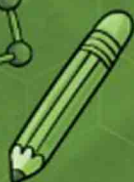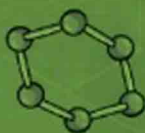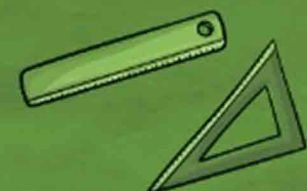Includes Statistical Analysis of All shifts
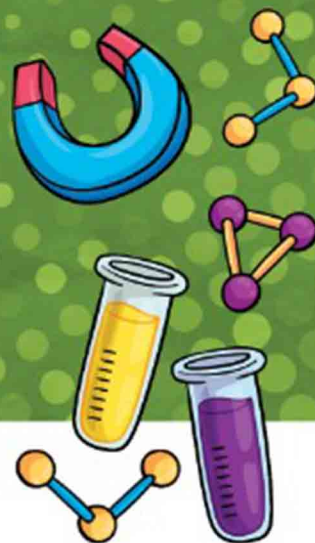
Exam EXperts

MHT-CET PCM

SOLVED PAPERS

2025

- Self-Assessment Scorecard
- Smart Keys : Thinking Hatke & Caution

Contains 15 Authentic papers conducted in 2025

Target Publications®

MHT-CET (PCM)
SOLVED PAPERS - 2025

All 15 papers conducted in 2025

Salient Features:

- **Authentic 2025 Papers:** Fifteen MHT-CET question papers for Physics, Chemistry, and Mathematics.

- **Detailed Solutions:** Includes answers and thorough explanation for all difficult questions.

- **Trend analysis:**

  - **Tables:** Chapter-wise weightage analysis of all shifts.

  - **Graphs:** Visual representation of difficulty levels for papers of each shift.

- **Concept Mapping:** Each question is mapped to the respective chapter and topic/exercise in the solution section for better comprehension.

- **Smart Keys:** (to tackle questions effectively)
  - *Thinking Hatke*
  - *Caution*

- **Assessment Tool:** Scorecards for self-assessment after each paper to track the progress.

Printed at: **Print to Print,** Mumbai

PREFACE

We are delighted to introduce our latest edition, '**MHT-CET (PCM) Solved Papers - 2025**', an exclusive compilation designed to assist students in their preparation for the MHT-CET exams. This edition includes 15 **authentic** exam papers conducted by the State Common Entrance Test Cell, covering:

Subjects: Physics, Chemistry, and Mathematics
Exam Dates: 19th April 2025 – 26th April 2025 (Morning and Afternoon Shifts), 5th May 2025 (Afternoon Shift)

This book serves as a comprehensive repository of all questions asked in the 2025 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 15 papers in each subject, helping students strategize their study plans effectively.

Key Takeaways

* **Central Repository:** All 2025 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 - 2025**' 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: Third

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 at : 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	No. of 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	Vectors, Error Analysis, 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 2, States of Matter (Gaseous and Liquids), Adsorption and colloids (Surface Chemistry), Hydrocarbons, Basic Principles of Organic Chemistry, Chemistry in Everyday Life.
3	Mathematics	Trigonometry - II, Straight Line, Circle, Probability, Complex Numbers, Permutations and Combinations, Functions, Limits, Continuity, Conic Section
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 2025 Exam Papers

Ch. no.	Std.	Chapter name	19th April (Shift I)	19th April (Shift II)	20th April (Shift I)	20th April (Shift II)	21st April (Shift I)	21st April (Shift II)	22nd April (Shift I)	22nd April (Shift II)	23rd April (Shift I)	23rd April (Shift II)	25th April (Shift I)	25th April (Shift II)	26th April (Shift I)	26th April (Shift II)	5th May (Shift II)	Total
	11th	Vectors	0	1	1	1	1	1	1	1	1	2	1	1	1	1	1	15
	11th	Error Analysis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
3	11th	Motion in a Plane	0	2	1	1	1	1	0	1	1	4	1	1	2	1	1	18
4	11th	Laws of Motion	2	1	1	1	1	1	2	1	2	0	1	1	1	1	1	17
5	11th	Gravitation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
7	11th	Thermal Properties of Matter	1	1	2	2	1	1	1	1	1	1	1	2	1	1	1	18
8	11th	Sound	1	0	1	0	1	2	1	1	2	1	1	1	1	1	1	15
9	11th	Optics	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	16
10	11th	Electrostatics	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	16
14	11th	Semiconductors	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	14
1	12th	Rotational Dynamics	4	2	3	3	3	2	3	3	2	2	3	3	2	3	3	41
2	12th	Mechanical Properties of Fluids	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	44
3	12th	Kinetic Theory of Gases and Radiation	3	4	2	1	2	4	3	3	3	1	3	3	3	2	3	40
4	12th	Thermodynamics	2	1	2	3	2	2	2	2	2	2	3	1	2	3	2	32
5	12th	Oscillations	3	3	3	3	3	3	3	3	2	2	3	3	3	4	3	44
6	12th	Superposition of Waves	3	4	3	3	3	3	2	3	3	2	3	3	3	2	3	43
7	12th	Wave Optics	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	46
8	12th	Electrostatics	3	2	3	3	3	3	4	3	3	3	3	3	3	3	2	44
9	12th	Current Electricity	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	31
10	12th	Magnetic Fields due to Electric Current	2	2	2	2	2	1	2	3	2	3	3	2	1	2	2	31
11	12th	Magnetic Materials	1	1	1	1	1	2	1	1	1	1	0	1	2	1	1	16
12	12th	Electromagnetic Induction	3	2	3	3	2	2	3	1	3	3	2	3	3	3	3	40
13	12th	AC Circuits	3	4	3	3	2	2	2	4	3	3	4	3	3	3	3	46
14	12th	Dual Nature of Radiation and Matter	2	2	2	2	2	2	2	2	2	3	3	2	2	2	2	32
15	12th	Structure of Atoms and Nuclei	2	3	2	2	2	2	2	2	2	2	1	2	2	2	2	30
16	12th	Semiconductor Devices	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	31
		Total	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	750

PHYSICS

Difficulty level-wise Analysis of MHT-CET 2025 Exam Papers

Chart axis values: 50, 45, 40, 35, 30, 25, 20, 15, 10, 5, 0

Categories: 19th April (Shift I), 19th April (Shift II), 20th April (Shift I), 20th April (Shift II), 21st April (Shift I), 21st April (Shift II), 22nd April (Shift I), 22nd April (Shift II), 23rd April (Shift I), 23rd April (Shift II), 25th April (Shift I), 25th April (Shift II), 26th April (Shift I), 26th April (Shift II), 5th May (Shift II)

Legend: ■ Easy ■ Medium ■ Difficult

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 fifteen 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.
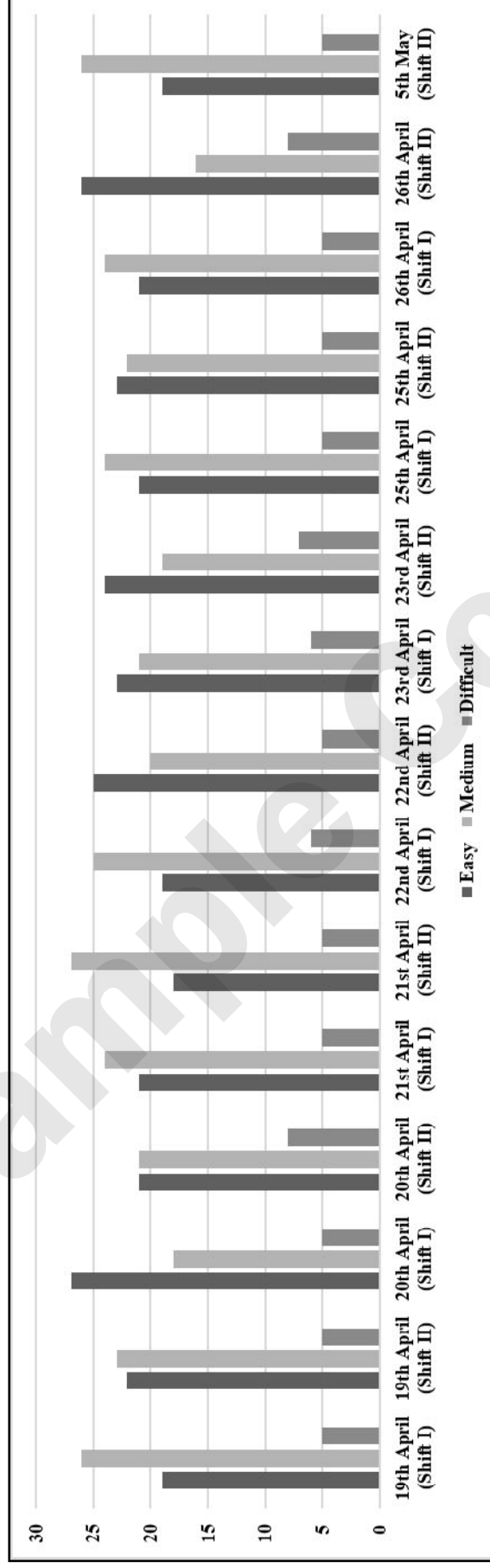
CHEMISTRY

