

PHYSICS, CHEMISTRY & MATHEMATICS**QP CODE: 100878****Paper – 2****Time Allotted: 3 Hours****Maximum Marks: 180**

- 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. All the section can be filled in **PART-A & B** of 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 **Blue/Black Ball Point Pen** 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 (01-04)** – Contains Four (04) multiple choice questions which have ONLY ONE CORRECT answer. Each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.
- (ii) **PART-A (05–07)** contains (3) Multiple Choice Questions which have **One or More Than One Correct** answer.
Full Marks: +4 If only the bubble(s) corresponding to all the correct option(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.
- (iii) **Part-B (01-06)** This section contains **SIX (06)** questions. The answer to each question is a **NON-NEGATIVE INTEGER**. For each question, enter the correct integer corresponding to the answer. Each question carries **+4 marks** for correct answer. **There is no negative marking.**
- (iv) **Part-B (07-10)** This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places. Each question carries **+3 marks** for the correct answer. **There is no negative marking.**

Name of the Candidate: _____

Batch: _____ Date of Examination: _____

Enrolment Number: _____

BATCH – NWCMPA425A1_PT-3

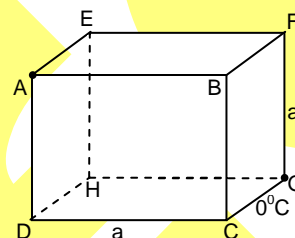
SECTION – I: PHYSICS**(PART – A)****(Single Correct Answer Type)**

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. An emf of 15V is applied in a circuit containing 5 H inductance and $10\ \Omega$ resistance. The ratio of the currents at time $t = \infty$ and $t = 1\text{ s}$ is

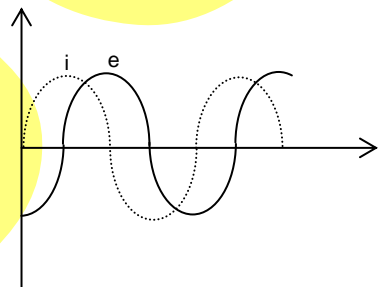
- (A) $\frac{e^{1/2}}{e^{1/2} - 1}$ (B) $\frac{e^2}{e^2 - 1}$
(C) $1 - e^{-1}$ (D) e^{-1}

2. A cubical frame is made by connecting 12 identical uniform conducting rods as shown in the figure. In the steady state the temperature of junction A is 100°C while that of G is 0°C . Then,



- (A) B and H will be at same temperature (B) Temperature of F is 40°C
(C) Temperature of D is 66.67°C (D) Temperature of E is 40°C

3. When an AC source of emf $e = E_0 \sin(100t)$ is connected across a circuit, the phase difference between the emf e and the current i in the circuit is observed to be $\frac{\pi}{4}$, as shown in the diagram. If the circuit consists possibly only of R-C or R-L or L-C in series, find the possible values of the two elements:



- (A) $R = 1\text{ k}\Omega$, $C = 10\ \mu\text{F}$ (B) $R = 1\text{ k}\Omega$, $C = 1\ \mu\text{F}$
(C) $R = 1\ \Omega$, $L = 10\text{ mH}$ (D) $R = 1\text{ k}\Omega$, $L = 1\text{ H}$

4. In case of earth:

- (A) Potential is maximum at the centre of earth
(B) Potential is same, both at centre and infinity but not zero
(C) Potential is zero, both at centre and infinity
(D) Field is zero, both at centre and infinity

Space For Rough Work

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. An ideal gas has a molar heat capacity C_v at constant volume. The molar heat capacity of this gas as a function of its volume, V

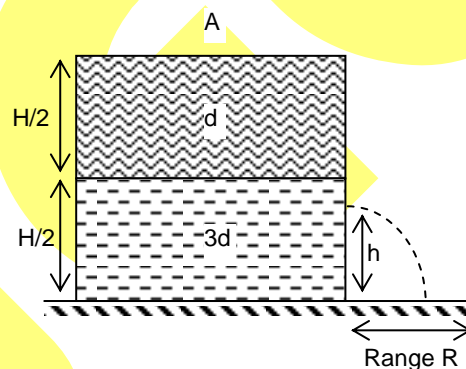
(A) is $\left(C_v + \frac{R}{\alpha V}\right)$ if the gas undergoes the process $T = T_0 e^{\alpha V}$

(B) is $\left(C_v + \frac{2R}{\alpha V}\right)$ if the gas undergoes the process $T = T_0 e^{\alpha V}$

(C) is $\left(C_v + \frac{R}{(1 + \alpha V)}\right)$ if the gas undergoes the process $P = P_0 e^{\alpha V}$

(D) is $\left(C_v + \frac{R}{\alpha V}\right)$ if the gas undergoes process $P = P_0 e^{\alpha V}$

6. 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 $v = \sqrt{\frac{2}{3}gH}$

7. Distance between centres of two stars is $10a$. Masses of the stars are M and $16M$ and radii are ' a ' and ' $2a$ ' respectively. A body of m is moved straight from the centre of larger star to that of smaller star.

