

PHYSICS, CHEMISTRY & MATHEMATICS

QP Code: 100172

Common
Test- V

Time Allotted: 3 Hours

Maximum Marks: 198

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

INSTRUCTIONS

Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.

A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains **Three Sections**.
3. **Section-I** is Physics, **Section-II** is Chemistry and **Section-III** is Mathematics.
4. Each **Section** is further divided into **Two Parts: Part-A & B** in the OMR.
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

B. Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with HB pencil for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Two Parts.

- (i) **Part-A (01-06)** – Contains seven (06) multiple choice questions which have **One or More** correct answer.
Full Marks: +4 If only the bubble(s) corresponding to all the correct options(s) is (are) darkened.
Partial Marks: +1 For darkening a bubble corresponding to **each correct option**, provided NO incorrect option is darkened.
Zero Marks: 0 If none of the bubbles is darkened.
Negative Marks: -1 In all other cases.
For example, if **(A), (C) and (D)** are all the correct options for a question, darkening all these three will result in **+4 marks**; darkening only **(A) and (D)** will result in **+2 marks**; and darkening **(A) and (B)** will result in **-1 marks**, as a wrong option is also darkened.
- (ii) **Part-B (01-06)** contains Six (06) Numerical based questions with single digit integer as answer, ranging from 0 to 9 (both inclusive) and each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.
- (iii) **Part-B (07-12)** contains Six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals to **Two decimal places** (e.g. 6.25, 7.00, -0.33, -30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking**.

Name of the Candidate : _____

Batch : _____ Date of Examination : _____

Enrolment Number : _____

BATCHES – NWCM224C1R, NWCM224C2R, NWCM224C1W, NWCM224C2W,
NWCM224C3W, PANINI224-C1, PANINI224-C2

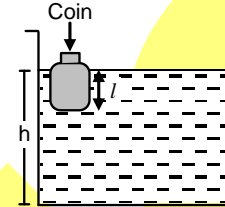
SECTION-1 : PHYSICS

PART – A

(Multi Correct Choice Type)

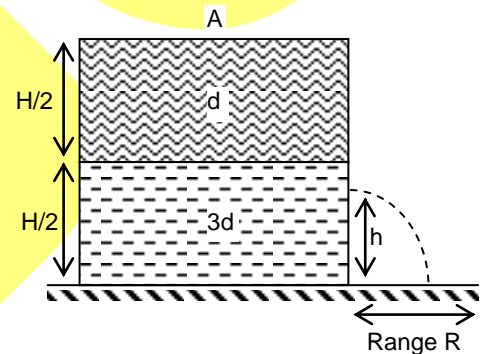
This section contains 6 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. A wooden block, with a coin placed on its top, floats in water as shown in the figure. The distances h and l are shown in figure. After sometime, the coin falls into the water. Then
- (A) h increase
 (B) h decrease
 (C) l decreases
 (D) l increases



2. The (x, y) co-ordinates of the corners of a square plate are $(0,0)$, $(L,0)$, (L,L) and $(0, L)$. The edges of the plate are clamped and transverse standing waves are set up in it. If $u(x, y)$ denotes the displacement of the plate at the point (x, y) at some instant of time, the possible expression(s) for u is (are) ($a =$ positive constant)
- (A) $a \cos(\pi x / 2L) \cos(\pi y / 2L)$ (B) $a \sin(\pi x / L) \sin(\pi y / L)$
 (C) $a \sin(\pi x / L) \sin(2\pi y / L)$ (D) $a \cos(2\pi x / L) \sin(\pi y / L)$

3. A container of large uniform cross sectional area A resting on a horizontal surface holds two immiscible non viscous and incompressible liquids of density d and $3d$, each of height $H/2$. The lower density liquid is open to the atmosphere having pressure P_0 . A tiny hole of area $a(a \ll A)$ is punched to the vertical side of lower container at a height h ($0 < h < H/2$) for which range is maximum.