Chapter-wise Analysis of MHT-CET 2025 Exam Papers

Ch. no.	Std.	Chapter name	19th April (Shift I)	19th April (Shift II)	20th April (Shift I)	20th April (Shift II)	21st April (Shift I)	21st April (Shift II)	22nd April (Shift I)	22nd April (Shift II)	23rd April (Shift I)	23rd April (Shift II)	25th April (Shift I)	25th April (Shift II)	26th April (Shift I)	26th April (Shift II)	5th May (Shift II)	Total
1	11th	Some Basic Concepts of Chemistry	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	16
4	11th	Structure of Atom	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
5	11th	Chemical Bonding	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
6	11th	Redox Reactions	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
8	11th	Elements of Group 1 and Group 2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
10	11th	States of Matter: Gaseous and Liquid States	1	1	1	1	1	1	1	0	1	1	1	1	2	1	1	15
11	11th	Adsorption and Colloids	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
14	11th	Basic Principles of Organic Chemistry	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
15	11th	Hydrocarbons	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
16	11th	Chemistry in Everyday Life	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
1	12th	Solid State	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45
2	12th	Solutions	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45
3	12th	Ionic Equilibria	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45
4	12th	Chemical Thermodynamics	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45
5	12th	Electrochemistry	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	44
6	12th	Chemical Kinetics	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45
7	12th	Elements of Groups 16, 17 and 18	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	31
8	12th	Transition and Inner Transition Elements	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	30
9	12th	Coordination Compounds	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	30
10	12th	Halogen Derivatives	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45
11	12th	Alcohols, Phenols and Ethers	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3	43
12	12th	Aldehydes, Ketones and Carboxylic Acids	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45
13	12th	Amines	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	31
14	12th	Biomolecules	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	30
15	12th	Introduction to Polymer Chemistry	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	30
16	12th	Green Chemistry and Nanochemistry	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
		Total	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	750

CHEMISTRY

Difficulty level-wise Analysis of MHT-CET 2025 Exam Papers

Chart legend: ■ Easy ■ Medium ■ Difficult

X-axis categories: 19th April (Shift I), 19th April (Shift II), 20th April (Shift I), 20th April (Shift II), 21st April (Shift I), 21st April (Shift II), 22nd April (Shift I), 22nd April (Shift II), 23rd April (Shift I), 23rd April (Shift II), 25th April (Shift I), 25th April (Shift II), 26th April (Shift I), 26th April (Shift II), 5th May (Shift II)

Y-axis: 0, 5, 10, 15, 20, 25, 30

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 fifteen 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 2025 Exam Papers

Ch. no.	Std.	Part	Chapter name	19th April (Shift I)	19th April (Shift II)	20th April (Shift I)	20th April (Shift II)	21st April (Shift I)	21st April (Shift II)	22nd April (Shift I)	22nd April (Shift II)	23rd April (Shift I)	23rd April (Shift II)	25th April (Shift I)	25th April (Shift II)	26th April (Shift I)	26th April (Shift II)	5th May (Shift II)	Total
3	11th	1	Trigonometry - II	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
5	11th	1	Straight Line	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	14
6	11th	1	Circle	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	14
7	11th	1	Conic Section	1	1	1	1	1	0	2	1	1	1	1	1	2	1	1	16
9	11th	1	Probability	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
1	11th	2	Complex Numbers	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	14
3	11th	2	Permutations and Combinations	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
6	11th	2	Functions	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
7	11th	2	Limits	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
8	11th	2	Continuity	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
1	12th	1	Mathematical Logic	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	31
2	12th	1	Matrices	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
3	12th	1	Trigonometric Functions	5	5	5	5	5	5	5	6	5	5	5	5	5	5	5	76
4	12th	1	Pair of Straight Lines	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
5	12th	1	Vectors	5	4	5	5	4	7	5	5	5	5	5	5	6	5	5	76
6	12th	1	Line and Plane	5	6	5	5	6	4	5	5	5	5	5	5	4	5	5	75
7	12th	1	Linear Programming	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
1	12th	2	Differentiation	3	3	3	3	2	3	3	3	3	3	3	3	2	3	3	43
2	12th	2	Applications of Derivatives	4	4	4	4	5	5	4	4	4	4	4	4	3	4	4	61
3	12th	2	Indefinite Integration	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45
4	12th	2	Definite Integration	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	30
5	12th	2	Application of Definite Integration	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
6	12th	2	Differential Equations	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	60
7	12th	2	Probability Distributions	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	30
8	12th	2	Binomial Distribution	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
			Total	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**750**

MATHEMATICS

Difficulty level-wise Analysis of MHT-CET 2025 Exam Papers
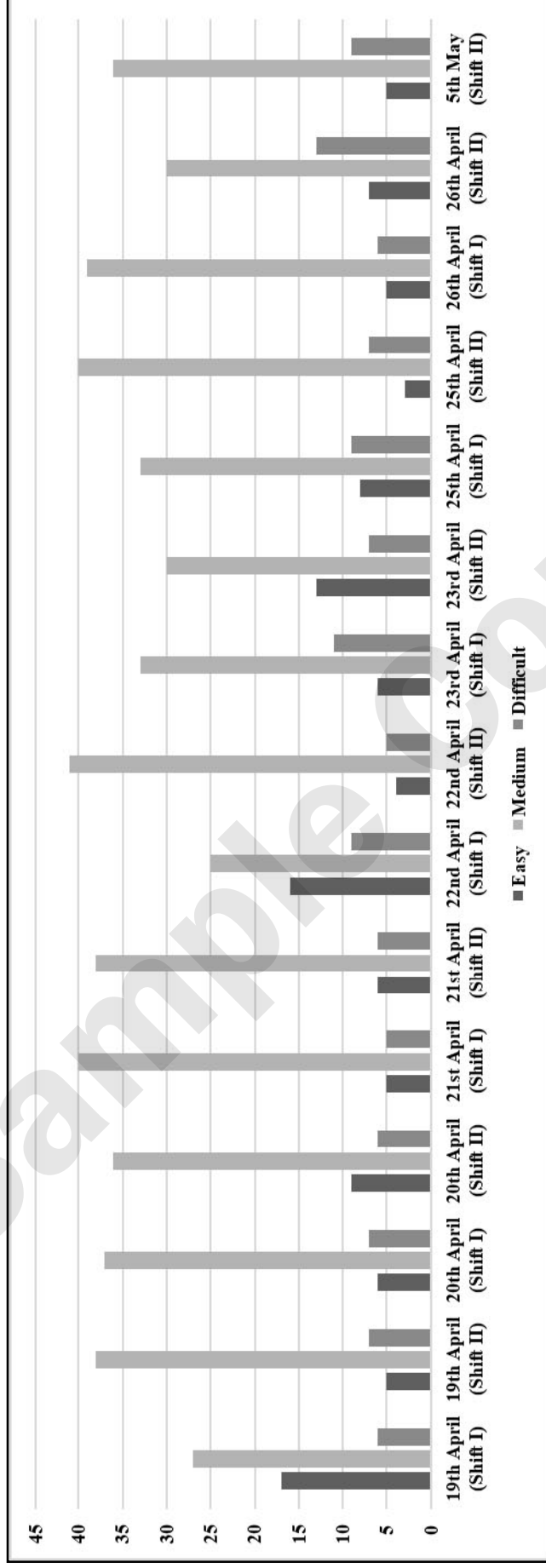
Legend: ■ Easy ■ Medium ■ Difficult

X-axis categories: 19th April (Shift I), 19th April (Shift II), 20th April (Shift I), 20th April (Shift II), 21st April (Shift I), 21st April (Shift II), 22nd April (Shift I), 22nd April (Shift II), 23rd April (Shift I), 23rd April (Shift II), 25th April (Shift I), 25th April (Shift II), 26th April (Shift I), 26th April (Shift II), 5th May (Shift II)

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:** While the distribution of easy, medium, and difficult questions varies among the fifteen 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.