(A) There will be one point of equilibrium outside the stars.

(B) There will be atleast one point of unstable equilibrium

(C) There will be three points of equilibrium between the centres of the stars.

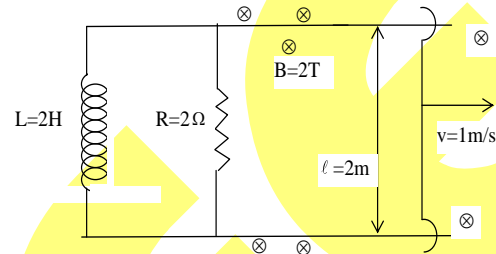
(D) Potential at the point of equilibrium outside the stars is $-\frac{5GM}{2a}$.

Space For Rough Work

(PART – B)
(Non – Negative Integer)

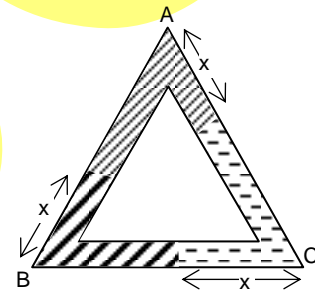
1. Three particles, each of mass m , are situated at the vertices of an equilateral triangle of side length a . The only forces acting on the particles are their mutual gravitational forces. It is desired that each particle moves in a circle while maintaining the original mutual separation a . Find the initial velocity that should be given to each particle. (take $a = \frac{GM}{16}$)

2. The given figure shows an inductor and resistance fixed on a conducting wire. A movable wire PQ starts moving on the fixed rails from $t = 0$ with constant velocity 1 m/s . A constant magnetic field ($B = 2\text{T}$) exist perpendicular to the plane of paper. If work done by the external force on the wire PQ in 2 second is $8x \text{ Joule}$, then $x =$



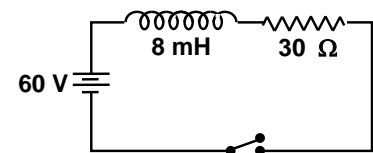
3. One mole of an ideal gas at temperature T_1 expands according to the law $\frac{P}{V^2} = a$ (constant). The work done by the gas till temperature of gas becomes T_2 is $\frac{1}{n} R[T_2 - T_1]$ then 'n' is:

4. A closed tube in the form of an equilateral triangle of side 12 m contains equal volume of three liquids which do not mix up and is placed vertically with its lowest side horizontal. Find x (in m) in the figure if the densities of liquids are in AP in clockwise



5. A satellite is moving in a circular orbit around earth at a height R above earth surface (R being radius of earth) It's velocity should be increased to \sqrt{k} times its initial orbital speed value, so as to make it escape from earth gravitational pull and reach infinity. Find k .

6. The rate of increase of current just after the switch is closed in the circuit shown is $2500n$ (in Ampere per second). Find the value of n .



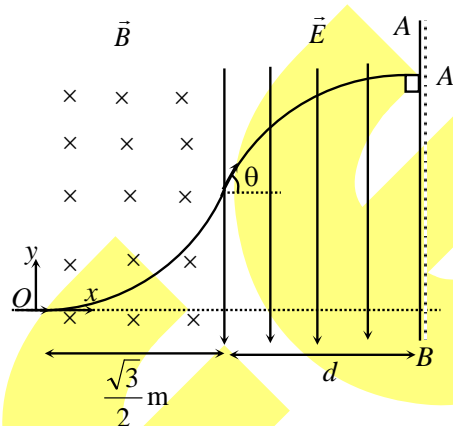
Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

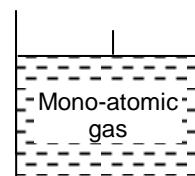
A charge particle of charge 1C and mass 10gm is moving with velocity $10 \hat{i}$ m/s in horizontal plane consisting of magnetic field $-0.1 \hat{k}$ T of width $\frac{\sqrt{3}}{2}$ m and electric field $-0.1 \hat{j}$ N/C of width d . Particle enters the magnetic field at $t = 0$ perpendicularly and follows the path as shown in the figure and strikes the wall AB perpendicularly at A' (neglect gravity)