- (A) $h = H/3$ (B) Range $R = \frac{2H}{3}$
 (C) Range $R = \frac{3H}{2}$ (D) Velocity of efflux $v = \sqrt{\frac{2}{3}gH}$

Space For Rough Work

4. A solid sphere moves with a terminal velocity of 20 m/s in air at a place where $g = 9.8 \text{ m/s}^2$. The sphere is taken to a gravity free place having air at the same pressure and pushed down at a speed of 20 m/s.
(A) Its initial acceleration will be 9.8 m/s^2 downwards.
(B) Its initial acceleration will be 9.8 m/s^2 upwards.
(C) The magnitude of acceleration will decrease as the time passes.
(D) It will eventually stop.
5. A source of sound of single frequency ν_0 flies along a straight line which is at a finite distance from the observer. Then the observer hears
(A) a frequency ν_0 at the instant when the source is nearest to him.
(B) a frequency greater than ν_0 at the instant when the source is nearest to him.
(C) a frequency ν_0 at an instant later than the instant of nearest position of the source.
(D) during the fly past, the increase in frequency is not equal to the decrease in the frequency
6. A closed organ pipe of length 28 cm closed at one end is found to be at resonance when a tuning fork of frequency 850 Hz is sounded near the open end. If velocity of sound in air is 340 m/s, then the
(A) air in the pipe is vibrating in fundamental mode
(B) air in the pipe is vibrating in first overtone
(C) end correction of the pipe is 1 cm
(D) end correction of the pipe is 2 cm

PART – B

Integer Answer Type

This section contains **6 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

1. If the intensity of sound is doubled, by how many decibels does the sound level increase? (in dB)
2. A bus is moving towards a huge wall with a velocity of 5 m/s. the driver sounds a horn of frequency 200 Hz. What is the frequency of beats heard by a passenger of the bus, if the speed of sound in air is 330 m/s.
3. Two soap bubbles of radii 2mm and 4mm are brought in contact. If the surface tension of liquid is $7 \times 10^{-2} \text{ Nm}^{-1}$. Then the radius of the common surface is $n \times 10^{-3} \text{ m}$ find n.
4. An air bubble of 1 cm radius is rising at a steady rate of 0.5 cm/s through a liquid of density 0.9 g/cm^3 . Calculate the coefficient of viscosity of the liquid (In 10^2 g/cm sec) Neglect the density of air.
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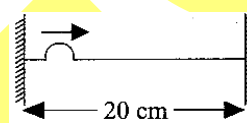
Space For Rough Work

5. A large tank is filled with water to a height H . A small hole is made at the base of the tank. It takes T_1 time to decrease the height of water to $H/9$ and it takes T_2 time to take out the rest of water. Find T_1 / T_2 .
6. A sinusoidal wave is propagating in negative x direction in a string stretched along x axis. A particle of string of $x = 2\text{m}$ is found at its mean position and its it moving in positive y direction at $t = 1\text{sec}$. The amplitude of the wave, the wave length and angular frequency of the wave are 0.1 meter, $\frac{\pi}{4}$ meter and 4π rad/s respectively. The instantaneous power transfer through $x = 2\text{m}$ and $t = 1.125$ second is

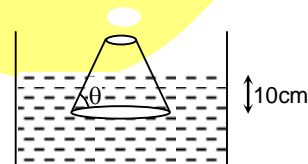
PART – B (Numerical based)

This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals).

7. A string of length 20 cm and linear mass density 0.40 g/cm is fixed at both ends and is kept under a tension of 16 N . A wave pulse is produced at $t = 0$ near an end as shown in figure which travels towards the other end. When will the string have the shape shown in the figure again? (in sec)



8. A conical flask of mass 10 kg and base area 10^3 cm^2 is floating in liquid of specific gravity 1.2 as shown in the figure. The force that liquid exerts on curved surface of conical flask is $50k$ newton. Find k (Neglect atmospheric pressure and take $g = 10\text{ m/s}^2$).