Time: 180 Minutes　　　Physics, Chemistry and Mathematics　　　Total Marks: 200

Physics and Chemistry

Time: 90 Minutes　　　　　　　　　　　　　　　　　　Total Marks: 100

PHYSICS

1. In hydrogen spectrum, the ratio of wavelengths of the last line of Lyman series and that of the last line of Balmer series is
(A) 1　(B) 0.5　(C) 0.25　(D) 0.2

2. For a perfectly black body, coefficient of emission is
(A) zero.
(B) unity.
(C) less than one (non-zero).
(D) infinity.

3. The potential difference $(V_A - V_B)$ between the points A and B in the given figure is
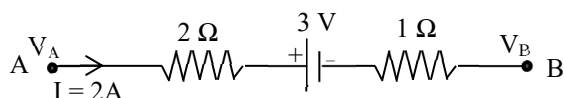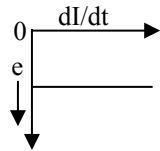
(A) 6 V　(B) − 3V　(C) 9 V　(D) 3 V

4. Which one of the following person is in an inertial frame of reference?
(A) A person (man) in a train which is slowing down to stop.
(B) A person (child) revolving in a merry-go-round.
(C) A person (driver) in a bus which is moving with constant velocity.
(D) A person (pilot) in an aeroplane which is taking off.

5. Two discs A and B of same material and thickness have radii R and 3R respectively. Their moments of inertia about their axis will be in the ratio
(A) 3:1　　　　　(B) 1:9
(C) 1:81　　　　(D) 1:27

6. When an observer moves towards a stationary source with velocity 'V_1', the apparent frequency of emitted note is 'F_1'. When observer moves away from stationary source with velocity 'V_1' the apparent frequency is 'F_2'. If 'v' is velocity of sound in air and $\frac{F_1}{F_2} = 2$, then $\frac{V}{V_1}$ is equal to
(A) 6　(B) 5　(C) 3　(D) 4

7. For the following reaction, the particle ' x ' is $_6C^{11}$ $\longrightarrow$ $_5B^{11} + \beta + X$
(A) proton　　　(B) neutrino
(C) anti neutrino　(D) neutron

8. In fundamental mode, the time required for the sound wave to reach up to closed end of a pipe filled with air is ' t ' second. The frequency of vibration of air column is (Neglect end correction)
(A) $(4t)^{-1}$　　　　(B) $(2t)^{-1}$
(C) 4t　　　　　　(D) 2t

9. A wire has three different sections as shown in figure. The magnitude of the magnetic field produced at the centre 'O' of the semicircle by three sections together is (μ_0 = permiability of free space)
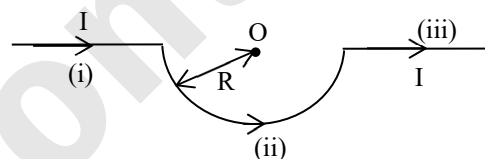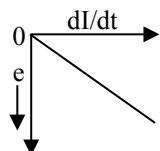
(A) $\frac{\mu_0 I}{4R}$　　　　(B) $\frac{\mu_0 I}{2R}$
(C) $\frac{\mu_0 I}{4\pi R}$　　　(D) $\frac{\mu_0 I}{2\pi R}$

10. A student measures time for 20 oscillations of a simple pendulum as 30 s, 32 s, 35 s and 35 s . If the minimum division in the measuring clock is 1 s , then correct mean time (in second) is
(A) (33 ± 2)　　　(B) (32 ± 3)
(C) (33 ± 3)　　　(D) (32 ± 2)

11. Light of wavelength ' λ ' falls on a metal having work function $\frac{hc}{\lambda_0}$. Photoelectric effect will take place only if (λ_0 is the threshold wavelength)
(A) $\lambda \geq \lambda_0$　　　(B) $\lambda \geq 2\lambda_0$
(C) $\lambda \leq \lambda_0$　　　(D) $\lambda = 4\lambda_0$

12. For a particle moving in a circle with constant angular speed, which of the following statements is 'false'?
(A) The velocity vector is tangent to the circle.
(B) The acceleration vector is tangent to the circle.
(C) The velocity and acceleration vectors are perpendicular to each other.
(D) The acceleration vector points to the centre of the circle.
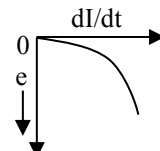
13. In Young's double slit experiment, the distance between screen and aperture is 1 m. The slit width is 2 mm. Light of 6000 Å is used. If a thin glass plate ($\mu = 1.5$) of thickness 0.04 mm is placed over one of the slits, then there will be a lateral displacement of the fringes by

(A) 0.5 cm (B) 1 cm
(C) 1.5 cm (D) 2 cm

14. For an ideal diode, in forward and reverse biased condition the resistance is respectively

(A) infinite, zero. (B) infinite, infinite.
(C) zero, zero. (D) zero, infinite.

15. In Young's double slit experiment, when light of wavelength 600 nm is used, 18 fringes are observed on the screen. If the wavelength of light is changed to 400 nm , the number of fringes observed on the screen is

(A) 12 (B) 18 (C) 22 (D) 24

16. If $\vec{A} = \hat{i} + \hat{j} + 3\hat{k}$, $\vec{B} = -\hat{i} + \hat{j} + 4\hat{k}$ and $\vec{C} = 2\hat{i} - 2\hat{j} - 8\hat{k}$, then the angle between the vectors $\vec{P} = \vec{A} + \vec{B} + \vec{C}$ and $\vec{Q} = \left(\vec{A} \times \vec{B}\right)$ is (in degree)

(A) 0° (B) 45°
(C) 90° (D) 60°

17. A coil of self-inductance L is connected in series with a bulb and an a. c. source. Brightness of the bulb decreases when

(A) an iron rod is inserted in the coil.
(B) frequency of a.c. source is decreased.
(C) number of turns in the coil is reduced.
(D) a capacitance of reactance ($X_C - X_L$) is included in the same circuit.

18. The period of S. H.M. of a particle is 16 second. The phase difference between the positions at t = 2 s and t = 4 s will be

(A) π (B) $\dfrac{\pi}{2}$ (C) $\dfrac{\pi}{4}$ (D) $\dfrac{\pi}{8}$

19. A body cools from 60°C to 40°C in 6 minutes. After next 6 minutes its temperature will be (Temperature of the surroundings is 10°C)

(A) 24°C (B) 28°C
(C) 18°C (D) 32°C

20. A parallel beam of light is incident normally on a plane surface absorbing 50% of the light and reflecting the rest. If the incident beam carries 90 W of power, the force exerted by it on the surface is (C = velocity of light in air = 3×10^8 m/s)

(A) 4.5×10^{-7} N (B) 1.5×10^{-7} N
(C) 3×10^{-7} N (D) 9×10^{-7} N

21. A tyre of a vehicle is filled with air having pressure 270 kPa at 27°C. The air pressure in the tyre when the temperature increases to 37°C is

(A) 282 kPa (B) 270 kPa
(C) 265 kPa (D) 279 kPa

22. A 20 Ω resistance, 10 mH inductance coil and 15 µF capacitor are joined in series. When a suitable frequency alternating current source is joined to this combination, the circuit resonates. If the resistance is made $\dfrac{1}{3}$ rd, the resonant frequency

(A) remains unchanged.
(B) is doubled.
(C) is quadrupled.
(D) is halved.