7. The time t after which it strikes the wall is _____ seconds.
8. The width of electric field is $\frac{\sqrt{3}}{2}$ k metres, then k is _____

Paragraph for Question no. 9 to 10

2 mole of mono-atomic gas is inclosed in cylinder having frictionless movable piston. Q Joule of heat is added to the gas undergoing process $\frac{P^n}{V} = \text{constant}$. During this process gas perform $\frac{Q}{6}$ Joule of work on its surrounding. [Gas constant $R = 8.3$ in MKS system]



9. Molar heat capacity of gas (in J/mol) is _____.
10. Value of 'n' is _____.

Space For Rough Work

SECTION – II: CHEMISTRY

(PART – A)

(Single Correct Answer Type)

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

- An alkyl polyhalide is hydrolysed to an aldehyde which gives iodoform test. Which is the polyhalide?
 (A) CH_3CCl_3 (B) CH_3CHCl_2
 (C) $\text{CH}_3\text{CH}_2\text{Cl}$ (D) CCl_3CCl_2
- Reaction of (X) with KCN forms (Y). (Y) gives CH_3COOH upon hydrolysis, (X) is
 (A) CH_3Cl (B) CH_3OH
 (C) CH_3NH_2 (D) CH_3CHO
- Which temperature is expressed as $\frac{a}{Rb}$?
 (A) Critical temperature (B) Boyle temperature
 (C) Inversion temperature (D) Liquification temperature
- In the expression of reduced volume $b = 4V_m$, V_m is the volume of
 (A) one molecule (B) one mole of molecule
 (C) two molecules (D) two mole molecules

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

- $$\text{CH}_3\underset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{NHCH}_2\text{CH}_2\text{CH}_3 \xrightarrow[\text{(ii) OH}^-]{\text{(i) CH}_3\text{I}} \text{Products}$$

The possible product(s) of above reaction is/are:

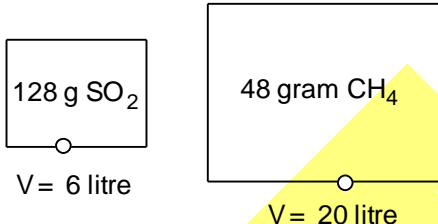
 (A) $\text{CH}_3\underset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{NCH}_3$ (B) $\text{CH}_3\text{CH}_2\text{CH}_2\text{NCH}_3$
 (C) $\text{CH}_3\underset{\text{CH}_3}{\text{C}}=\text{CH}_2$ (D) $\text{CH}_3\text{CH}=\text{CH}_2$

Space For Rough Work

6. Which products are formed by $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{COOH}$?
- (A) Oximes with NH_2OH (B) hydrazones with NH_2NH_2
 (C) Iodoforms with I_2/NaOH (D) esters with CH_3OH
7. Which of the following statement(s) is/are correct regarding the van der Waal's equation?
- $$\left(P + \frac{n^2a}{V^2}\right)(V - nb) = nRT$$
- (A) At high pressure the equation for one mole of gas reduces to $PV = Pb + RT$
 (B) At low pressure the equation for one mole of gas reduces to $PV = RT - \frac{a}{V}$
 (C) At extremely low pressure and high temperature it reduces to $PV = nRT$
 (D) At extremely high pressure and very low temperature the equation reduces to $PV = RT - Pb$.

(PART – B)
(Non – Negative Integer)

1. $2\text{H}_2\text{S} + \text{SO}_2 \longrightarrow 3\text{S} + 2\text{H}_2\text{O}$
 What is the equivalent mass of sulphur in above reaction?

2. 

If the ratio of the relative rates of effusion of the ideal gases from the two containers is expressed as $x : y$, what is the value of $(x + y)$?

3. $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3 + \text{CH}_3\text{MgBr} \xrightarrow{\text{H}_2\text{O}/\text{H}^+} (\text{X})$
- ↓
1. $\text{Cu}/300^\circ\text{C}$
- ↓
2. $\text{O}_3/\text{Zn}/\text{H}_2\text{O}$
- ↓
- (Y) + $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3$

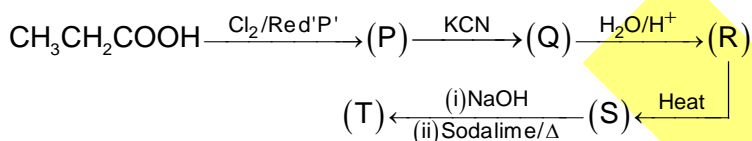
The molar mass of (Y) in above reaction in g mol^{-1} unit is