9. The surface energy of water (in joule) kept in a cylindrical vessel of radius 6.0 cm will be (Surface tension of water 0.075 J/m^2)
10. The power of sound from a speaker is raised from 10 mW to 500 mW . What is the power increased in (decibel) dB as compared to initial original power is ($\log 50 = 1.69$)
11. A large wooden plate of area 10 m^2 floating on the surface of a river is made to move horizontally with a speed of 2 m/s by applying a tangential force. River is 1 m deep and the water in contact with the bed is stationary. Then the force required to keep the plate moving with constant speed is (in newton) (Coefficient of viscosity of water $= 10^{-3}\text{ N-s/m}^2$)
12. A wave pulse in a horizontal string is represented by a function $y(x,t) = \frac{6}{2 + (x - 3t)^2}$ (c. g. s system) then the wavelength of the wave (in cm) is

Space For Rough Work

SECTION-2 : CHEMISTRY

PART – A

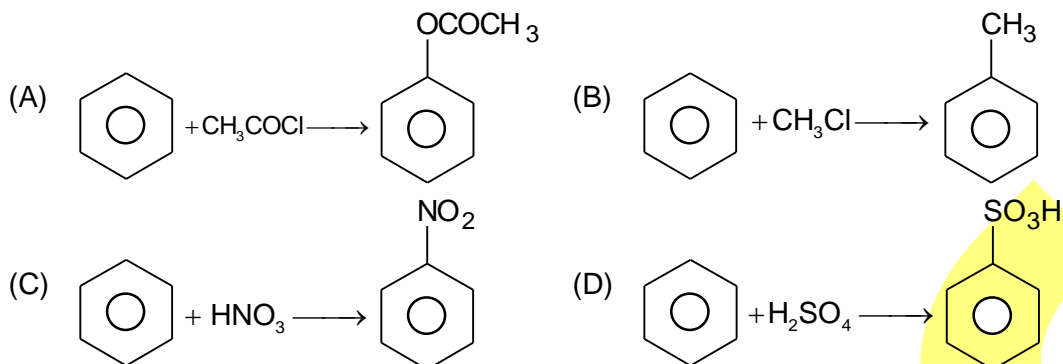
(Multi Correct Choice Type)

This section contains 6 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

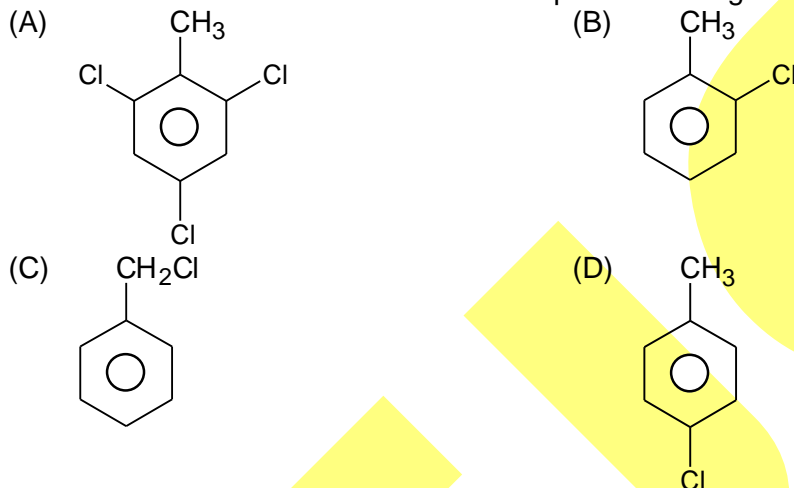
- The spontaneity means, having the potential to proceed without the assistance of external agency. The processes which occur spontaneously are
(A) flow of heat from colder to warmer body
(B) gas in a container contracting into one corner
(C) gas expanding to fill the available volume
(D) burning carbon in oxygen to give carbon dioxide
 - For an ideal gas, the work of reversible expansion under isothermal condition can be calculated by using the expression $w = -nRT \ln \frac{V_f}{V_i}$. A sample containing 0.1 mol of an ideal gas is expanded isothermally and reversibly to ten times of its original volume, in two separate experiments. The expansion is carried out at 300 K and at 600 K respectively. Choose the correct option.
(A) Work done at 600 K is 20 times the work done at 300 K
(B) Work done at 300 K is twice the work done at 600 K
(C) Work done at 600 K is twice the work done at 300 K
(D) $\Delta U = 0$ in both cases
 - Which is true about the efficiency of Carnot cycle
(A) Efficiency is always less than one
(B) Efficiency is independent of substance considered
(C) For all reversible Carnot cycle operating between the same initial and final temperature.
(D) Efficiency is one only when $T_1 = 0$; $T_2 = \infty$
 - Phenols react with
(A) sodium bicarbonate
(B) sodium hydroxide
(C) potassium hydroxide
(D) ferric chloride
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Space For Rough Work