23. If the period of a oscillation of mass 'm' suspended from a spring is 2 s , then the period of suspended mass '4m' with the same spring will be

(A) 1s (B) 3s (C) 2s (D) 4s

24. The current flowing through an inductor of self-inductance L is continuously increasing at constant rate. The variation of induced e.m.f. (e) verses dI/dt is shown graphically by figure
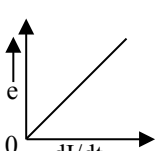
(A) B (B) A (C) D (D) C

25. Three point charges + Q, + 2Q and q are placed at the vertices of an equilateral triangle. The value of charge q in terms of Q, so that electrical potential energy of the system is zero, is given by

(A) $q = \dfrac{1}{3}Q$ (B) $q = \dfrac{2}{3}Q$
(C) $q = -\dfrac{2}{3}Q$ (D) $q = -\dfrac{3}{2}Q$

26. The surface energy of a liquid drop is 'V'. It is sprayed into 1000 equal droplets. The surface energy of all the droplets is

(A) V (B) 10 V
(C) 100 V (D) 1000 V

27. When an n-p-n junction transistor is used as an amplifier in common emitter mode,
    (A) the base emitter junction is reverse biased.
    (B) the input impedance is high and the output impedance is low.
    (C) input signal is applied between the base and emitter and the output is obtained between collector and emitter.
    (D) the input voltage and the output voltage are in phase.

28. The average force applied on the walls of a closed container depends as T^x where T is the temperature of an ideal gas. The value of x is
    (A) 1 (B) 2 (C) 3 (D) 4

29. A hollow cylinder has a charge of 'q' C within it. If ϕ is the electric flux associated with the curved surface B, the flux linked with the plane surface A will be

    $$\boxed{©BⒶ}$$
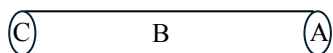
    (A) $\dfrac{\phi}{3}$
    (B) $\dfrac{q}{\varepsilon_0} - \phi$
    (C) $\dfrac{q}{3\varepsilon_0}$
    (D) $\dfrac{1}{2}\left(\dfrac{q}{\varepsilon_0} - \phi\right)$

30. A diatomic gas $\left(\gamma = \dfrac{7}{5}\right)$ is compressed adiabatically to volume $\dfrac{V_0}{32}$, where V_0 is its initial volume. The initial temperature of the gas is T_i in kelvin and the final temperature is xT_i in kelvin. The value of x is
    (A) 5 (B) 4 (C) 3 (D) 2

31. The coefficient of mutual induction is 2 H and induced e.m.f. across secondary is 2 kV. Current in the primary is reduced from 6 A to 3 A. The time required for the change of current is
    (A) 4×10^{-3} s
    (B) 6×10^{-3} s
    (C) 2×10^{-3} s
    (D) 3×10^{-3} s

32. A liquid drop having surface energy E is spread into 729 droplets of same size. The final surface energy of the droplets is
    (A) 6 E (B) 9 E (C) E (D) 3 E

33. A body is projected vertically from earth's surface with $\left(\dfrac{1}{3}\right)^{rd}$ of escape velocity. The maximum height reached by the body is (R = radius of earth)
    (A) $\dfrac{R}{4}$ (B) $\dfrac{R}{8}$ (C) $\dfrac{R}{9}$ (D) $\dfrac{R}{6}$

34. Two planar concentric rings of metal wire having radii r_1 and r_2 ($r_1 > r_2$) are placed in air. The current I is flowing through the coil of larger radius. The mutual inductance between the coils is given by (μ_0 = permeability of free space)
    (A) $\dfrac{\mu_0\pi r_1^2}{2r_2}$
    (B) $\dfrac{\mu_0\pi r_1^2}{2r_1}$
    (C) $\dfrac{\mu_0\pi(r_1 + r_2)^2}{2r_1}$
    (D) $\dfrac{\mu_0\pi(r_1 - r_2)^2}{2r_2}$

35. The work done by a gas as it is taken in a cyclic process (shown in graph) is
    (A) 2 pv
    (B) −2 pv
    (C) 3 pv
    (D) −3 v
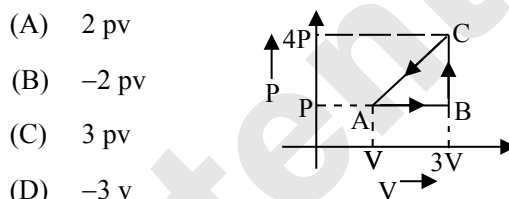
36. A conducting sphere of radius 'R' is given a charge 'Q' uniformly. The electric field and the electric potential at the centre of the sphere are respectively [ε_0 = permittivity of free space]
    (A) zero and $\dfrac{Q}{4\pi\varepsilon_0 R}$
    (B) $\dfrac{Q}{4\pi\varepsilon_0 R^2}$ and zero
    (C) $\dfrac{Q}{4\pi\varepsilon_0 R}$ and $\dfrac{Q}{4\pi\varepsilon_0 R^2}$
    (D) zero and zero

37. An inclined plane makes an angle 30° with the horizontal. A solid sphere rolling down an inclined plane from rest without slipping has linear acceleration (g = acceleration due gravity) (sin 30° = 0.5)
    (A) $\dfrac{5g}{7}$ (B) $\dfrac{5g}{14}$ (C) $\dfrac{2g}{3}$ (D) $\dfrac{g}{3}$

38. Two pipes of lengths L_1 and L_2, open at both ends are joined in series. If 'f_1' and 'f_2' are the fundamental frequencies of two pipes, then the fundamental frequency of series combination will be (neglect end correction)
    (A) $\dfrac{f_1 f_2}{f_1 - f_2}$
    (B) $f_1 + f_2$
    (C) $\dfrac{f_1 f_2}{f_1 + f_2}$
    (D) $\sqrt{f_1^2 + f_2^2}$

39. A long wire carrying a steady current is bent into a circle of single turn. The magnetic field at the centre of the coil is 'B'. If it is bent into a circular loop of radius 'r_1' having 'n' turns, the magnetic field at the centre of the coil for same current is
    (A) $\dfrac{B}{n^2}$ (B) $\dfrac{B}{n}$ (C) $n^2 B$ (D) nB

40. Two spheres each of mass M and radius R are connected with a massless rod of length 4 R. The moment of inertia of the system about an axis passing through the centre of one of the spheres and perpendicular to the rod will be
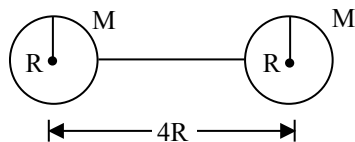
(A) $\dfrac{21}{5} MR^2$ (B) $\dfrac{84}{5} MR^2$

(C) $\dfrac{42}{5} MR^2$ (D) $\dfrac{5}{21} MR^2$

41. In Young's double slit experiment, for the n th dark fringe (n = 1, 2, 3…) the phase difference of the interfering waves in radian will be

(A) $n\dfrac{\pi}{2}$ (B) $(2n + 1)\pi$

(C) $(2n - 1)\pi$ (D) $(2n - 1)\dfrac{\pi}{2}$

42. A water drop of 0.01 cm^3 is squeezed between two glass plates and spreads in to area of 10 cm^2. If surface tension of water is 70 dyne / cm then the normal force required to separate glass plates from each other will be

(A) 12 N   (B) 14 N
(C) 16 N   (D) 28 N

43. A null point is obtained at 200 cm on potentiometer wire when cell in secondary circuit is shunted by 5 Ω. When a resistance of 15 Ω is used for shunting, null point moves to 300 cm. The internal resistance of the cell is

(A) 3 Ω   (B) 4 Ω   (C) 5 Ω   (D) 6 Ω

44. A resistance of 200 Ω and an inductor of $\dfrac{1}{2\pi}$ H are connected in series to a.c. voltage of 40 V and 100 Hz frequency. The phase angle between the voltage and current is

(A) $\tan^{-1}(1/5)$ (B) $\tan^{-1}(1/4)$
(C) $\tan^{-1}(1/3)$ (D) $\tan^{-1}(0.5)$

45. A wire of length L, diameter 'd' density of material 'e' is under tension 'T', having fundamental frequency of vibration n_A. Another wire of length 2L, tension 2T, density 2e and diameter 3d has fundamental frequency of vibration n_B. The ratio $n_B : n_A$ is

