Functions | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **15** |
| 7 | 11th | Limits | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **16** |
| 8 | 11th | Continuity | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **16** |
| 1 | 12th | Mathematical Logic | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | **33** |
| 2 | 12th | Matrices | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **16** |
| 3 | 12th | Trigonometric Functions | 6 | 5 | 5 | 5 | 5 | 5 | 6 | 4 | 5 | 5 | 5 | 6 | 4 | 6 | 5 | 5 | **82** |
| 4 | 12th | Pair of Straight Lines | 1 | 1 |  | 1 | 1 | 1 | 1 | 1 | 1 |  | 2 | 1 | 1 | 1 | 1 | 1 | **15** |
| 5 | 12th | Vectors | 7 | 6 | 6 | 6 | 5 | 4 | 6 | 6 | 6 | 7 | 5 | 6 | 7 | 5 | 6 | 6 | **94** |
| 6 | 12th | Line and Plane | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | **65** |
| 7 | 12th | Linear Programming | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **16** |
| 1 | 12th | Differentiation | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | **51** |
| 2 | 12th | Applications of Derivatives | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | **76** |
| 3 | 12th | Indefinite Integration | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | **64** |
| 4 | 12th | Definite Integration | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | **21** |
| 5 | 12th | Application of Definite Integration | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **16** |
| 6 | 12th | Differential Equations | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | **49** |
| 7 | 12th | Probability Distributions | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | **31** |
| 8 | 12th | Binomial Distribution | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **16** |
|  |  | **Total** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **800** |

# MATHEMATICS

## Difficulty level-wise Analysis of MHT-CET 2024 Exam Papers

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**D – Difficult:** The most Challenging Questions that require application of various concepts and encourage students to think beyond the information given in the textbooks.

**Analysis**

- **Analysis of questions by difficulty level:** While the distribution of easy, medium, and difficult questions varies among the sixteen papers, a notable trend is the prevalence of medium-level questions, with a smaller number of both difficult and easy questions.
  This suggests that the entrance exam places a strong emphasis on the comprehension and practical application of concepts. Students are encouraged to approach their preparation by meticulously studying the chapters, with a particular focus on effectively applying formulas and concepts in order to excel in the entrance exam.

Physics and Chemistry

Time: 90 Minutes Total Marks: 100

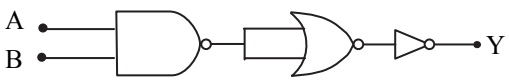
## PHYSICS

**1.** In semiconductors at room temperature,
(A) the valence band is completely filled.
(B) the conduction band is completely empty.
(C) the conduction band is partially filled and the valence band is partially empty.
(D) the valence band is completely filled and conduction band is partially empty.

**2.** A particle at rest starts moving with a constant angular acceleration of 4 rad/s$^2$ in a circular path. The time at which magnitudes of its centripetal acceleration and tangential acceleration will be equal, is (in second)

(A) $\frac{1}{4}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$

**3.** The logic circuit in figure is equivalent to




(A) OR gate (B) AND gate
(C) NOR gate (D) NAND gate

**4.** The intensity of light coming from one of the slits in Young's double slit experiment is double the intensity from the other slit. The ratio of the maximum intensity to the minimum intensity in the interference fringe pattern observed is

(A) 9 : 1 (B) 34 : 1
(C) 4 : 1 (D) 16 : 1

**5.** A sample of oxygen gas and a sample of hydrogen gas both have the same mass, same volume and the same pressure. The ratio of their absolute temperature is (Molecular wt. of $O_2$ & $H_2$ is 32 and 2 respectively)

(A) 1 : 4 (B) 1 : 8
(C) 16 : 1 (D) 12 : 1

**6.** The height above the earth's surface at which the acceleration due to gravity becomes $\left(\frac{1}{n}\right)$ times the value at the surface is ( R = radius of earth)

(A) $\frac{R}{\sqrt{n}}$ (B) $R \cdot \sqrt{n}$
(C) $\left(\sqrt{n}+1\right)R$ (D) $\left(\sqrt{n}-1\right)R$

**7.** A streamline flow of a liquid of density 'ρ' is passing through a horizontal pipe of cross-sectional area $A_1$ and $A_2$ at two ends. If the pressure of liquid is 'P' at a point where flow speed is 'v', then pressure at another point where the flow of speed becomes 3v is

(A) $P-\frac{3}{4}\rho v^2$ (B) $P-2\rho v^2$
(C) $P-3\rho v^2$ (D) $P-4\rho v^2$

**8.** In an a.c. circuit $I = 100 \sin 200\pi t$. The time required for the current to achieve its peak value will be

(A) $\frac{1}{100}$ s (B) $\frac{1}{200}$ s
(C) $\frac{1}{300}$ s (D) $\frac{1}{400}$ s

**9.** 90 J of work is done to move an electric charge of magnitude 3 C from a place A, where potential is −10 V to another place B, where potential is '$V_1$' volt. The value of $V_1$ is

(A) 10 V (B) 20 V
(C) 30 V (D) −40 V

**10.** A particle is performing simple harmonic motion and if the oscillations are damped oscillations then the angular frequency is given by

(A) $\sqrt{\frac{k}{m}+\left(\frac{b}{2m}\right)^2}$ (B) $\frac{k}{m}+\left(\frac{b}{2m}\right)^2$
(C) $\sqrt{\frac{k}{m}-\left(\frac{b}{2m}\right)^2}$ (D) $\frac{k}{m}-\left(\frac{b}{2m}\right)^2$

**11.** The magnetic energy stored in an inductor of inductance 5μH carrying a current of 2 A is

(A) 10 mJ (B) 5 mJ
(C) 10 μJ (D) 5 μJ

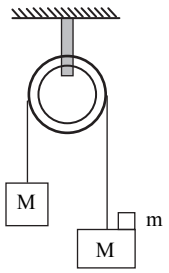
**12.** Two identical blocks each of mass 'M' attached to the ends of a massless inextensible string which passes over a pulley with a fixed axis as shown below. A small mass 'm' is now placed on the block B. The acceleration with which the two blocks move together is
[g = gravitational acceleration]

(A) $\frac{mg}{2M+m}$

(B) $\frac{Mg}{M+2m}$

(C) $\frac{Mg}{2M+m}$

(D) $\frac{mg}{M+2m}$




**13.** The radius of innermost orbit of hydrogen atom is $5.3\times10^{-11}$ m. The radius of fourth allowed orbit of hydrogen atom is

(A) 8.48 Å (B) 2·12 Å
(C) 4·77 Å (D) 0.53 Å

**14.** Two thin lenses have a combined power of + 9D. When they are separated by a distance of 20 cm, their equivalent power becomes $+\frac{27}{5}$D. The power of both the lenses in dioptre are respectively

(A) 4, 5 (B) 3, 6
(C) 2, 7 (D) 1, 8

**15.** Two simple harmonic progressive waves have displacements → $y_1 = a_1\sin\left(\frac{2\pi x}{\lambda}-\omega t\right)$ and $y_2 = a_2\cos\left(\frac{2\pi x}{\lambda}-\omega t+\phi\right)$

What is the phase difference between two waves?

(A) $\left(\phi+\frac{\pi}{2}\right)$ (B) $\phi$

(C) $\left(\phi-\frac{\pi}{2}\right)$ (D) $(\phi+\pi)$

**16.** The pressure inside a soap bubble A is 1.01 atmosphere and that in a soap bubble B is 1.02 atmosphere. The ratio of volume of A to that of B is

(A) 2 : 1 (B) 8 : 1
(C) 101 : 102 (D) 102 : 101

**17.** A bicycle wheel of radius 'R' has 'n' spokes. It is rotating at the rate of 'F' r.p.m. perpendicular to the horizontal component of earth's magnetic field $\vec{B}$. The e.m.f. induced between the rim and the centre of the wheel is

(A) $\frac{1}{2}B\pi FR^2$ (B) $B\pi FR^2$

(C) $\frac{1}{n}B\pi FR$ (D) $B\pi FR^2n$

**18.** Choose the correct answer.
When a point of suspension of pendulum is moved vertically upward with acceleration 'a', its period of oscillation

(A) decreases
(B) increases
(C) remains same
(D) some times increases and some times decreases

**19.** When a metallic surface is illuminated with a radiation of wavelength 'λ', the stopping potential is 'V'. If the same surface is illuminated with radiation of wavelength '3λ', the stopping potential is '$\left(\frac{V}{6}\right)$'. The threshold wavelength for the surface is