5. In which reaction(s), polysubstitution do(es) not take place.



6. The reaction of toluene with chlorine in the presence of light cannot form



PART – B

Integer Answer Type

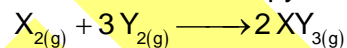
This section contains **6 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

1. When a certain mass of an ideal gas is adiabatically compressed so that its volume is reduced to $\frac{1}{32}$ times, its absolute temperature is increased 4 times. The number of atoms in a molecule of the gas are

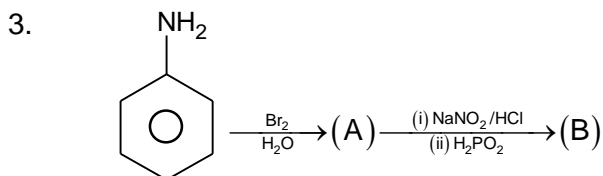
2.

Type of Bond	X – X	Y – Y	X – Y
Bond energy in kJ mol ⁻¹	128	200	120

Calculate the enthalpy change in kJ unit of the following reaction from the above data.



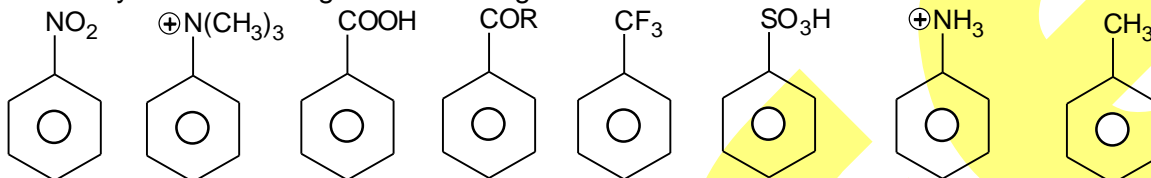
Space For Rough Work



The number of hydrogen(s) present in product B is/are

4. How many of the following are O, P-directing and activating groups towards EAS reaction?
-Cl, -NO₂, -SO₃H, -NH₂, -OH, -NR₂, -OR

5. How many of the following cannot undergo Friedel-Crafts reaction?

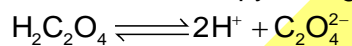


6. How many maximum number of alkyl nitrate(s) is/are formed by nitration (reaction with conc. HNO₃) of CH₃CH₂CH₃?

PART - B (Numerical based)

This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals).

7. The heat of neutralization of oxalic acid is -25.4 kcal mol⁻¹ using strong base, NaOH. Hence, the enthalpy change of the process is (in Kcal)



8. The reaction $\text{CH}_4(\text{g}) + \text{Cl}_2(\text{g}) \longrightarrow \text{CH}_3\text{Cl}(\text{g}) + \text{HCl}(\text{g})$ has $\Delta H = -25$ kcal

Bond	Bond energy kCal
$E_{\text{C}-\text{Cl}}$	84
$E_{\text{H}-\text{Cl}}$	103
$E_{\text{C}-\text{H}}$	X
$E_{\text{Cl}-\text{Cl}}$	Y