(A) 1:2   (B) 1:4   (C) 1:6   (D) 1:8

46. 'n' small spherical drops of same size which are charged to 'V' volt each coalesce to form a single big drop. The potential of the big drop is

(A) $\dfrac{V}{n}$ (B) $n.V$

(C) $n^{1/3}.V$ (D) $n^{2/3}.V$

47. In a transistor (common emitter configuration) the ratio of power gain to voltage gain is (α and β are current ratios)

(A) $\dfrac{\beta}{\alpha}$ (B) $\alpha\beta$

(C) α (D) β

48. A particle oscillates in straight line simple harmonically with period 8 second and amplitude $4\sqrt{2}$ m. Particle starts from mean position. The ratio of the distance travelled by it in 1st second of its motion to that in 2nd second is $\left(\sin 45^\circ = 1/\sqrt{2}, \sin\dfrac{\pi}{2} = 1\right)$

(A) 1:8   (B) 1:4
(C) 1:2   (D) $1:(\sqrt{2} - 1)$

49. The length of the compound microscope is 15 cm. The magnifying power for relaxed eye is 25. If the focal length of eye lens is 6 cm then the object distance for objective lens will be

(A) 1.3 cm   (B) 1.5 cm
(C) 1.7 cm   (D) 1.9 cm

50. The magnetic susceptibility of iron is 5499. The relative permeability of iron will be

(A) 5500×10^7 (B) 5500×10^{-7}
(C) 5500   (D) 5501

CHEMISTRY

1. Solubility of $Ca_3(PO_4)_2$ is 'S' mol dm^{-3}. Find solubility product.

(A) S^5 (B) $108\ S^5$
(C) $54\ S^5$ (D) $12\ S^5$

2. Which from following reagents is used in Gatterman-Koch formylation of arene?

(A) $AlH(i\text{–}Bu)_2$
(B) CO, HCl (anhyd. $AlCl_3$)
(C) $CrO_2Cl_2(CS_2)$
(D) DIBAl - H

3. Which of the following species acts as reducing agent during working of hydrogen-oxygen fuel cell?

(A) H_2 (B) O_2
(C) H^+ (D) NaOH

4. The rate constant for a first order reaction is 0.58 s^{-1} at 300 K and 0.026 s^{-1} at 290 K. What is the energy of activation? (R = 8.314 J K^{-1} mol^{-1})

(A) 124.48 kJ
(B) 224.55 kJ
(C) 348.18 kJ
(D) 513.21 kJ

Mathematics

Time: 90 Minutes   Total Marks: 100

1. The general solution of $x(x-1)\dfrac{dy}{dx} = x^3(2x-1)+(x-2)y$ is

(A) $y(x-1) = x^3 + c(x-1)$, where c is the constant of integration.

(B) $y = x^3(x-1) + c$, where c is the constant of integration.

(C) $y(x-1) = x^3(x-1) + cx^2$, where c is the constant of integration.

(D) $y(x-1) = x^3(x-1) + c$, where c is the constant of integration.

2. The direction cosines of the line $x - y + 2z = 5$ and $3x + y + z = 6$ are

(A) $\dfrac{-3}{5\sqrt{2}}, \dfrac{5}{5\sqrt{2}}, \dfrac{4}{5\sqrt{2}}$
(B) $\dfrac{3}{5\sqrt{2}}, \dfrac{-5}{5\sqrt{2}}, \dfrac{4}{5\sqrt{2}}$

(C) $\dfrac{3}{5\sqrt{2}}, \dfrac{5}{5\sqrt{2}}, \dfrac{4}{5\sqrt{2}}$
(D) $\dfrac{3}{5\sqrt{2}}, \dfrac{5}{5\sqrt{2}}, \dfrac{-4}{5\sqrt{2}}$

3. 20 is divided into two parts so that the product of the cube of one part and the square of the other part is maximum, then these two parts are

(A) 15, 5   (B) 16, 4

(C) 12, 8   (D) 14, 6

4. The acute angle between the diagonals of a parallelogram whose vertices are A(2, −1), B(0, 2), C(2, 3) and $D(4,0)$ is

(A) $\cot^{-1}2$ (B) $\cot^{-1}\left(\dfrac{1}{3}\right)$

(C) $\tan^{-1}2$ (D) $\tan^{-1}\left(\dfrac{2}{3}\right)$

5. The shortest distance between the line $y - x = 1$ and the curve $x = y^2$ is

(A) $\dfrac{3\sqrt{2}}{8}$ (B) $\dfrac{2\sqrt{3}}{8}$

(C) $\dfrac{3\sqrt{2}}{5}$ (D) $\dfrac{\sqrt{3}}{4}$

6. The equation of the circle passing through the point (1, 1) and having two diameters along the pair of lines $x^2 - y^2 - 2x + 4y - 3 = 0$ is

(A) $(x+2)^2 + (y-2)^2 = 4$

(B) $(x-3)^2 + (y-1)^2 = 4$

(C) $(x-1)^2 + (y-2)^2 = 1$

(D) $(x+1)^2 + (y+2)^2 = 1$

7. $\int \sin^5 x\, dx =$

(A) $\cos x + \dfrac{2}{3}\cos^2 x - \dfrac{\cos^5 x}{5} + c$, where c is the constant of integration

(B) $\cos x + \dfrac{2}{3}\cos^2 x + \dfrac{\cos^5 x}{5} + c$, where c is the constant of integration

(C) $-\left(\cos x - \dfrac{2}{3}\cos^2 x + \dfrac{\cos^5 x}{5} + c\right)$, where c is the constant of integration

(D) $\cos x - \dfrac{2}{3}\cos^2 x + \dfrac{\cos^5 x}{5} + c$, where c is the constant of integration

8. If the angle between the planes $x - 2y + 3z - 5 = 0$ and $x + \alpha y + 2z + 7 = 0$ is $\cos^{-1}\left(\dfrac{1}{14}\right)$ then the difference between the values of α is

(A) $\dfrac{12}{11}$ (B) $\dfrac{62}{55}$

(C) $\dfrac{31}{11}$ (D) $\dfrac{8}{5}$

9. If the shortest distance between the lines $\dfrac{x-k}{2} = \dfrac{y-4}{3} = \dfrac{z-3}{4}$ and $\dfrac{x-2}{4} = \dfrac{y-4}{6} = \dfrac{z-7}{8}$ is $\dfrac{13}{\sqrt{29}}$, then k =

(A) 1   (B) −1
(C) 2   (D) −2

10. The acute angle between the lines $x = -2 + 2t, y = 3 - 4t, z = -4 + t$ and $x = -2 - t, y = 3 + 2t, z = -4 + 3t$ is

(A) $\cos^{-1}\left(\dfrac{1}{\sqrt{6}}\right)$ (B) $\cos^{-1}\left(\dfrac{1}{\sqrt{5}}\right)$

(C) $\sin^{-1}\left(\dfrac{2}{\sqrt{5}}\right)$ (D) $\cos^{-1}\left(\dfrac{2}{\sqrt{6}}\right)$

11. If the curves $y^2 = 6x$ and $9x^2 + by^2 = 16$ intersect each other at right angles, then the value of b is

(A) 4   (B) $\dfrac{7}{2}$ (C) 6   (D) $\dfrac{9}{2}$

12. The value of $\sqrt{3}\cot 20° - 4\cos 20°$ is equal to

(A) 1   (B) −1

(C) 0   (D) $\dfrac{1}{2}$

40. If $\tan^{-1}\left(\dfrac{x}{2}\right) + \tan^{-1}\left(\dfrac{y}{2}\right) + \tan^{-1}\left(\dfrac{z}{2}\right) = \dfrac{\pi}{2}$ then

$xy + yz + zx =$

(A) 0   (B) 2   (C) –1   (D) 4

41. In a triangle ABC, with usual notations if $\dfrac{2\cos A}{a} + \dfrac{\cos B}{b} + \dfrac{2\cos C}{c} = \dfrac{a}{bc} + \dfrac{b}{ca}$ then $\angle A =$