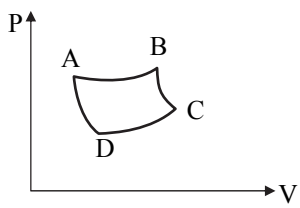
(A) 3λ (B) 4λ (C) 5λ (D) 6λ

**20.** The magnetic field at the centre of a current carrying circular coil of area 'A' is 'B'. The magnetic moment of the coil is
($\mu_0$ = permeability of free space)

(A) $\frac{2\mu_0\pi^{1/2}}{B\,A^{3/2}}$ (B) $\frac{B\,A^{3/2}}{\mu_0\pi}$

(C) $\frac{2B\,A^{3/2}}{\mu_0\pi^{1/2}}$ (D) $\frac{B\,A^2}{\mu_0\pi}$

**21.** The P-V graph of an ideal gas, cycle is shown. The adiabatic process is described by the region




(A) AB and BC (B) AB and CD
(C) AD and BC (D) BC and CD

**22.** A galvanometer of resistance 'G' is shunted by resistance of 'S' ohm. To keep the main current in the circuit unchanged the resistance to be put in series with Galvanometer is

(A) $\frac{G^2}{S+G}$ (B) $\frac{G}{S+G}$

(C) $\frac{S^2}{G+S}$ (D) $\frac{GS}{S+G}$

**23.** In an A.C. circuit, the potential difference 'V' and current 'I' are given respectively by $V = 100\sin(100t)$ V, $I = 100\sin\left(100t+\frac{\pi}{3}\right)$ mA

The power dissipated in the circuit will be [Given → $\cos\frac{\pi}{3}=\frac{1}{2}$]

(A) $10^4$ W (B) 10 W
(C) 2.5 W (D) 5 W

**24.** An annular ring has mass $10\,kg$ and inner and outer radii are $10m$ and $5m$ respectively. Its moment of inertia about an axis passing through its centre and perpendicular to its plane is

(A) $525\ kgm^2$ (B) $625\ kgm^2$

(C) $525\ gcm^2$ (D) $625\ gcm^2$

**25.** Railway track is made of steel segments separated by small gaps to allow for linear expansion. The segment of track is 10 m long when laid at temperature 17°C. The maximum temperature that can be reached is 45°C. Increase in length of the segment of railway track is 'x' $\times 10^{-5}$ m. The value of 'x' is ($\alpha_{steel} = 1.2 \times 10^{-5}$/°C)

(A) 168 (B) 204 (C) 336 (D) 530

**26.** A wire under tension $225\ N$ produces 6 beats per second when it is tuned with a fork. When the tension changes to 256 N, it is again tuned with the same tuning fork, the number of beats remain unchanged. The frequency of tuning fork will be

(A) $256\ Hz$ (B) $186\ Hz$

(C) $225\ Hz$ (D) $280\ Hz$

**27.** In the third orbit of hydrogen atom the energy of an electron 'E'. In the fifth orbit of helium $(Z = 2)$ the energy of an electron will be

(A) $\frac{25\,E}{36}$ (B) $\frac{36\,E}{25}$

(C) $\frac{3\,E}{5}$ (D) $\frac{5\,E}{3}$

**28.** At S.T.P., the mean free path of gas molecule is $1500d$, where 'd' is diameter of molecule. What will be the mean free path at $373\ K$ at constant volume?

(A) $1500\ d$ (B) $\frac{373}{273} \times 1500\ d$

(C) $\frac{273}{373} \times 1500\ d$ (D) $\sqrt{\frac{373}{273}} \times 1500\ d$

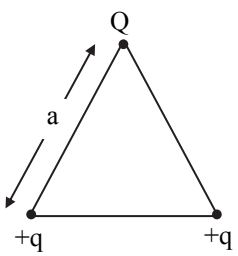
**29.** Three charges are placed at the vertices of an equilateral triangle as shown in the figure. For what value of charge 'Q', the electrostatic potential energy of the system is zero?

(A) $-q$

(B) $\frac{q}{2}$

(C) $-2q$

(D) $-\frac{q}{2}$




[***Note:*** The question has been modified to get the correct answer.]

**30.** One mole of an ideal gas at an initial temperature of 'T' K does '6R' of work adiabatically. If the ratio of specific heats of this gas at constant pressure and at constant volume is $5/3$, the final temperature of gas will be $(R = 8.31\ J\ mole^{-1}\ K^{-1})$

(A) $(T + 4 \cdot 2)K$ (B) $(T - 4 \cdot 2)K$

(C) $(T + 4)K$ (D) $(T - 4)K$

**31.** In a Young's double slit experiment, the source is white light. One of the holes is covered by a red filter and another by a blue filter. In this case

(A) there shall be alternative interference fringes of red and blue.

(B) there shall be interference fringes for red distinct from that for blue.

(C) there shall be no interference fringes.

(D) there shall be interference fringes for red mixing with one for blue.

**32.** Glycerine of density $1 \cdot 25 \times 10^3\ kg/m^3$ is flowing in conical shaped horizontal pipe. Cross-sectional area of the pipe at its both ends is $10\ cm^2$ and $5\ cm^2$ respectively. Pressure difference at both the ends is $3\ N/m^2$. Rate of flow of liquid in the pipe is

(A) $4 \times 10^{-5}\ m^3/s$ (B) $2 \times 10^{-5}\ m^3/s$

(C) $5 \times 10^{-5}\ m^3/s$ (D) $6 \times 10^{-5}\ m^3/s$

**33.** In an NPN transistor $10^{10}$ electrons enter the emitter in $10^{-6}$ s and 2% electrons recombine with holes in base. The current ratios '$\alpha$' and '$\beta$' of a transistor are respectively (nearly)

(A) $0 \cdot 98, 49$ (B) $49, 0 \cdot 98$

(C) $0 \cdot 49, 98$ (D) $98, 0 \cdot 49$

**34.** Velocity of sound waves in air is $330\ m/s$. For a particular sound wave in air, path difference of $40\ cm$ is equivalent to phase difference of $(1 \cdot 6)\pi$. The frequency of this wave is

(A) $165\ Hz$ (B) $150\ Hz$

(C) $660\ Hz$ (D) $330\ Hz$

**35.** A particle is performing uniform circular motion along the circumference of the circle of diameter $1\ m$ with frequency $4\ Hz$. The acceleration of the particle in $m/s^2$ is

(A) $8\pi^2$ (B) $16\pi^2$

(C) $24\pi^2$ (D) $32\pi^2$

**36.** A uniformly charged conducting sphere of diameter $14\ cm$ has surface charge density of $40\ \mu Cm^{-2}$. The total electric flux leaving the surface of the sphere is nearly (Permittivity of free space $= 8.85 \times 10^{-12}$ SI unit )

(A) $40\ kWb$ (B) $140\ kWb$

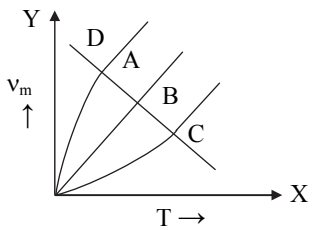
(C) $240\ kWb$ (D) $280\ kWb$

**37.** The acceleration of a moving body can be found from
(A) area under velocity - time graph.
(B) area under distance - time graph.
(C) slope of the velocity - time graph.
(D) slope of the distance - time graph.

**38.** Two identical current carrying coils with same centre are placed with their planes perpendicular to each other. If current $I = \sqrt{2}$ A and radius of the coil is $R = 1$ m, then magnetic field at centre is equal to ($\mu_0$ = permeability of free space)

(A) $\mu_0$ (B) $\frac{\mu_0}{2}$
(C) $2\mu_0$ (D) $\sqrt{2}\,\mu_0$

**39.** The frequency '$\nu_m$' corresponding to which the energy emitted by a black body is maximum may vary with the temperature 'T' of the body as shown by the curves 'A', 'B', 'C' and 'D' in the figure. Which one of these represents the correct variation?