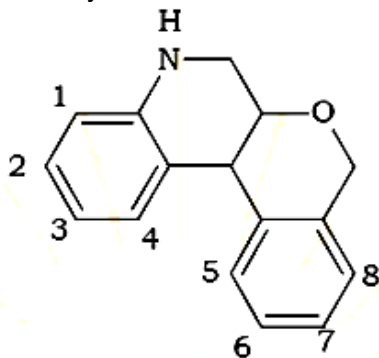
From the given data what is the bond energy of Cl - Cl bond(in kcal)

Space For Rough Work

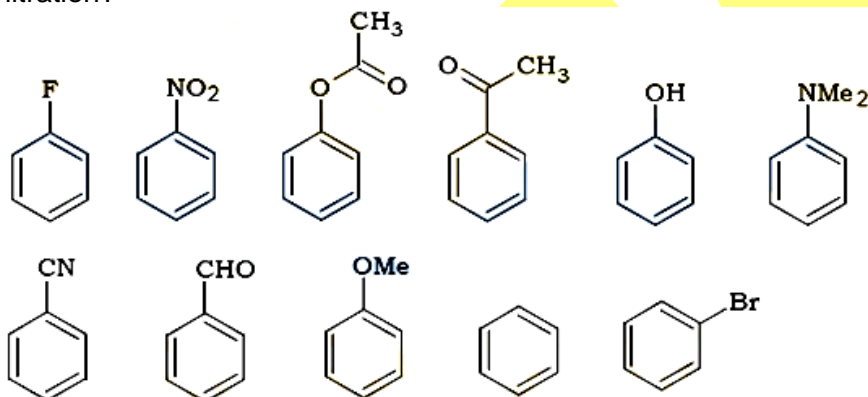
9. For the water gas reaction,

$$\text{C(s)} + \text{H}_2\text{O(g)} \rightleftharpoons \text{CO(g)} + \text{H}_2\text{(g)}$$
 The standard Gibbs free energy of reaction(at 1000 K) is -8.1 kJ mol^{-1} . Calculate its equilibrium constant

10. From which position does NO_2^\oplus replace a hydrogen from the following compound predominately?



11. How many of the following compounds are more reactive than chlorobenzene towards nitration?



12. Calculate the entropy change accompanying the following change of state
 $5 \text{ mol of O}_2(27^\circ\text{C}, 1 \text{ atm}) \rightarrow 5 \text{ mol of O}_2(117^\circ\text{C}, 5 \text{ atm})$
 $C_P \text{ for O}_2 = 6.95 \text{ cal deg}^{-1} \text{ mol}^{-1}$

Space For Rough Work

SECTION-3 : MATHEMATICS

PART – A

(Multi Correct Choice Type)

This section contains 6 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. An ellipse intersects the hyperbola $2x^2 - 2y^2 = 1$ orthogonally. The eccentricity of the ellipse is reciprocal of that of the hyperbola. If the axes of the ellipse are along the coordinates axes, then
 (A) Equation of ellipse is $x^2 + 2y^2 = 2$ (B) The foci of ellipse are $(\pm 1, 0)$
 (C) Equation of ellipse is $x^2 + 2y^2 = 4$ (D) The foci of ellipse are $(\pm\sqrt{2}, 0)$
2. A straight line touches the rectangular hyperbola $9x^2 - 9y^2 = 8$ and the parabola $y^2 = 32x$. An equation of the line is
 (A) $9x + 3y - 8 = 0$ (B) $9x - 3y + 8 = 0$
 (C) $9x + 3y + 8 = 0$ (D) $9x - 3y - 8 = 0$
3. Equation of a tangent passing through $(2, 8)$ to the hyperbola $5x^2 - y^2 = 5$ is
 (A) $3x - y + 2 = 0$ (B) $3x + y + 14 = 0$
 (C) $23x - 3y - 22 = 0$ (D) $3x - 23y + 178 = 0$
4. ${}^{2n}P_n$ is equal to
 (A) $(n+1)(n+2)\dots\dots(2n)$ (B) $2^n [1.3.5\dots\dots(2n-1)]$
 (C) $(2).(6).(10)\dots\dots(4n-2)$ (D) $n!({}^{2n}C_n)$
5. There are 12 points in a plane of which 5 are collinear. The number of distinct quadrilaterals which can be formed with vertices at these points is:
 (A) $2 \cdot {}^7P_3$ (B) 7P_3
 (C) $10 \cdot {}^7C_3$ (D) 420
6. The number of ways in which 200 different things can be divided into groups of 100 pairs is:
 (A) $\frac{200!}{2^{100}}$ (B) $\left(\frac{101}{2}\right)\left(\frac{102}{2}\right)\left(\frac{103}{2}\right)\dots\dots\dots\left(\frac{200}{2}\right)$
 (C) $\frac{200!}{2^{100}(100)!}$ (D) $(1,3,5,\dots\dots\dots,199)$