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

42. If $f(1) = 1, f'(1) = 3$, then the derivative of $f\big(f(f(x))\big) + (f(x))^2$ at $x = 1$ is

(A) 9   (B) 12   (C) 15   (D) 33

43. If $y = \log_e x^3 + 3\sin^{-1}x + kx^2$ and $y'\left(\dfrac{1}{2}\right) = 2\sqrt{3}$, then $k =$

(A) 6   (B) –6   (C) $2\sqrt{3}$ (D) 1

44. In a triangle ABC with usual notations, if a, b, c are in arithmetic progression, then, $\tan\dfrac{A}{2} \cdot \tan\dfrac{C}{2} =$

(A) 3   (B) $\dfrac{1}{13}$ (C) –3   (D) $\dfrac{1}{3}$

45. If $\tan 3\theta = \cot\theta$, then $\theta =$

(A) $\dfrac{(2n+1)\pi}{8}, n \in \mathbb{Z}$ (B) $\dfrac{(2n+1)\pi}{4}, n \in \mathbb{Z}$

(C) $\dfrac{(n+2)\pi}{3}, n \in \mathbb{Z}$ (D) $n\pi, n \in \mathbb{Z}$

46. The shaded region in the following figure represents a solution set of
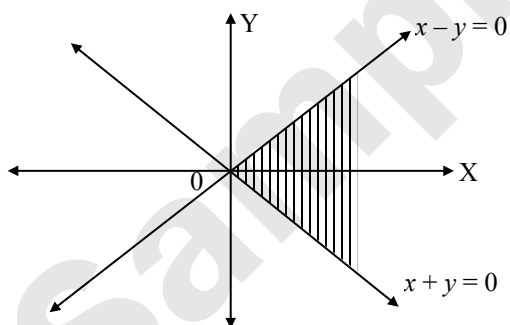
(A) $x - y \geq 0, x + y \geq 0$
(B) $x - y \leq 0, x + y \geq 0$
(C) $x - y \geq 0, x + y \leq 0$
(D) $x - y \leq 0, x + y \leq 0$

47. With usual notations, in a triangle ABC, if θ is any real number, then $a\cos(B - \theta) + b\cos(A + \theta)$ is

(A) $a\cos\theta$ (B) $b\cos\theta$
(C) $c\cos\theta$ (D) $c\cos\theta$

48. If $A = \begin{bmatrix} 1 & \tan x \\ -\tan x & 1 \end{bmatrix}$, then $A^T A^{-1} =$

(A) $\begin{bmatrix} \cos 2x & -\sin 2x \\ -\sin 2x & \cos 2x \end{bmatrix}$

(B) $\begin{bmatrix} \cos 2x & -\sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$

(C) $\begin{bmatrix} -\cos 2x & \sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$

(D) $\begin{bmatrix} -\cos 2x & \sin 2x \\ -\sin 2x & \cos 2x \end{bmatrix}$

49. The sum of the degree and order of the differential equation $\sqrt{\dfrac{d^2 y}{dx^2}} = \sqrt[5]{\dfrac{dy}{dx} - 5}$ is

(A) 1   (B) 3
(C) 5   (D) 7

50. The differential equation whose solution represents the family $x^2 y = 4e^x + c$, where c is an arbitrary constant, is

(A) $x\dfrac{dy}{dx} + xy = 0$

(B) $x^2 \dfrac{dy}{dx} + (2x - xy) = 0$

(C) $x\dfrac{dy}{dx} + (x - 2)y = 0$

(D) $x\dfrac{dy}{dx} + (2 - x)y = 0$

MHT-CET - 2025 20th April (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.*]

PHYSICS

1. (C) Std.12 | Ch-15
15.5 Atomic Spectra

Wavelength, $\frac{1}{\lambda} = R\left(\frac{1}{n^2} - \frac{1}{m^2}\right)$

For last line of Lyman series:
n = 1, m = ∞

$\frac{1}{\lambda_L} = R\left(\frac{1}{1^2} - \frac{1}{\infty^2}\right) = R$ ...(i)

For last line of Balmer series:
n = 2, m = ∞

$\frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{\infty^2}\right) = \frac{R}{4}$ ...(ii)

Dividing equation (ii) by equation (i),

$\frac{\lambda_L}{\lambda_B} = \frac{R/4}{R} = \frac{1}{4} = 0.25$

2. (B) Std.12 | Ch-3
3.12 Emission of Heat Radiation

3. (C) Std.12 | Ch-9
9.2 Kirchhoff's Laws of Electrical Network

Given circuit can also be drawn as,
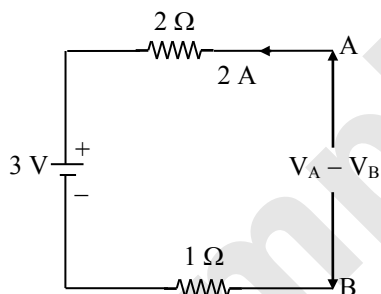
By Kirchhoff's voltage law,
$V_A - (2 \times 2) - (3) - (2 \times 1) - V_B = 0$

∴ $V_A - 4 - 3 - 2 - V_B = 0$

∴ $V_A - V_B = +9$ V

4. (C) Std.11 | Ch-4
4.4 Inertial and Non-Inertial Frames of Reference

5. (B) Std.12 | Ch-1
1.5 Moment of Inertia as an Analogous Quantity for Mass

The ratio of moments of inertia of two discs of the same mass and same thickness is given by,

$\frac{I_1}{I_2} = \frac{R_1^2}{R_2^2}$

∴ $\frac{I_1}{I_2} = \frac{R^2}{(3R)^2} = \frac{1}{9}$

6. (C) Std.11 | Ch-8
8.9 Doppler Effect

Apparent frequency is given by,

$F' = \left[\frac{V \pm V_0}{V \mp V_S}\right]F$

Since source is stationary,

∴ $V_S = 0$; $V_0 = V_1$

∴ $F_1 = \left[\frac{V + V_1}{V}\right]F$

$F_2 = \left[\frac{V - V_1}{V}\right]F$

∴ $\frac{F_1}{F_2} = \frac{V + V_1}{V - V_1}$

∴ $2 = \frac{V + V_1}{V - V_1}$

∴ $2V - 2V_1 = V + V_1$

∴ $V = 3V_1$

∴ $\frac{V}{V_1} = 3$

7. (B) Std.12 | Ch-15
15.9 Radioactive Decays

8. (A) Std.12 | Ch-6
6.7 Harmonics and Overtones

The distance between the open end and the closed end in the fundamental mode is $\frac{\lambda}{4}$. If the time required to cover the distance is t, then the time required to travel distance equal to λ will be 4t. Therefore, the period of the wave is 4t. Hence, the frequency is $\frac{1}{4t}$.

9. (A) Std.12 | Ch-10
10.12 Magnetic Field Produced by a Current in a Circular Arc of a Wire

10. (A) Std.11 | Ch-Error Analysis
2. Estimation of Errors

Mean time, t = $\frac{30 + 32 + 35 + 35}{4} = \frac{132}{4}$

= 33s

CHEMISTRY

1. **(B)** Std.12| Ch-3
3.9 Solubility product

$Ca_3(PO_4)_2 \rightleftharpoons 3Ca^{2+} + 2PO_4^{3-}$
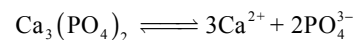
$x = 3$ $y = 2$ $K_{sp} = x^x.y^y.s^{x+y}$

∴ $K_{sp} = [Ca^{2+}]^3[PO_4^{3-}]^2 = (3S)^3 \times (2S)^2$

$= 27 \times 4 \times S^5 = 108\ S^5$

2. **(B)** Std.12| Ch-12
12.4 Preparation of aldehydes and ketones

3. **(A)** Std.12| Ch-5
5.11 Fuel cells

4. **(B)** Std.12| Ch-6
6.7 Temperature dependence of reaction rates

$\log_{10} \dfrac{k_2}{k_1} = \dfrac{E_a}{2.303\,R} \left(\dfrac{T_2 - T_1}{T_1 T_2} \right)$

Substituting the given values

$\log_{10} \dfrac{0.58}{0.026} = \dfrac{E_a}{2.303 \times 8.314\ J\ K^{-1}\ mol^{-1}}$

$\times \left[\dfrac{300\ K - 290\ K}{290\ K \times 300\ K} \right]$

$\log_{10} 22.307 = \dfrac{E_a}{2.303 \times 8.314\ J\ mol^{-1}} \times \dfrac{10}{290 \times 300}$