(A) straight line D (B) curve C
(C) straight line B (D) curve A

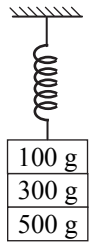
**40.** The resistances in the left and right gap of a metre bridge are $40\Omega$ and $60\Omega$ respectively. When the bridge is balanced, the distance of the null point from the centre of the wire towards left is
(A) 5 cm (B) 10 cm
(C) 15 cm (D) 20 cm

**41.** The magnitude of gravitational field at distance '$r_1$' and '$r_2$' from the centre of a uniform sphere of radius 'R' and mass 'M' are '$F_1$' and '$F_2$' respectively. The ratio '$(F_1/F_2)$' will be (if $r_1 > R$ and $r_2 < R$ )

(A) $\frac{R^2}{r_1 r_2}$ (B) $\frac{R^3}{r_1 r_2^2}$
(C) $\frac{R^3}{r_1^2 r_2}$ (D) $\frac{R^4}{r_1^2 r_2^2}$

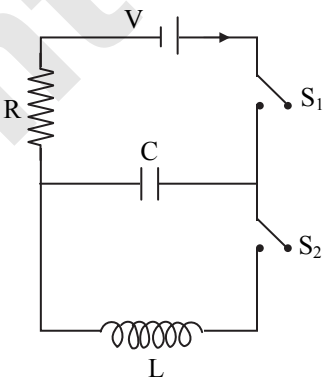
**42.** Three masses 500 g, 300 g and 100 g are suspended at the end of spring as shown in figure and are in equilibrium. When the 500 g mass is removed, the system oscillates with a period of 3 second. When the 300 g mass is also removed it will oscillate with a period of

(A) 1 s
(B) 1.5 s
(C) 2 s
(D) 2.5 s




**43.** The electrostatic potential inside a charged spherical ball is given by $V = ar^2 + b$ where 'r' is the distance from its centre and 'a' and 'b' are constants. The volume charge density of the ball is [$\varepsilon_0$ = permittivity of free space]
(A) $-24\pi a\,\varepsilon_0 r$ (B) $-6a\,\varepsilon_0 r$
(C) $-24\pi a\,\varepsilon_0$ (D) $-6a\,\varepsilon_0$

**44.** In the given circuit, when $S_1$ is closed, the capacitor gets fully charged. Now $S_1$ is open and $S_2$ is closed. Then




(A) there is no exchange of energy between L and C.
(B) the current in the circuit is in the same direction.
(C) the instantaneous current in the circuit may be $V\left(\sqrt{\frac{C}{L}}\right)$.
(D) the energy stored in the circuit is purely in the form of magnetic energy.

**45.** A plane mirror produces a magnification of
(A) –1 (B) +1
(C) zero (D) +2

**46.** The work function of metal 'A' and 'B' are in the ratio 1 : 2. If light of frequency 'f' and '2f' is incident on surface 'A' and 'B' respectively, then the ratio of kinetic energies of emitted photo electrons is
(A) 1 : 1 (B) 1 : 2 (C) 1 : 3 (D) 1 : 4

**47.** The telescopes, for a given wavelength, the objectives with large aperture are used for
(A) greater magnification.
(B) greater resolution.
(C) reducing lens aberration.
(D) ease of manufacture.

**48.** A circuit having a self inductance of 1 henry carries a current of 1 A . To prevent the sparking when the circuit is broken, a capacitor which can withstand 500 V is connected across the switch. What is the minimum value of the capacitance of the capacitor?
(A) 2 μF (B) 4 μF
(C) 6 μF (D) 8 μF

**49.** An air column in a closed organ pipe vibrating in unison with a fork, produces second overtone. The vibrating air column has
(A) three nodes and two antinodes.
(B) three nodes and three antinodes.
(C) four nodes and three antinodes.
(D) three nodes and four antinodes.

**50.** At certain place a magnet makes 30 oscillations per minute. At another place if the magnetic induction is increased by two times the magnetic induction at first place, then the time period of same magnet will be
(A) $\frac{2}{\sqrt{3}}$ s (B) $2\sqrt{3}$ s
(C) $\frac{\sqrt{3}}{2}$ s (D) $\sqrt{3}$ s

## CHEMISTRY

**1.** Which element from following is used in photoelectric cells?
(A) Li (B) Be (C) Cs (D) Mg

**2.** What is the total number of particles present in bcc unit cell?
(A) 1 (B) 2 (C) 3 (D) 4

**3.** Which among the following polymers is obtained by ring opening polymerization process?
(A) Polyacrylonitrile (B) Nylon 6,6
(C) Nylon 6 (D) Terylene

**4.** Identify an example of solution that consists of solid as solute and liquid as solvent.
(A) Sea water
(B) Bronze
(C) Carbonated water
(D) Chloroform in nitrogen

**5.** Which of the following compounds is obtained when cyclohexene is oxidized using $KMnO_4$ in dilute $H_2SO_4$?
(A) Cyclohexanol (B) Cyclohexanone
(C) Benzoic acid (D) Adipic acid

**6.** Which from following expressions is used to calculate $E_{cell}$ for the following cell at 25°C?
$Pb_{(s)}\left|Pb^{++}_{(1M)}\right|\left|Ag^{+}_{(10M)}\right|Ag_{(s)}$
(A) $E_{cell} = (E^{\circ}_{cell} + 0.0592)$ V
(B) $E_{cell} = (E^{\circ}_{cell} - 0.0592)$ V
(C) $E_{cell} = (E^{\circ}_{cell} - 0.0296)$ V
(D) $E_{cell} = (E^{\circ}_{cell} + 0.0296)$ V
[***Note:*** The question has been modified to get the correct answer.]

**7.** Which of the following compounds is obtained by using Swartz reaction?
(A) Alkyl iodides (B) Alkyl bromides
(C) Alkyl chlorides (D) Alkyl fluorides

**8.** What is the bond order in CO molecule?
(A) 1 (B) 3 (C) 2 (D) $\frac{1}{2}$

**9.** Which of the following is an example of heterogenous catalysis?
(A) Oxidation of $SO_{2(g)}$ in presence of $NO_{(g)}$.
(B) Decomposition of aqueous $H_2O_2$ in presence of $I^-_{(aq)}$.
(C) Hydrolysis of sugar in presence of aq. $H_2SO_4$.
(D) Hydrogenation of vegetable oil in presence of $Ni_{(s)}$.

**10.** Identify the monomers used for preparation of Buna–S.
(A) Phenol and formaldehyde
(B) 1,3–butadiene and styrene
(C) Ethylene glycol and styrene
(D) β-hydroxy butyric acid and phenol

**11.** Which among the following is NOT an intensive property?
(A) Internal energy (B) Viscosity
(C) Surface tension (D) Specific heat

**12.** How many moles of iodomethane are consumed in the following conversion?
$CH_3NH_2 \xrightarrow[\Delta]{CH_3I} (CH_3)_4\ N^+I^-$
(A) Four (B) Three
(C) Two (D) One

**13.** Calculate the time required for reactant to decrease the concentration from 100% to 20%, if rate constant of first order reaction is 0.02303 $hours^{-1}$.
(A) 28 hour (B) 42 hour
(C) 56 hour (D) 70 hour

**14.** Identify the number of donor atoms in EDTA molecule that form coordinate bond with central metal atom or ion in a complex.
(A) 3 (B) 1 (C) 6 (D) 4

**15.** Which from following gases of same mass exerts highest pressure at constant temperature?
(A) $H_2$ (B) $N_2$
(C) $O_2$ (D) $Cl_2$

**16.** Calculate the volume of unit cell of an element having molar mass 27 g $mol^{-1}$ that forms fcc unit cell. [$\rho.N_A = 16.0 \times 10^{23}$ g $cm^{-3}$ $mol^{-1}$]
(A) $7.50 \times 10^{-23}$ $cm^3$
(B) $6.75 \times 10^{-23}$ $cm^3$
(C) $5.75 \times 10^{-23}$ $cm^3$
(D) $8.25 \times 10^{-23}$ $cm^3$
[***Note:*** The question has been modified to get the correct answer.]

**17.** What is the ratio of concentration of salt to concentration of weak acid in buffer solution to maintain its pH value 7.2 ($pK_a = 6.2$).
(A) 1.5 (B) 10.0
(C) 5.0 (D) 8.5

**18.** Which of the following isomers has highest boiling point?
(A) tert-Butylamine
(B) Ethyldimethylamine
(C) Diethylamine
(D) n-Butylamine

**19.** Identify the product obtained when methyl bromide reacts with sodium tert-butoxide.
(A) Isobutylene and methanol
(B) 1-Methoxybutane
(C) 2-Methoxybutane
(D) 2-Methoxy-2-methylpropane

**20.** Which from following is NOT true about electrolysis of molten NaCl?
(A) $Cl_2$ gas is liberated at anode.
(B) Na is deposited at cathode.
(C) The decomposition of NaCl into $Na_{(s)}$ and $Cl_{2(g)}$ is spontaneous.
(D) Electrical energy is used to carry out the reaction.