Space For Rough Work

4. How many of the following reaction(s) produce C_2H_5OH ?
- (a) $CH_3CHO \xrightarrow{LiAlH_4}$
- (b) $CH_3COOH \xrightarrow{LiAlH_4}$
- (c) $CH_2 = CH_2 \xrightarrow{H_2O/H^+}$
- (d) $CH_3COOC_2H_5 \xrightarrow{LiAlH_4}$
- (e) $C_2H_5COOC_2H_5 \xrightarrow{LiAlH_4}$
- (f) $CH_3COOC_2H_5 \xrightarrow{NaBH_4}$
5. One litre solution of NaOH contains 8 gram solute. How much mL of 0.5 M HCl solution can completely neutralize it?
6. The molar mass of the carbohydrate present in RNA in $g\ mol^{-1}$ unit is

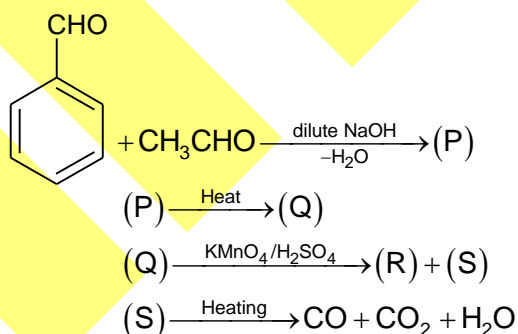
(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

Answer the following questions on the basis of above write up.

7. If the molar mass of 'T' is $X\ g\ mol^{-1}$, what is the value of $\frac{X}{20}$?
8. $(Q) \xrightarrow{LiAlH_4} (U)$
If the maximum moles of CH_3I that can be absorbed by one mole of (U) is x, what is the value of $\frac{x}{2}$?

Paragraph for Question no. 9 to 10

9. If the number of stereoisomers of (P) and (Q) are respectively x and y, what is the value of $\left(\frac{x+y}{16}\right)$?
10. Reaction of (R) with NaOH, followed by heating with sodalime produces an aromatic compound(S). If the molar mass of (S) in $x\ g\ mol^{-1}$. What is the value of $\frac{x}{52}$?

Space For Rough Work

SECTION – III: MATHEMATICS

(PART – A)

(Single Correct Answer Type)

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. Let N be the number of points (x, y, z) in space such that $x + y + z = 12$, where $x, y, z \in \mathbb{N}$.
The number of divisors of N is equal to:
(A) 2 (B) 4
(C) 9 (D) 16
2. 7 different coloured balls are to be kept in 5 different boxes. A box may contain any number of balls and no box is empty (order of balls is considered in the boxes). Then number of such ways are:
(A) $7! \cdot {}^6C_4$ (B) $7! \cdot 5! \cdot {}^6C_2$
(C) $7! \cdot 5!$ (D) none of these
3. If $\binom{2n+1}{0} + \binom{2n+1}{3} + \binom{2n+1}{6} + \dots = 170$, then n equals
(A) 2 (B) 4
(C) 6 (D) 8
4. If z satisfies $iz^2 = \bar{z}^2 + z$, then $\arg(z)$ is equal to (z is a non-zero complex number)
(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{3}$
(C) $-\frac{\pi}{4}$ (D) $-\frac{3\pi}{4}$

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. The system of equations
 $\log_{10}(2000xy) - (\log_{10} x)(\log_{10} y) = 4$
 $\log_{10}(2yz) - (\log_{10} y)(\log_{10} z) = 1$
 $\log_{10}(zx) - (\log_{10} z)(\log_{10} x) = 0$. Correct options $(x, y, z \in \mathbb{R})$ can be
 (A) $x + y + z = 7$ (B) $x + y + z = 220$
 (C) $x = z$ (D) $x = y = z$

Space For Rough Work

6. If $(9 + \sqrt{80})^n = I + f$ where I, n are integers and $0 < f < 1$, then
 (A) I is an odd integer (B) I is an even integer
 (C) $(I + f)(1 - f) = 1$ (D) $1 - f = (9 - \sqrt{80})^n$
7. Let tangents at $A(z_1)$ and $B(z_2)$ are drawn to the circle $|z| = 2$. Then which of the following is/are CORRECT?
 (A) The equation of tangent at A is given by $\frac{z}{z_1} + \frac{\bar{z}}{\bar{z}_1} = 2$.
 (B) If tangent at $A(z_1)$ and $B(z_2)$ intersect at $P(z_p)$, then $z_p = \frac{2z_1z_2}{z_1 + z_2}$
 (C) Slope of tangent at $A(z_1)$ is $\frac{1}{i} \left(\frac{z_1 + \bar{z}_1}{z_1 - \bar{z}_1} \right)$.
 (D) If points $A(z_1)$ and $B(z_2)$ on the circle $|z| = 2$ are such that $z_1 + z_2 = 0$, then tangents intersect at $\frac{\pi}{2}$.