$1.3484 = \dfrac{E_a}{19.15\ J\ mol^{-1}} \times 1.15 \times 10^{-4}$

$E_a = \dfrac{1.3484 \times 19.15}{1.15 \times 10^{-4}}\ J\ mol^{-1}$

$= 224538\ J\ mol^{-1}$

$\approx 224.55\ kJ\ mol^{-1}$

5. **(B)** Std.11| Ch-15
15.1 Alkanes

$CH_3CH_2CH_3 + Br_2 \xrightarrow{UV\ light} CH_3 - \underset{\underset{Br}{|}}{CH} - CH_3$

Propane

2-Bromopropane (97%)
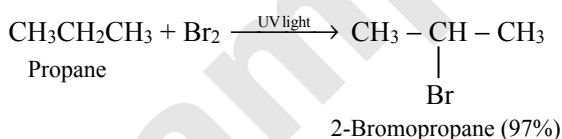
6. **(D)** Std.12| Ch-10
10.6 Chemical properties

$\underset{\text{n-propyl chloride}}{CH_3CH_2CH_2Cl} + KCN \xrightarrow[\text{(alc.)}]{\Delta}$

$\underset{\text{Butanenitrile}}{CH_3CH_2CH_2CN} + \underset{\substack{\text{Potassium}\\\text{chloride}}}{KCl}$
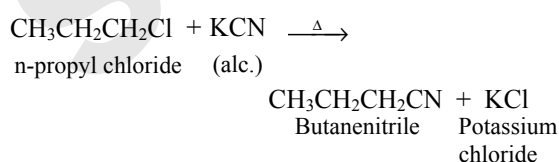
7. **(D)** Std.12| Ch-5
5.7 Electrode Potential and cell Potential

$Zn^{+2}_{(aq)} + 2e^- \longrightarrow Zn_{(s)};\quad E° = -0.76\ V$

$2Zn_{(s)} \longrightarrow 2Zn^{+2}_{(aq)} + 4e^-;$
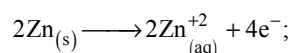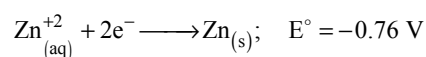
$E° = -(-0.76\ V) = +0.76\ V$

> **Caution - Q.7**
> E° is independent of the amount of substance and is an intensive property.

8. **(B)** Std.12| Ch-9
9.1 Introduction

In cisplatin, $[Pt(NH_3)_2Cl_2]$, the complex consists of two ammonia molecules and two chloride ions acting as ligands.

9. **(C)** Std.12| Ch-7
7.5 Anomalous behaviour of oxygen and fluorine

Cl has high bond dissociation enthalpy among all halogens.

> **Caution - Q.9**
> Fluorine has a small atomic size and the lone pairs on each F atom in F_2 are very close, causing strong repulsion and weakening the F–F bond. As a result, the bond dissociation enthalpy of F_2 is lower than that of Cl_2 and Br_2.

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

A free expansion means expansion against zero opposing force.
$P_{ext} = 0$ and hence, $W = 0$.

11. **(A)** Std.12| Ch-4
4.5 Expression for pressure-volume (PV) work

1 bar $dm^3 \times 100 = J$
$V_1 = 15\ dm^3$
$V_2 = 20\ dm^3$
$W = -P_{ext}\Delta V$

$P_{ext} = -\dfrac{W}{\Delta V} = -\dfrac{W}{(V_2 - V_1)}$

$P_{ext} = -\dfrac{(-600)J}{(20-15)dm^3} = \dfrac{600\ J}{5\ dm^3} \times \dfrac{1\ dm^3\ bar}{100\ J}$

$= 1.2\ bar$

[***Note:*** In the question dm^{-3} is changed to dm^3 to apply appropriate textual concepts.]

12. **(B)** Std.12| Ch-14
14.2 Carbohydrates

Formation of gluconic acid when reacted with bromine water confirms that carbonyl group in glucose is in the form of aldehyde.
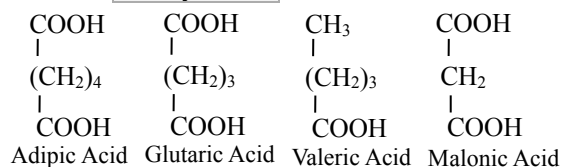
$\underset{\text{Glucose}}{\overset{\displaystyle CHO}{\underset{\displaystyle CH_2OH}{|\ (CHOH)_4\ |}}} + [O] \xrightarrow[Br_2\ water]{(O)} \underset{\text{Gluconic acid}}{\overset{\displaystyle COOH}{\underset{\displaystyle CH_2OH}{|\ (CHOH)_4\ |}}}$
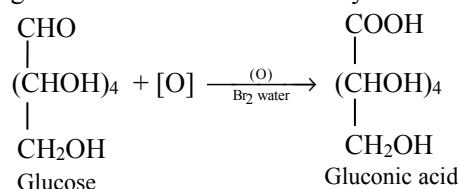
13. **(D)** Std.11| Ch-6
6.2 Oxidation number

In $Na_2S_4O_6$, Na is present in $+1$ oxidation state, whereas in other compounds, the oxidation state of metal atom is $+\dfrac{8}{3}$.
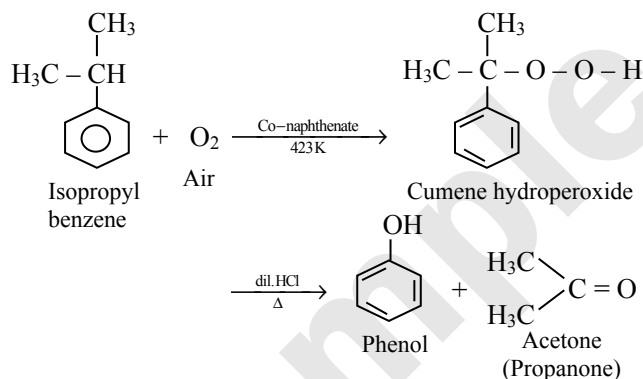
Thinking Hatke - Q.13

Alkali metals have oxidation number $+1$ in all their compounds.

14. **(C)** Std.12| Ch-12
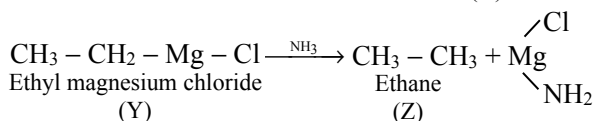12.3 Nomenclature of aldehydes, ketones and carboxylic acids

COOH	COOH	CH₃	COOH
(CH₂)₄	(CH₂)₃	(CH₂)₃	CH₂
COOH	COOH	COOH	COOH
Adipic Acid	Glutaric Acid	Valeric Acid	Malonic Acid

15. **(D)** Std.12| Ch-11
11.4 Alcohols and phenols

Cumene (isopropylbenzene) on air oxidation in presence of Co-naphthenate gives cumene hydroperoxide, which on hydrolysis with

dil. HCl gives phenol and acetone. This is the commercial method of preparation of phenol.

Isopropyl benzene + O₂ (Air) $\xrightarrow[423K]{Co-naphthenate}$ Cumene hydroperoxide

$\xrightarrow[\Delta]{dil.HCl}$ Phenol + Acetone (Propanone)

16. **(D)** Std.12| Ch-15
15.6 Commercially important polymers

17. **(D)** Std.12| Ch-10
Multifarious

$CH_3 - CH_2 - OH \xrightarrow[\Delta]{SOCl_2} CH_3 - CH_2 - Cl$
Ethanol — Ethyl chloride (X)

$CH_3 - CH_2 - Mg - Cl \xrightarrow{NH_3} CH_3 - CH_3 + Mg \begin{smallmatrix} Cl \\ NH_2 \end{smallmatrix}$
Ethyl magnesium chloride (Y) — Ethane (Z)

Thinking Hatke - Q.17

RMgX on reacting with any species that has an acidic hydrogen like H_2O, NH_3, amines, carboxylic acids, phenols, HCl etc. produces $R - H$.