**21.** Which element from following exhibits lowest number of different oxidation states?
(A) Sc (B) Cu
(C) Ti (D) Zn

**22.** Which functional group from following is considered as principal functional group if polyfunctional compound is to be named by IUPAC system?
(A) –CHO (B) –OH
(C) $–NH_2$ (D) –C ≡ C–

**23.** Calculate the edge length of fcc unit cell if radius of metal atom is 139 pm.
(A) $2.78 \times 10^{-8}$ cm (B) $3.21 \times 10^{-8}$ cm
(C) $3.93 \times 10^{-8}$ cm (D) $6.95 \times 10^{-8}$ cm

**24.** Which from following techniques is used for preliminary confirmation of nanoparticles?
(A) UV-visible spectroscopy
(B) X ray diffraction
(C) Scanning electron microscopy
(D) Transmission electron microscopy

**25.** What is the value of pOH if a buffer solution is prepared by mixing equal volumes of 0.4 M $NH_4OH$ and 0.5 M $NH_4Cl$ solutions. ($pK_b = 4.730$)
(A) 6.0 (B) 4.83
(C) 10.42 (D) 7.81

**26.** In a process 605 J heat is absorbed by the system and 380 J work is done by the system on surrounding. What is the value of ΔU?
(A) –225 J (B) –985 J
(C) +225 J (D) +985 J

**27.** Identify false statement from following.
(A) Cellulose is constituent of cell wall in animal cells.
(B) Starch is common constituent of food grains.
(C) Lactose is constituent of milk.
(D) Animals store polysaccharides in their body in the form of glycogen.

**28.** The resistance of decimolar solution of NaCl is 30 ohms. Calculate the conductivity of solution if the cell constant is 0.33 $cm^{-1}$.
(A) 0.025 $\Omega^{-1}$ $cm^{-1}$ (B) 0.035 $\Omega^{-1}$ $cm^{-1}$
(C) 0.011 $\Omega^{-1}$ $cm^{-1}$ (D) 0.029 $\Omega^{-1}$ $cm^{-1}$

**29.** What is the total number of unpaired electrons in an element placed at period-4 and group-12 either in excited or at ground state?
(A) Zero (B) One
(C) Two (D) Three

**30.** Which of the following is NOT obtained when a mixture of bromoethane and 1–bromopropane is treated with sodium metal in dry ether?
(A) Propane (B) Butane
(C) Pentane (D) Hexane

**31.** What is the oxidation number of underlined species in $\underline{P}F_6^-$ and $\underline{V}_2O_7^{-4}$ ions respectively?
(A) +5 and –5 (B) 5 and +5
(C) –5 and +5 (D) 3 and +3

**32.** Calculate the molality of solution of non volatile solute having depression in freezing point 0.93 K and cryoscopic constant of solvent 1·86 K kg $mol^{-1}$.
(A) 0.3 mol $kg^{-1}$ (B) 0.4 mol $kg^{-1}$
(C) 0.5 mol $kg^{-1}$ (D) 0.6 mol $kg^{-1}$

**33.** Which of the following salt solutions turns red litmus blue?
(A) $NH_4CN$ (B) $NH_4Cl$
(C) $NH_4NO_3$ (D) $NaNO_3$

**34.** Which from following compounds is obtained when acyl chloride is hydrolysed with water?
(A) Alcohols (B) Aldehydes
(C) Carboxylic acids (D) Esters

**35.** What is the rate of formation of $O_2$ for the reaction stated below?

$2N_2O_{5(g)} \longrightarrow 4NO_{2(g)} + O_{2(g)}$

$\left[\frac{d[N_2O_5]}{dt} = 0.02 \text{ mol dm}^{-3}\text{s}^{-1}\right]$

(A) 0.01 mol $dm^{-3}$ $s^{-1}$
(B) 0.02 mol $dm^{-3}$ $s^{-1}$
(C) 0.03 mol $dm^{-3}$ $s^{-1}$
(D) 0.04 mol $dm^{-3}$ $s^{-1}$

**36.** Which from following complexes contains only neutral ligands in it?
(A) Pentaammineaquacobalt(III) chloride
(B) Triamminetrithiocyanatorhodium(III)
(C) Bis(ethylenediamine) dithiocyanatoplatinum(IV)
(D) Triamminetrinitrocobalt(III)

**37.** What is the number of moles of carbon atoms present in n mole molecules of an alkane if it exhibits five structural isomers?
(A) 4n (B) 3n (C) 5n (D) 6n

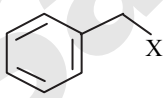
**38.** Identify the product 'B' in the following sequence of reactions.

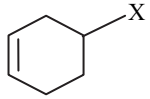
$CH_3MgBr \xrightarrow{CdCl_2} A \xrightarrow{CH_3COCl} B$

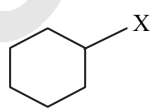
(A) Dimethyl cadmium
(B) Propanone
(C) Butanone
(D) Propanal

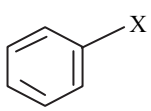
**39.** Rate law for the reaction $2NO + Cl_2 \rightarrow 2NOCl$ is rate $= k[NO]^2[Cl_2]$. When will the value of k increase?
(A) by increasing temperature
(B) by increasing $[NO]$
(C) by increasing $[Cl_2]$
(D) by increasing both $[NO]$ and $[Cl_2]$

**40.** Which among the following is haloarene ?

(A) 

(B) 

(C) 

(D) 


**41.** What is energy associated with fourth orbit of hydrogen atom?
$\left(R_H = 2.18 \times 10^{-18} \text{ J}\right)$
(A) $-0.436 \times 10^{-18}$ J (B) $-0.545 \times 10^{-18}$ J
(C) $-0.242 \times 10^{-18}$ J (D) $-0.136 \times 10^{-18}$ J

**42.** Identify glycosidic linkages for formation of chain and branches respectively in amylopectin.
(A) $\beta-1,6$ and $\alpha-1,6$
(B) $\alpha-1,6$ and $\beta-1,4$
(C) $\beta-1,4$ and $\alpha-1,6$
(D) $\alpha-1,4$ and $\alpha-1,6$

**43.** Which from following species does not have number of electrons similar to other three species?
(A) Ne (B) $O^{--}$
(C) Na (D) $Na^+$

**44.** What is the name of tert-butyl alcohol according to carbinol system?
(A) Methyl carbinol
(B) Ethyl carbinol
(C) Propyl carbinol
(D) Trimethyl carbinol

**45.** Identify the element having outer electronic configuration $ns^2np^5$.
(A) I (B) Te
(C) Ar (D) Ne

**46.** What is the mass in kg of 5 mole of acetic acid (mol. mass $= 60 \text{ g mol}^{-1}$)?
(A) 0.3 kg (B) 3.0 kg
(C) 30 kg (D) 300 kg

**47.** A solution of non volatile solute is obtained by dissolving 2 g in 50 g benzene. Calculate the vapour pressure of solution if vapour pressure of pure benzene is 640 mm Hg at 25°C .
[mol. mass of benzene $= 78 \text{ g mol}^{-1}$, mol. mass of solute $= 64 \text{ g mol}^{-1}$]
(A) 600.21 mm Hg (B) 604.52 mm Hg
(C) 608.64 mm Hg (D) 612.83 mm Hg

**48.** A gas absorbs certain amount of heat and expands by 200 $cm^3$ against a constant external pressure of $2 \times 10^5 \text{ Nm}^{-2}$. What is work done by system?
(A) –400.3 J (B) –40.53 J
(C) –3.947 J (D) –253.1 J

**49.** Which of the following is primary allylic alcohol?
(A) $CH_2 = CH - \underset{\displaystyle CH_3}{\underset{|}{CH}} - OH$
(B) $CH_2 = CH - CH_2 - OH$
(C) $CH_2 = CH - C(CH_3)_2 - OH$
(D) $CH_3 - CH = CH - CH_2 - CH_2 - OH$

**50.** Identify elements present in copper pyrites.
(A) Cu, K, S (B) Mg, Cu, P
(C) Ca, S, O (D) Fe, Cu, S

Mathematics

Time: 90 Minutes | Total Marks: 100

**1.** The vector equation of a line whose Cartesian equations are $y = 2, 4x - 3z + 5 = 0$ is

(A) $\bar{r} = \left(3\hat{i} + 4k\right) + \lambda\left(2\hat{j} + \frac{5}{3}\hat{k}\right)$

(B) $\bar{r} = \left(3\hat{i} + 4k\right) + \lambda\left(2\hat{j} - \frac{5}{3}\hat{k}\right)$

(C) $\bar{r} = \left(2\hat{j} + \frac{5}{3}\hat{k}\right) + \lambda\left(3\hat{i} + 4k\right)$

(D) $\bar{r} = \left(2\hat{j} - \frac{5}{3}\hat{k}\right) + \lambda\left(3\hat{i} + 4k\right)$

**2.** If 3 books on Physics, 2 books on Chemistry and 4 books on Mathematics are to be arranged on a shelf so that all the Physics books are together and all the Mathematics books are together, then the number of such arrangements is

(A) 576 (B) 288
(C) 3456 (D) 1152

**3.** The value of $\lim_{x \to 0} \frac{x}{|x| + x^2}$ is

(A) 1 (B) –1
(C) 0 (D) does not exist.