Space For Rough Work

PART – B

Integer Answer Type

This section contains **6 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

1. 5 person including 1 lady are to deliver lectures to an audience. If organizer arrange the lectures in n ways, so that the lady is always in the middle then sum of digits of n is
2. There are four balls of different colours and four boxes of colours, same as those of the balls, one each in a box, could be placed such that a ball does not go to a box of its own colour is _____
3. If the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide, then the value of b^2 is
4. The number of possible tangents which can be drawn to the curve $4x^2 - 9y^2 = 36$, which are perpendicular to the straight line $5x + 2y - 10 = 0$ is:
5. If the hyperbolas, $x^2 + 3xy + 2y^2 + 2x + 3y + 2 = 0$ and $x^2 + 3xy + 2y^2 + 2x + 3y + c = 0$ are conjugate of each other, then the value of 'c' is equal to:
6. If the eccentricity of the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$ is e then the value of $5e$ is

PART – B

(Numerical based)

This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals).

7. How many three digit numbers have at least one even digit is
8. A male and a female typist are needed in an Institution. If 10 ladies and 15 gentlemen apply, then in how many ways can the selection be made
9. Let A be the set of 4-digit numbers $a_1a_2a_3a_4$ where $a_1 > a_2 > a_3 > a_4$, then $n(A)$ is equal to
10. The eccentricity of the ellipse $9x^2 + 5y^2 - 30y = 0$ is e then the value of $3e$ is
11. The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$, and having its centre $(0, 3)$ is
12. Area of the triangle formed by the lines $x - y = 0$, $x + y = 0$ and any tangent to the hyperbola $x^2 - y^2 = 9$, is

Space For Rough Work

BATCHES – Two Yr CRP2224 C-lot Batches**Common Test – V****Code : 100172****ANSWERS****SECTION-1 : PHYSICS****PART – A**

- | | | | |
|-------|-------|--------|-------|
| 1. BC | 2. BC | 3. ABD | 4. CD |
| 5. A | 6. BD | | |

PART – B

- | | | | |
|---------|----------|----------|----------|
| 1. 3 | 2. 6 | 3. 4 | 4. 4 |
| 5. 2 | 6. 0 | 7. 0.02 | 8. 0.04 |
| 9. 0.08 | 10. 16.9 | 11. 0.02 | 12. 6.28 |

SECTION – 2 : CHEMISTRY**PART – A**

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|--------|--------|---------|--------|
| 1. CD | 2. CD | 3. ABCD | 4. BCD |
| 5. ACD | 6. ABD | | |

PART – B

- | | | | |
|---------|-------|--------|-----------|
| 1. 2 | 2. 8 | 3. 3 | 4. 4 |
| 5. 7 | 6. 4 | 7. 2.0 | 8. 57.85 |
| 9. 2.65 | 10. 3 | 11. 6 | 12. -6.88 |

SECTION – 3 : MATHEMATICS**PART – A**

- | | | | |
|-------|--------|-------|---------|
| 1. AB | 2. BC | 3. AC | 4. ABCD |
| 5. AD | 6. BCD | | |

PART – B

- | | | | |
|--------|-------|--------|--------|
| 1. 6 | 2. 9 | 3. 9 | 4. 0 |
| 5. 0 | 6. 4 | 7. 775 | 8. 150 |
| 9. 210 | 10. 2 | 11. 4 | 12. 9 |