18. **(B)** Std.12| Ch-4
4.9 Enthalpies of physical transformations

Molar mass of ethanol (C_2H_5OH)
$= (2 \times 12.01) + (6 \times 1.008) + (1 \times 16.00)$
$= 46.08$ g mol⁻¹

Number of moles $= \dfrac{\text{Given mass}}{\text{Molar mass}}$

$= \dfrac{11.5 \text{ g}}{46.08 \text{ g mol}^{-1}} = 0.25$ moles

Total heat supplied $= 11.8$ kJ

∴ Enthalpy of vaporization (ΔH_{vap})

$= \dfrac{\text{Heat supplied}}{\text{Number of moles}} = \dfrac{11.8 \text{ kJ}}{0.25 \text{ moles}} = 47.2$ kJ mol⁻¹

19. **(A)** Std.12| Ch-13
13.7 Reactions of arene diazonium salts

20. **(D)** Std.12| Ch-3
3.9 Solubility product

$AgBr_{(s)} \rightleftharpoons Ag^+_{(aq)} + Br^-_{(aq)}$
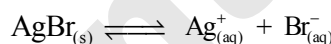
∴ $x = 1, y = 1$
$K_{sp} = x^x y^y S^{x+y} = (1)^1 (1)^1 S^{1+1} = S^2$
∴ $K_{sp} = (7.1 \times 10^{-7})^2 = 5.04 \times 10^{-13}$

21. **(D)** Std.12| Ch-12
12.9 Chemical properties of carboxylic acids

$C_2H_5 - COOCH_3 \xrightarrow[\text{dil. NaOH}]{\Delta} C_2H_5 - COONa$
Methyl propanoate — Sodium propanoate

$\xrightarrow[\text{conc.HCl}]{H^+} C_2H_5 - COOH + NaCl$
Propanoic acid
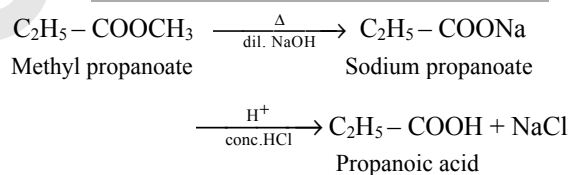
22. **(B)** Std.11| Ch-14
14.4 Nomenclature of organic compounds

23. **(C)** Std.12| Ch-11
11.5 Ethers

$CH_3 - CH - Cl + C_2H_5ONa \longrightarrow$
    |
    CH_3 — Sodium ethoxide
Isopropyl chloride
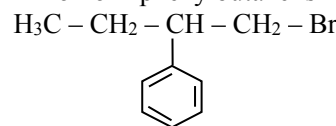
$CH_3 CH = CH_2 + C_2H_5OH + NaCl$
Propene
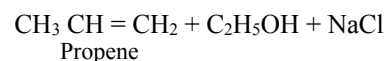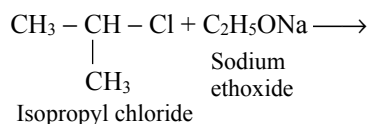
Caution - Q.23

Secondary and tertiary alkyl halides on reaction with sodium ethoxide, undergo elimination reaction leading to the formation of alkene instead of ether.

24. **(D)** Std.12| Ch-10
10.1 Classification of halogen derivatives

1-Bromo-2-phenylbutane is 1° alkyl halide.
$H_3C - CH_2 - CH - CH_2 - Br$

MATHEMATICS

1. (C) $\boxed{\text{Std.12 | Part-2 | Ch-6 | Exercise-6.5}}$

$$x(x-1)\frac{dy}{dx} = x^3(2x-1)+(x-2)y$$

∴ $$x(x-1)\frac{dy}{dx} - (x-2)y = x^3(2x-1)$$

∴ $$\frac{dy}{dx} - \frac{x-2}{x(x-1)}y = \frac{x^2(2x-1)}{x-1}$$

This is of the type

$$\frac{dy}{dx} + Py = Q$$

I.F. = $e^{\int Pdx}$

$$P = \frac{2-x}{x(x-1)} = \frac{A}{x} + \frac{B}{x-1}$$

∴ $2-x = A(x-1)+Bx$

∴ $2-x = (A+B)x - A$

∴ $A = -2$ and
$A + B = -1$
$\Rightarrow B = 1$

I.F. = $e^{\int Pdx} = e^{-\int\frac{2}{x}dx + \int\frac{1}{x-1}dx}$

$$= e^{-2\log x + \log(x-1)}$$

$$= e^{-\log x^2 + \log(x-1)}$$

$$= e^{\log\left(\frac{x-1}{x^2}\right)}$$

$$= \frac{x-1}{x^2}$$

∴ Solution of the given equation is

$$y\left(\frac{x-1}{x^2}\right) = \int\frac{x-1}{x^2}\cdot\frac{x^2(2x-1)}{x-1}dx + c$$

$$= x^2 - x + c$$

∴ $y(x-1) = x^4 - x^3 + cx^2$

∴ $y(x-1) = x^3(x-1) + cx^2$

2. (A) $\boxed{\text{Std.12 | Part-1 | Ch-6 | Exercise-6.3}}$

Given equation of planes are
$x - y + 2z = 5$
$3x + y + z = 6$
Vectors normal to given planes are
$\overline{n_1} = \hat{i} - \hat{j} + 2\hat{k}$ and
$\overline{n_2} = 3\hat{i} + \hat{j} + \hat{k}$
$\overline{n} = \overline{n_1} \times \overline{n_2}$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 2 \\ 3 & 1 & 1 \end{vmatrix}$$

$$= -3\hat{i} + 5\hat{j} + 4\hat{k}$$

∴ $\hat{n} = \frac{-3}{5\sqrt{2}}\hat{i} + \frac{5}{5\sqrt{2}}\hat{j} + \frac{4}{5\sqrt{2}}\hat{k}$

3. (C) $\boxed{\text{Std.12 | Part-2 | Ch-2 | Exercise-2.4}}$

Let $x + y = 20 \Rightarrow y = 20 - x$ …(i)
and $x^3y^2 = z$
$\Rightarrow z = x^3(20-x)^2 \Rightarrow z = 400x^3 + x^5 - 40x^4$

∴ $$\frac{dz}{dx} = 1200x^2 + 5x^4 - 160x^3$$

For maximum or minimum,

$$\frac{dz}{dx} = 0$$

$\Rightarrow 1200x^2 + 5x^4 - 160x^3 = 0$
$\Rightarrow x = 12, 20$

$$\frac{d^2z}{dx^2} = 2400x + 20x^3 - 480x^2$$

∴ $$\left(\frac{d^2z}{dx^2}\right)_{x=12} = -5760 < 0$$

∴ z is maximum at $x = 12$.
From (i), $y = 20 - 12 = 8$

∴ The parts of 20 are 12 and 8.

4. (C) $\boxed{\text{Std.11 | Part-1 | Ch-5 | Exercise-5.2}}$

Here,

Slope of 1st diagonal $(m_1) = \frac{3+1}{2-2} = \infty$

Slope of 2nd diagonal $(m_2) = \frac{0-2}{4-0} = -\frac{1}{2}$

$$\tan\theta = \left|\frac{m_2-m_1}{1+m_1m_2}\right|$$

$$= \left|\frac{\frac{m_2}{m_1}-1}{\frac{1}{m_1}+m_2}\right| = \left|\frac{1}{\frac{1}{2}}\right|$$

∴ $\tan\theta = 2$

∴ $\theta = \tan^{-1}2$

5. (A) $\boxed{\text{Std.12 | Part-2 | Ch-2 | Exercise-2.1}}$
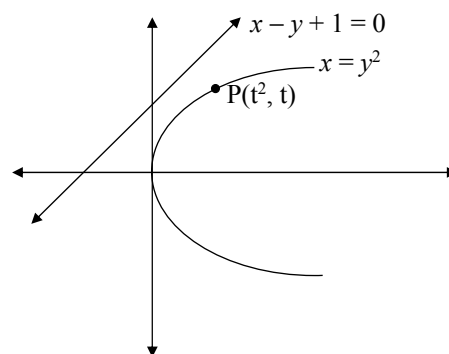
Given equation of line is
$x - y + 1 = 0$ ...(i)

∴ Slope = 1
$x = y^2$
Differentiating w.r.t. x, we get

$$1 = 2y\frac{dy}{dx}$$