**4.** Let $\bar{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\bar{b} = \hat{i} + \hat{j}$. Let $\bar{c}$ be a vector such that $|\bar{c} - \bar{a}| = 3$ and $\left|(\bar{a} \times \bar{b}) \times \bar{c}\right| = 3$ and the angle between $\bar{c}$ and $\bar{a} \times \bar{b}$ is $30^\circ$, then $\bar{a} \cdot \bar{c}$ is equal to

(A) 2 (B) $-\frac{1}{8}$

(C) $\frac{25}{8}$ (D) 5

**5.** The value of $\cos\left(2\cos^{-1}x + \sin^{-1}x\right)$ at $x = \frac{1}{5}$, where $0 \le \cos^{-1}x \le \pi$ and $-\frac{\pi}{2} \le \sin^{-1}x \le \frac{\pi}{2}$, is

(A) $\frac{\sqrt{6}}{5}$ (B) $-\frac{\sqrt{6}}{5}$

(C) $\frac{2\sqrt{6}}{5}$ (D) $-\frac{2\sqrt{6}}{5}$

**6.** Considering only the principal values of inverse function, the set

$A = \left\{x \ge 0 / \tan^{-1}(2x) + \tan^{-1}(3x) = \frac{\pi}{4}\right\}$

(A) is an empty set.
(B) is a singleton set.
(C) contains more than two elements.
(D) contains two elements.

**7.** The slopes of the lines given by $x^2 + 2hxy + 2y^2 = 0$ are in the ratio $1:2$, then h is

(A) $\frac{1}{2}$ (B) $\frac{3}{2}$ (C) 3 (D) 1

**8.** If $y = \left[e^{4x}\left(\frac{x-4}{x+3}\right)^{\frac{3}{4}}\right]$ then $\frac{dy}{dx} =$

(A) $\frac{dy}{dx} = y\left[4 + \frac{21}{4(x-4)(x+3)}\right]$

(B) $\frac{dy}{dx} = \left[4 + \frac{21}{4(x-4)(x+3)}\right]$

(C) $\frac{dy}{dx} = \frac{1}{y}\left[4 + \frac{21}{4(x-4)(x+3)}\right]$

(D) $\frac{dy}{dx} = y\left[4 + \frac{21}{4(x+4)(x+3)}\right]$

**9.** $\int 3^{3^x} \cdot 3^x \, dx =$

(A) $\frac{3^x}{(\log 3)^2} + c$, where c is a constant of integration.

(B) $\frac{3^{3^x}}{\log 3} + c$, where c is a constant of integration.

(C) $\frac{3^{3^x}}{(\log 3)^2} + c$, where c is a constant of integration.

(D) $\frac{3^x}{\log 3} + c$, where c is a constant of integration.

**10.** If $f(x) = \frac{1 + \cos \pi x}{\pi(1-x)^2}$, for $x \ne 1$ is continuous at $x = 1$, then $f(1)$ is equal to

(A) $\frac{\pi}{2}$ (B) $\frac{2}{\pi}$ (C) $\frac{\pi^2}{4}$ (D) $\frac{4}{\pi^2}$

**11.** The length of the longest interval, in which the function $3\sin x - 4\sin^3 x$ is increasing, is

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{2}$ (C) $\frac{3\pi}{2}$ (D) $\pi$

**12.** The scalar $\bar{a} \cdot \left[(\bar{b} + \bar{c}) \times (\bar{a} + \bar{b} + \bar{c})\right]$ equals

(A) 0 (B) $\left[\bar{a}\ \bar{b}\ \bar{c}\right] + \left[\bar{b}\ \bar{c}\ \bar{a}\right]$

(C) $\left[\bar{a}\ \bar{b}\ \bar{c}\right]$ (D) 1

**13.** The volume of parallelopiped formed by vectors $\hat{i}+m\hat{j}+\hat{k}, \hat{j}+m\hat{k}$ and $m\hat{i}+\hat{k}$ becomes minimum when $m$ is

(A) 2 (B) 3 (C) $\sqrt{3}$ (D) $\frac{1}{\sqrt{3}}$

**14.** If the vectors $\bar{a}=\hat{i}-\hat{j}+2\hat{k}, \bar{b}=2\hat{i}+4\hat{j}+\hat{k}$ and $\bar{c}=m\hat{i}+\hat{j}+n\hat{k}$ are mutually perpendicular, then $(m,n)$ is

(A) $(3,-2)$ (B) $(-2,3)$
(C) $(2,-3)$ (D) $(-3,2)$

**15.** $\int \log(1+x)^{1+x}\,dx =$

(A) $(1+x)^2\log(1+x)-\frac{1}{2}+c$, where c is a constant of integration.

(B) $\frac{(1+x)^2}{2}\log(1+x)+c$, where c is a constant of integration.

(C) $\frac{(1+x)^2}{2}\left[\log(1+x)-\frac{1}{2}\right]+c$, where c is a constant of integration.

(D) $\frac{1+x}{2}\log(1+x)+c$, where c is a constant of integration.

**16.** $\int\left(\frac{x+2}{x+4}\right)^2\cdot e^x\,dx =$

(A) $e^x\left(\frac{x}{x+4}\right)+c$, where c is a constant of integration.

(B) $e^x\left(\frac{x+2}{x+4}\right)+c$, where c is a constant of integration.

(C) $e^x\left(\frac{x-2}{x+4}\right)+c$, where c is a constant of integration.

(D) $e^x\left(\frac{2x}{x+4}\right)+c$, where c is a constant of integration.

**17.** In $\Delta ABC$, with usual notations, if $\frac{1}{b+c}+\frac{1}{c+a}=\frac{3}{a+b+c}$, then $m\angle C$ is equal to

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{6}$

**18.** If $a>0$ and $z=\frac{(1+i)^2}{a-i}, i=\sqrt{-1}$, has magnitude $\sqrt{\frac{2}{5}}$, then $\bar{z}$ is equal to

(A) $\frac{1}{5}-\frac{3}{5}i$ (B) $-\frac{1}{5}-\frac{3}{5}i$
(C) $-\frac{1}{5}+\frac{3}{5}i$ (D) $-\frac{3}{5}-\frac{1}{5}i$

**19.** A bag contains 4 Red and 6 Black balls. A ball is drawn at random from the bag, its colour is observed and this ball along with 3 additional balls of the same colour are returned to the bag. If now a ball is drawn at random from the bag, then the probability that this drawn ball is red is

(A) $\frac{41}{65}$ (B) $\frac{24}{65}$ (C) $\frac{26}{65}$ (D) $\frac{28}{65}$

**20.** Let K be the set of all real values of $x$, where the function $f(x)=\sin|x|-|x|+2(x-\pi)\cos|x|$ is not differentiable. Then the set K is

(A) $\{0\}$ (B) an empty set
(C) $\{\pi\}$ (D) $\{0,\pi\}$

**21.** Let f and g be continuous functions on $[0,a]$ such that $f(x)=f(a-x)$ and $g(x)+g(a-x)=4$, then $\int_0^a f(x)g(x)dx$ is equal to

(A) $4\int_0^a f(x)dx$ (B) $\int_0^a f(x)dx$
(C) $2\int_0^a f(x)dx$ (D) $-3\int_0^a f(x)dx$

**22.** The principal solutions, of the equation $\sqrt{3}\sec x+2=0$, are

(A) $\frac{2\pi}{3},\frac{4\pi}{3}$ (B) $\frac{4\pi}{3},\frac{5\pi}{3}$
(C) $\frac{5\pi}{6},\frac{7\pi}{6}$ (D) $\frac{7\pi}{6},\frac{11\pi}{6}$

**23.** The number of real solutions of $\tan^{-1}\sqrt{x(x+1)}+\sin^{-1}\sqrt{x^2+x+1}=\frac{\pi}{2}$ is

(A) zero. (B) one.
(C) two. (D) infinite.