(PART – B)
(Non – Negative Integer)

1. The mean and variance of a random variable X having a binomial distribution are 4 and 2 respectively. Then, $256P(X > 6)$ is equal to
2. If a point P denoting the complex number z moves in the Argand plane satisfying $\operatorname{Re}\left(\frac{z-3}{z+i}\right) = \frac{2}{5}$, then locus traced by z is $x^2 + y^2 + ax + by + c = 0$. The value of $(b - c - a)$ is
3. The value of $\sum_{n=1}^{9999} \frac{1}{(\sqrt{n} + \sqrt{n+1})(\sqrt[4]{n} + \sqrt[4]{n+1})}$ is
4. If $\sum_{n=1}^{49} \frac{1}{\sqrt{n} + \sqrt{n^2 - 1}} = a + b\sqrt{2}$ for some positive integers a and b then the value of $(a - b)$ is _____

Space For Rough Work

5. If the range of the function $f(x) = \frac{x^2 + ax + b}{x^2 + 2x + 3}$ is $[-5, 4]$, where $a, b \in \mathbb{N}$, then the value of $(a^2 + b^2) =$ _____

6. Let A, B, C be three sets of complex numbers as defined below.

$$A = \{z : |z+1| \leq 2 + \operatorname{Re}(z)\}, \quad B = \{z : |z-1| \geq 1\} \quad \text{and} \quad C = \left\{z : \left| \frac{z-1}{z+1} \right| \geq 1\right\}$$

The number of point(s) having integral coordinates in the region $A \cap B \cap C$ is

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

In a class of 10 students, probability of exactly i students passing an examination is directly proportional to i^2 . Then, answer the following questions:

7. The probability that exactly five students passing an examination be $\frac{p}{q}$ (where p, q are coprime) then $p + q$ is

8. If a student is selected at random, then the probability that he has passed the examination be $\frac{p}{q}$ (where p, q are coprime) then $p + q$ is

Paragraph for Question no. 9 to 10

Let $f(x)$ and $g(x)$ be two quadratic polynomials $f(x) = ax^2 + bx + c$, $g(x) = dx^2 + cx + e$ where $a, b, c, d, e, f \in \mathbb{R}$

9. If a, b, c are positive real numbers and $f(x) \geq 0 \forall x \in \mathbb{R}$ then minimum value of $\frac{a+b+c}{b}$ is

10. If $H(x) = f(x)g(x)$ where $ad=1$ and $H(1)=1, H(2)=2, H(3)=3$ then $\frac{H(-1)+H(5)}{H(0)+H(4)}$ is

Space For Rough Work

FIITJEE INTERNAL TEST

BATCH: NWCMPA425A1_PT-3

Paper – 2

Code: 100878

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

PART – A

- | | | | |
|-------|--------|---------|------|
| 1. B | 2. B | 3. C | 4. D |
| 5. AC | 6. ABD | 7. ABCD | |

PART – B

- | | | | |
|----------|----------|---------|---------|
| 1. 4 | 2. 4 | 3. 3 | 4. 4 |
| 5. 2 | 6. 3 | 7. 0.97 | 8. 5.00 |
| 9. 14.94 | 10. 0.43 | | |

Chemistry

PART – A

- | | | | |
|---------|--------|--------|------|
| 1. B | 2. A | 3. B | 4. A |
| 5. ABCD | 6. ABD | 7. ABC | |

PART – B

- | | | | |
|---------|---------|--------|--------|
| 1. 24 | 2. 19 | 3. 30 | 4. 4 |
| 5. 400 | 6. 150 | 7. 1.5 | 8. 1.5 |
| 9. 0.25 | 10. 1.5 | | |

Mathematics

PART – A

- | | | | |
|--------|--------|--------|------|
| 1. B | 2. A | 3. B | 4. C |
| 5. ABC | 6. ACD | 7. ABC | |

PART – B

- | | | | |
|--------|-------------------------------|-------|-------|
| 1. 9 | 2. 6 | 3. 9 | 4. 2 |
| 5. 277 | 6. 5 | 7. 82 | 8. 25 |
| 9. 2 | 10. 5.29 (range 5.28 to 5.29) | | |