**24.** If $\bar{a}=(2\hat{i}+2\hat{j}+3\hat{k}), \bar{b}=(-\hat{i}+2\hat{j}+\hat{k})$ and $\bar{c}=(3\hat{i}+\hat{j})$ such that $(\bar{a}+\lambda\bar{b})$ is perpendicular to $\bar{c}$, then the value of $\lambda$ is

(A) –8 (B) 8 (C) 10 (D) $\frac{8}{3}$

**25.** The solution of the differential equation $\frac{dy}{dx}=(x-y)^2$ when $y(1)=1$ is

(A) $\log\left|\frac{2-y}{2-x}\right|=2(y-1)$

(B) $-\log\left|\frac{1+x-y}{1-x+y}\right|=x+y-2$

(C) $\log\left|\frac{2-x}{2-y}\right|=x-y$

(D) $-\log\left|\frac{1-x+y}{1+x-y}\right|=2(x-1)$

**26.** If $x_0$ is the point of local minima of $f(x)=\bar{a}\cdot(\bar{b}\times\bar{c})$ where $\bar{a}=x\hat{i}-2\hat{j}+3\hat{k}$, $\bar{b}=-2\hat{i}+x\hat{j}-\hat{k}, \bar{c}=7\hat{i}-2\hat{j}+x\hat{k}$, then value of $\bar{a}\cdot\bar{b}$ at $x=x_0$ is

(A) $-3$ (B) $-15$ (C) $-12$ (D) $-9$

**27.** $\hat{a},\hat{b}$, and $\hat{c}$ are three unit vectors such that $\hat{a}\times(\hat{b}\times\hat{c})=\frac{\sqrt{3}}{2}(\hat{b}+\hat{c})$. If $\hat{b}$ is not parallel to $\hat{c}$, then the angle between $\hat{a}$ and $\hat{b}$ is

(A) $\frac{5\pi}{6}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{3}$ (D) $\frac{2\pi}{3}$

**28.** For a suitable chosen real constant a, let a function $f:\mathbb{R}-\{-a\}\to\mathbb{R}$ be defined by $f(x)=\frac{a-x}{a+x}$. Further suppose that for any real number $x\neq -a$ and $f(x)\neq -a$, (fof) $(x)=x$. Then $f\left(-\frac{1}{5}\right)$ is equal to

(A) $1\cdot5$ (B) $2\cdot0$
(C) $1\cdot0$ (D) $3\cdot0$

**29.** If the statement $p\vee\sim(q\wedge r)$ is false, then the truth values of $p,q$ and $r$ are respectively

(A) F, T, F (B) T, F, F
(C) F, T, T (D) F, F, T

**30.** If $\left(m_i,\frac{1}{m_i}\right), m_i>0, i=1,2,3,4$ are four distinct points on a circle, then the product $m_1\ m_2\ m_3\ m_4$ is equal to

(A) $-1$ (B) 1
(C) 0 (D) 2

**31.** If two lines $x+(a-1)y=1$ and $2x+a^2y=1\left(a\in R-\{0,1\}\right)$ are perpendicular, then the distance of their point of intersection from the origin is

(A) $\frac{2}{5}$ (B) $\frac{\sqrt{2}}{5}$ (C) $\frac{2}{\sqrt{5}}$ (D) $\sqrt{\frac{2}{5}}$

**32.** If $x\frac{dy}{dx}=y(\log y-\log x+1)$, then general solution of this equation is

(A) $\log\left(\frac{x}{y}\right)=cy$, where c is a constant of integration.

(B) $\log\left(\frac{x}{y}\right)=cx$, where c is a constant of integration.

(C) $\log\left(\frac{y}{x}\right)=cy$, where c is a constant of integration.

(D) $\log\left(\frac{y}{x}\right)=cx$, where c is a constant of integration.

**33.** A spherical metal ball at $80^\circ C$ cools in 5 minutes to $60^\circ C$, in surrounding temperature of $20^\circ C$, then the temperature of the ball after 20 minutes is approximately

(A) $(8.15)^\circ C$ (B) $(11.85)^\circ C$
(C) $(28.15)^\circ C$ (D) $(31.85)^\circ C$

**34.** If a discrete random variable X takes values 0, 1, 2, 3,…….. with probability $P(X=x)=k(x+1)5^{-x}$, where k is a constant, then $P(X=0)$ is

(A) $\frac{7}{25}$ (B) $\frac{16}{25}$ (C) $\frac{18}{25}$ (D) $\frac{19}{25}$

**35.** The Cartesian equation of the plane, passing through the points $(3,1,1),(1,2,3)$ and $(-1,4,2)$, is

(A) $5x+6y-2z-23=0$
(B) $-5x+6y+2z+23=0$
(C) $5x+6y+2z-23=0$
(D) $5x-6y+2z-23=0$

**36.** The equation of the line passing through the point $(-1,3,-2)$ and perpendicular to each of the lines $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ and $\frac{x+2}{-3}=\frac{y-1}{2}=\frac{z+1}{5}$, is

(A) $\frac{x+1}{2}=\frac{y-3}{7}=\frac{z+2}{4}$
(B) $\frac{x+1}{-2}=\frac{y-3}{-7}=\frac{z+2}{4}$
(C) $\frac{x+1}{2}=\frac{y-3}{7}=\frac{z+2}{-4}$
(D) $\frac{x+1}{2}=\frac{y-3}{-7}=\frac{z+2}{4}$

**37.** If $y=a\sin x+b\cos x$ (where a and b are constants), then $y^2+\left(\frac{dy}{dx}\right)^2$ is

(A) a function of $x$.
(B) a function of $x$ and $y$.
(C) a function of $y$.
(D) a constant.

**38.** If Rolle's theorem holds for the function $f(x)=x^3+bx^2+ax+5$ on [1, 3] with $c=2+\frac{1}{\sqrt{3}}$, then the values of a and b respectively are

(A) $-11,6$ (B) $11,6$
(C) $-11,-6$ (D) $11,-6$

**39.** Ten bulbs are drawn successively, with replacement, from a lot containing 10% defective bulbs, then the probability that there is at least one defective bulb, is

(A) $1-\left(\frac{1}{10}\right)^{10}$ (B) $1-\left(\frac{3}{10}\right)^{10}$

(C) $1-\left(\frac{9}{10}\right)^{10}$ (D) $1-\left(\frac{7}{10}\right)^{10}$

**40.** If statement I : If the work is not finished on time, the contractor is in trouble.
statement II : Either the work is finished on time or the contractor is in trouble.
then

(A) statement II is negation of statement I.
(B) statement II is converse of statement I.
(C) statement II and statement I are equivalent.
(D) statement II is an inverse of statement I.

**41.** The value of $\sin\left(2\cos^{-1}\left(-\frac{3}{5}\right)\right)$ is

(A) $\frac{24}{25}$ (B) $-\frac{24}{25}$ (C) $\frac{8}{25}$ (D) $-\frac{8}{25}$

**42.** If $y=\sqrt{\frac{1-\sin^{-1}x}{1+\sin^{-1}x}}$, then $\left(\frac{dy}{dx}\right)$ at $x=0$ is

(A) 1 (B) 2 (C) –2 (D) –1

**43.** The point, at which the maximum value of $10x+6y$ subject to the constraints $x+y\le 12$, $2x+y\le 20, x\ge 0, y\ge 0$ occurs, is

(A) $(10,0)$ (B) $(8,4)$

(C) $(0,12)$ (D) $(12,0)$

**44.** If the line $\frac{x-3}{2}=\frac{y+2}{-1}=\frac{z+4}{3}$ lies in the plane $\ell x+my-z=9$, then $\ell^2+m^2$ is

(A) 1 (B) 4 (C) 2 (D) 5

**45.** The mean of 100 observations is 50 and their standard deviation is 5 , then the sum of all squares of all the observations is

(A) 252500 (B) 250500
(C) 250000 (D) 255000

**46.** The area of the region bounded by hyperbola $x^2-y^2=9$ and its latus rectum is

(A) $9\left[\sqrt{2}-\log\left(\sqrt{2}+1\right)\right]$ sq. units

(B) $4\left[\sqrt{2}-\log\left(\sqrt{2}+1\right)\right]$ sq. units

(C) $3\left[\sqrt{2}-\log\left(\sqrt{2}+1\right)\right]$ sq. units

(D) $18\left[\sqrt{2}-\log\left(\sqrt{2}+1\right)\right]$ sq. units

**47.** $\int\frac{dx}{3-2\cos 2x}=\frac{\tan^{-1}\left(f(x)\right)}{\sqrt{5}}+c$, (where c is a constant of integration), then $f(\pi/4)$ has the value

(A) $-\sqrt{5}$ (B) $\sqrt{5}$ (C) $\frac{2}{\sqrt{5}}$ (D) $\frac{1}{\sqrt{5}}$

**48.** The normal to the curve, $y(x-2)(x-3)=x+6$ at the point, where the curve intersects the Y-axis, passes through the point

(A) $\left(-\frac{1}{2},-\frac{1}{2}\right)$ (B) $\left(\frac{1}{2},\frac{1}{2}\right)$

(C) $\left(\frac{1}{2},-\frac{1}{3}\right)$ (D) $\left(\frac{1}{2},\frac{1}{3}\right)$

**49.** For all real $x$, the vectors $Cx\hat{i}-6\hat{j}-3\hat{k}$ and $x\hat{i}+2\hat{j}+2Cx\hat{k}$ make an obtuse angle with each other, then the value of C can be in

(A) $(0,1)$ (B) $\left(-2,\frac{-4}{3}\right)$

(C) $\left(\frac{-4}{3},0\right)$ (D) $\left(0,\frac{4}{3}\right)$

**50.** If $A=\begin{bmatrix}3 & -1\\ -4 & 2\end{bmatrix}$, then $A^{-1}$ is

(A) $\begin{bmatrix}1 & -\frac{1}{2}\\ 2 & \frac{3}{2}\end{bmatrix}$ (B) $\begin{bmatrix}1 & \frac{1}{2}\\ -2 & \frac{3}{2}\end{bmatrix}$

(C) $\begin{bmatrix}1 & -\frac{1}{2}\\ -2 & \frac{3}{2}\end{bmatrix}$ (D) $\begin{bmatrix}1 & \frac{1}{2}\\ 2 & \frac{3}{2}\end{bmatrix}$

| MHT-CET - 2024 2nd May (Shift – I) Score card | | |
|---|---|---|
| **Subject** | **Total Number of correct answers** | **Total Marks:** |
| **Physics** | | (Out of 50) |
| **Chemistry** | | (Out of 50) |
| **Mathematics** | | (Out of 100) |
| **Total** | | (Out of 200) |

[*In Physics and Chemistry, each question carries 1 Mark. In Mathematics, each question carries 2 Marks. There is no negative marking for wrong answers.*]

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To see complete chapter buy **Target Notes** or **Target E-Notes**

## 2nd May (Shift – I)

## PHYSICS

**1.** **(C)** Std.11 | Ch-14
14.4 Intrinsic Semiconductor

**2.** **(C)** Std.12 | Ch-1
1.2 Characteristics of Circular Motion

Given that, $\alpha = 4$ rad/s$^2$
Centripetal (radial) acceleration, $a_r = r\omega^2$
Tangential acceleration, $a_t = r\alpha$
If $a_r = a_t$, then $r\omega^2 = r\alpha$
$\therefore \quad \omega^2 = \alpha = 4$
$\therefore \quad \omega = \sqrt{4} = 2$ rad/s
But, $\omega = \omega_0 + \alpha t = 0 + \alpha t = \alpha t$
$\therefore \quad 2 = 4t$
$\therefore \quad t = \frac{1}{2}$ s

**3.** **(D)** Std.12 | Ch-16
16.5 Logic gates

The output of the NAND gate will be $\overline{A.B}$.
The output of the NOR gate will be
$\overline{\overline{A.B} + \overline{A.B}} = A.B$
The output of the NOT gate will be $\overline{A.B}$
Thus, the given network is equivalent to a NAND gate.

**4.** **(B)** Std.12 | Ch-7
7.8 Interference

Two coherent sources of intensities $I_1$ and $I_2$ produce,

maximum intensity, $I_{max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$ and

minimum intensity, $I_{min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2$ in an interference pattern.

$$\frac{I_{max}}{I_{min}} = \frac{\left(\sqrt{I_1} + \sqrt{I_2}\right)^2}{\left(\sqrt{I_1} - \sqrt{I_2}\right)^2} = \frac{I_1 + I_2 + 2\sqrt{I_1 I_2}}{I_1 + I_2 - 2\sqrt{I_1 I_2}}$$

Given $I_1 = 2I_2$

$$\therefore \quad \frac{I_{max}}{I_{min}} = \frac{3I_2 + 2\sqrt{2}I_2}{3I_2 - 2\sqrt{2}I_2} = \frac{3 + 2\sqrt{2}}{3 - 2\sqrt{2}} = 34$$

**5.** **(C)** Std.11 | Ch-7
7.4 Absolute Temperature and Ideal Gas Equation

$$P_1V_1 = \frac{m_1}{M_1}RT_1 \quad \ldots.(i)$$

$$P_2V_2 = \frac{m_2}{M_2}RT_2 \quad \ldots.(ii)$$

Dividing (i) by (ii)

$$\frac{T_1}{T_2} = \frac{M_1}{M_2} = \frac{32}{2} = \frac{16}{1}$$

**6.** **(D)** Std.11 | Ch-5
5.6 Variation in the Acceleration due to gravity with Altitude, Depth, Latitude and Shape

Given: $\frac{g'}{g} = \frac{1}{n}$

$$\frac{1}{n} = \frac{R^2}{(R+h)^2} \Rightarrow \frac{R}{R+h} = \frac{1}{\sqrt{n}}$$

$\therefore \quad \sqrt{n}R = R + h$
$\therefore \quad R\left(\sqrt{n} - 1\right) = h$

**7.** **(D)** Std.12 | Ch-2
2.9 Bernoulli's equation

Using Bernoulli's equation,

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

$$P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$$

…(given horizontal pipe)

Substituting the given values,

$$P + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho(3v)^2$$

$$P_2 = P + \left(\frac{1}{2}\rho v^2 - \frac{9}{2}\rho v^2\right) = P - 4\rho v^2$$

**8.** **(D)** Std.12 | Ch-13
13.3 Average and RMS values

$I = 100 \sin 200\pi t$
Peak value $I_0 = 100$ A
When $I = 100$ A, we have
$100 = 100 \sin 200\pi t$
$\therefore \quad \sin 200\pi t = 1$
$\therefore \quad 200\pi t = \frac{\pi}{2}$
$\therefore \quad t = \frac{1}{400}$ s

**9.** **(B)** Std.12 | Ch-8
8.4 Electric Potential due to a Point Charge, a Dipole and a System of Charges

$W = q\,\Delta V$
$W = q(V_1 - V_A)$
$W = 3[V_1 - (-10)]$
$\frac{90}{3} = V_1 + 10$
$V_1 = 20$ V

Page no. **180** to **183** are purposely left blank.

To see complete chapter buy **Target Notes** or **Target E-Notes**

**44.** **(C)** Std.12 | Ch-13
13.7 LC Oscillations

Maximum energy in capacitor = Maximum energy in inductor

$\frac{1}{2}CV^2 = \frac{1}{2}LI^2$

$\therefore \quad I^2 = \frac{C}{V}V^2$

$\therefore \quad I = V\sqrt{\frac{C}{L}}$

**45.** **(B)** Std.11 | Ch-9
9.4 Reflection

**46.** **(B)** Std.12 | Ch-14
14.2 The Photoelectric Effect

For A, $E_{A_{max}} = h\nu - \phi_A$

For B, $E_{B_{max}} = h(2\nu) - \phi_B$

$\frac{E_{A_{max}}}{E_{B_{max}}} = \frac{h\nu - \phi_A}{2h\nu - \phi_B}$

As $\frac{\phi_A}{\phi_B} = \frac{1}{2} \Rightarrow \phi_B = 2\phi_A$

$\therefore \quad \frac{E_{A_{max}}}{E_{B_{max}}} = \frac{\frac{h\nu - \phi_A}{\phi_A}}{\frac{2h\nu - \phi_B}{\phi_A}} = \frac{\frac{h\nu}{\phi_A} - 1}{\frac{2h\nu}{\phi_A} - 2}$

$= \frac{h\nu - \phi_A}{\phi_A} \times \frac{\phi_A}{2(h\nu - \phi_A)} = \frac{1}{2}$

**47.** **(B)** Std.12 | Ch-7
7.10 Resolving Power

According to mathematical equation R.P. $\propto \frac{1}{\lambda}$, telescopes being used in sunlight to observe celestial objects, practically there is no control on wavelength incident ($\lambda$). Hence, using objective lens of large aperture is effective way to increase R.P. of telescope.

**48.** **(B)** Std.12 | Ch-13
13.7 LC Oscillations

The energy stored in the inductance is $U = \frac{1}{2}LI^2$

$U = \frac{1}{2} \times 1 \times 1^2 = 0.5 \text{ J}$

This energy must be transferred to the capacitor.

Energy stored by a capacitor $U = \frac{1}{2}CV^2$

$\therefore \quad \frac{1}{2}CV^2 = \frac{1}{2}LI^2$

$\therefore \quad C = L\left(\frac{I}{V}\right)^2 = 1\left(\frac{1}{500}\right)^2 = 4\ \mu\text{F}$

**49.** **(B)** Std.12 | Ch-6
6.7 Harmonics and Overtones

Frequency of $n^{th}$ harmonic of a closed pipe $f_n = \frac{nV}{4L}$

Frequency of different modes of vibration in a closed pipe $f'_n = \frac{(2n-1)V}{4L_1}$

$\therefore$ Frequency of 2nd overtone, $f'_3 = \frac{5V}{4L_1}$ (n=3)

In a closed pipe, the number of nodes and anti-nodes are the same. Hence, there will be 3 nodes and 3 antinodes.

**50.** **(A)** Std.12 | Ch-11
11.2 Torque Acting on a Magnetic Dipole in a Uniform Magnetic Field

$T = 2\pi\sqrt{\frac{I}{MB}} \Rightarrow T \propto \frac{1}{\sqrt{B}}$

Given, $n_1 = 30$ osc./min $\Rightarrow T_1 = 2$ s

$\therefore \quad \frac{T_2}{T_1} = \frac{\sqrt{B_1}}{\sqrt{B_2}}$

Now, $B_2 = B_1 + 2B_1 = 3B_1$

$\therefore \quad \frac{T_2}{T_1} = \sqrt{\frac{B_1}{3B_1}} = \frac{1}{\sqrt{3}} \Rightarrow T_2 = \frac{1}{\sqrt{3}} \times 2 = \frac{2}{\sqrt{3}}$ s

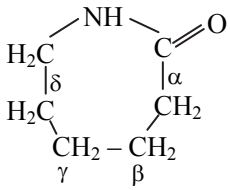
## CHEMISTRY

**1.** **(C)** Std.11 | Ch-8
8.2 Alkali metals and alkaline earth metals

**2.** **(B)** Std.12 | Ch-1
1.5 Cubic system

In bcc unit cell, $\left(\frac{1}{8} \times 8\right) + 1 = 2$

**3.** **(C)** Std.12 | Ch-15
15.3 Some important polymers

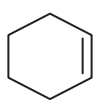



$\xrightarrow[533-543\ K]{H_2O}$ $+NH-(CH_2)_5-CO+_n$ (Nylon 6)

$\in$-Caprolactam (n molecules)

**4.** **(A)** Std.12 | Ch-2
2.2 Types of solutions

**5.** **(D)** Std.12 | Ch-12
12.5 Preparation of carboxylic acids



cyclohexene

$\xrightarrow[H_2SO_4]{KMnO_4}$ $HOOC-(CH_2)_4-COOH$
Adipic Acid

**48.** **(B)** Std.12 | Ch-4
4.4 Expression for pressure-volume (PV) work

$W = -P\Delta V$
$= -2 \times 10^5 \text{ N m}^{-2} \times 200 \times 10^{-6} \text{ m}^3$
$= -40.0 \text{ J} \approx -40.53 \text{ J}$

**49.** **(B)** Std.12 | Ch-11
11.2 Classification

$H_2C = CH - \underset{\displaystyle CH_3}{\underset{|}{CH}} - OH \Rightarrow 2°$ Allylic alcohol

$CH_2 = CH - CH_2 - OH \Rightarrow 1°$ Allylic alcohol
$CH_2 = CH - C(CH_3)_2 - OH \Rightarrow 3°$ Allylic alcohol
$CH_3 - CH = CH - CH_2 - CH_2 - OH$
$\Rightarrow$ Not allylic alcohol

**50.** **(D)** Std.12 | Ch-8
8.9 Extraction of metals

Copper pyrite = $CuFeS_2$

## MATHEMATICS

**1.** **(C)** Std.12 | Part-1 | Ch-6 | Exercise-6.1
Given cartesian equation of line is
$4x - 3z + 5 = 0, y = 2$
$\Rightarrow 4x = 3z - 5, y = 2$
$\Rightarrow 4x = 3\left(z - \frac{5}{3}\right), y = 2$

$\Rightarrow \frac{x}{3} = \frac{z - \frac{5}{3}}{4}, y = 2$

$\therefore$ The given line passes $\left(0, 2, \frac{5}{3}\right)$ and the direction ratios are proportional to 3, 0, 4.

$\therefore$ The vector equation is
$\bar{r} = \left(2\hat{j} + \frac{5}{3}\hat{k}\right) + \lambda\left(3\hat{i} + 4\hat{k}\right)$

**2.** **(C)** Std.11 | Part-2 | Ch-3 | Exercise-3.1
There are 3 books on physics, 2 books on Chemistry and 4 books on Mathematics.
All Physics books and Mathematics books are kept together.

$\therefore$ All Physics books will be considered as 1 unit and all Mathematics books are also considered as 1 unit.

$\therefore$ Physics, Mathematics and 2 Chemistry books can be arranged in 4! ways.
Also, 3 Physics and 4 Mathematics books can be arranged themselves in $3! \times 4!$ ways

$\therefore$ Total number of arrangements $= 4! \times 3! \times 4!$
$= 3456$

**3.** **(D)** Std.11 | Part-2 | Ch-7 | Exercise-7.1

$\text{L.H.L.} = \lim\limits_{x \to 0^-} \frac{x}{|x| + x^2}$
$= \lim\limits_{x \to 0^-} \frac{x}{-x + x^2}$
$= \lim\limits_{x \to 0^-} \frac{1}{x - 1} = -1$

$\text{R.H.L.} = \lim\limits_{x \to 0^+} \frac{x}{|x| + x^2}$
$= \lim\limits_{x \to 0^+} \frac{x}{x + x^2}$
$= \lim\limits_{x \to 0^+} \frac{1}{1 + x} = 1$
$= \text{L.H.L.} \neq \text{R.H.L.}$

$\therefore$ Limit does not exist.

**4.** **(A)** Std.12 | Part-1 | Ch-5 | Exercise-5.4
$\bar{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\bar{b} = \hat{i} + \hat{j}$
$|a| = \sqrt{4 + 1 + 4} = 3$

$\bar{a} \times \bar{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 1 & -2 \\ 1 & 1 & 0 \end{vmatrix} = 2\hat{i} - 2\hat{j} + \hat{k}$

$\therefore \quad |\bar{a} \times \bar{b}| = \sqrt{4 + 4 + 1} = 3$

Angle between $\bar{c}$ and $\bar{a} \times \bar{b}$ is $\frac{\pi}{6}$ …[Given]

$\therefore \quad \sin\frac{\pi}{6} = \frac{|(\bar{a} \times \bar{b}) \times \bar{c}|}{|\bar{a} \times \bar{b}||\bar{c}|}$

$\Rightarrow \frac{1}{2} = \frac{3}{3 \times |\bar{c}|}$

$\Rightarrow |\bar{c}| = 2$

Now, $|\bar{c} - \bar{a}| = 3$

$\Rightarrow |\bar{c}|^2 + |\bar{a}|^2 - 2\bar{a} \cdot \bar{c} = 9$

$\Rightarrow 4 + 9 - 2\,\bar{a} \cdot \bar{c} = 9$

$\Rightarrow \bar{a} \cdot \bar{c} = 2$

**5.** **(D)** Std.12 | Part-1 | Ch-3 | Exercise-3.3
$\cos(2\cos^{-1}x + \sin^{-1}x)$
$= \cos[(\sin^{-1}x + \cos^{-1}x) + \cos^{-1}x]$
$= \cos\left(\frac{\pi}{2} + \cos^{-1}x\right)$
$= -\sin(\cos^{-1}x)$
$= -\sin\left(\sin^{-1}\sqrt{(1 - x^2)}\right)$
$= -\sqrt{1 - x^2}$
$= -\sqrt{1 - \left(\frac{1}{5}\right)^2}$
$= -\sqrt{\frac{24}{25}} = -\frac{2\sqrt{6}}{5}$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