

PHYSICS, CHEMISTRY & MATHEMATICS

QP Code: 100690

Common Test – 1

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 Six (06) 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 (07-12)** – Contains Six (06) multiple choice questions which have **One or More** 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.
- (ii) **Part-B (01-06)** 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 : _____

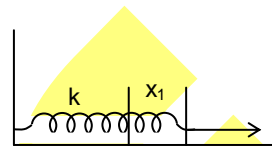
BATCH – NWCMSW425A1

SECTION-1 : PHYSICS**PART – A****(Single Correct Choice Type)**

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

1. Initially the spring is stretched by x_1 from its original length. If the work done is W , find out the additional work done to stretch it further by $(3x_1)$ distance towards right

(A) $3W$ (B) $9W$
(C) $8W$ (D) can't be found

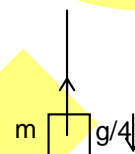


2. The relation between time t and distance x moved by a particle is $t = \alpha x^2 + \beta x$ where α and β are constants. The retardation is (if v represents velocity)

(A) $2\alpha v^3$ (B) $2\beta v^3$ (C) $2\alpha\beta v^3$ (D) $2\beta^2 v^3$

3. The work done by tension in lowering down a block of mass = m kg through a distance 'd' is

(A) $mg \frac{d}{4}$ (B) $3mg \frac{d}{4}$
(C) $-3mg \frac{d}{4}$ (D) mgd

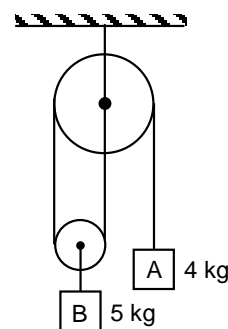


4. Given the $\vec{A} + \vec{B} = \vec{C}$ and that \vec{C} is \perp to \vec{A} . Further if $|\vec{A}| = |\vec{C}|$, then what is the angle between \vec{A} and \vec{B}

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

5. The acceleration of the blocks (A) and (B) respectively in situation shown in the figure is: (pulleys & strings are massless)

(A) $\frac{2g}{7}$ downward, $\frac{g}{7}$ upward
(B) $\frac{2g}{3}$ downward, $\frac{g}{3}$ upward
(C) $\frac{10g}{13}$ downward, $\frac{5g}{13}$ upward
(D) none of these



Space For Rough Work

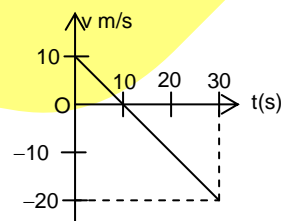
6. Average velocity of particle moving in a straight line, with constant acceleration a and initial velocity u in first t seconds
- (A) $u + \frac{1}{2}at$ (B) $u + at$ (C) $\frac{u+at}{2}$ (D) $\frac{u}{2}$

(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.

7. Which of the following are correct?
- (A) A parachutist of weight W strikes the ground with his legs and comes to rest with an upward acceleration of magnitude $3g$. Force exerted on him by ground during landing is $4W$.
- (B) Two massless spring balances are hung vertically in series from a fixed point and a mass M kg is attached to the lower end of the lower spring balance. Each spring balance reads M kgf
- (C) A rough vertical board has an acceleration a along the horizontal direction so that a block of mass m pressing against its vertical side does not fall. The coefficient of friction between the block and the board is greater than g/a .
- (D) A man is standing at a weighing machine. If man jumps away from it the reading of the weighing machine first increases and then decreases to zero.

8. The velocity-time graph for a particle moving on a straight line is shown in figure.



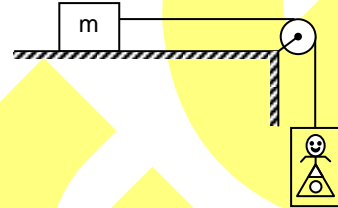
- (A) the particle has constant acceleration.
- (B) the particle has never turned around.
- (C) the particle has zero displacement at $t = 30$ s.
- (D) the average speed in the interval 0 to 10 s is the same as the average speed in the interval 10 s to 20 s.
9. A man has to hold his umbrella at 30° with the vertical to keep himself dry. He, then runs at a speed of 10 m/s leaving umbrella behind and finds the raindrops to be hitting him vertically. Speed of the raindrop with respect to the earth is
- (A) 10 m/s (B) $20\sqrt{3}$ m/s (C) 20 m/s (D) $10\sqrt{3}$ m/s
10. A particle of mass 5 kg moving in the X - Y plane has its potential energy given by $U = (-7x + 24y)$ Joule. The particle is initially at origin and has velocity $\vec{u} = (14.4\hat{i} + 4.2\hat{j})$ m/s
- (A) the particle has speed 25 m/s at $t = 4$ sec
- (B) the particle has an acceleration 5 m/s²
- (C) the acceleration of particle is normal to its initial velocity
- (D) none of these

Space For Rough Work

11. A particle initially at rest moves in a straight line with constant acceleration under a constant force F . Select the correct alternative(s). (More than one option may be correct)
- (A) power developed by this force varies linearly with time
 (B) power developed by this force varies parabolically with time
 (C) power developed by this force varies linearly with displacement
 (D) power developed by this force varies parabolically with displacement

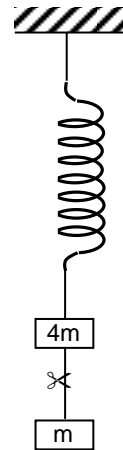
12. In the figure, a man of true mass M is standing on a weighing machine placed in a cabin. The cabin is joined by a string with a body of mass m . Assuming no friction, and negligible mass of cabin and weighing machine, the measured mass of man is (normal force between the man and the machine is proportional to the mass)

- (A) Measured mass of man is $\frac{Mm}{(M+m)}$
 (B) Acceleration of man is $\frac{mg}{(M+m)}$
 (C) Acceleration of man is $\frac{Mg}{(M+m)}$
 (D) Measured mass of man is M .



PART – B
(Numerical Type)

1. System shown in figure is in equilibrium and at rest. The spring and string are mass less, now the string is cut. The ratio of magnitudes of acceleration of mass $2m$ and m just after the string is cut is r , then $7r$ is



2. In a car race, car A takes 4 seconds less than car B to reach the finish line and passes the finishing line with velocity v more than car B. Assume cars start from rest and travel with constant acceleration $a_A = 4 \text{ m/s}^2$ and $a_B = 1 \text{ m/s}^2$. Find the value of v in m/s .

Space For Rough Work

3. A particle of mass m is moving in a circular path of constant radius $r(0.5 \text{ m})$ such that its centripetal acceleration a_c is varying with time t as $a_c = k^2rt^2$, where k is a constant, then power delivered to the particle by the forces acting on it at $t = 5 \text{ sec}$. (take $mk^2 = 1 \text{ unit}$)
4. Two seconds after the projection, a projectile is moving in a direction at 30° to the horizontal. After one more second, it is moving horizontally. The magnitude of the initial velocity is $(gy\sqrt{3})$. Find the value of 'y'.
5. A uniform chain of length ℓ and mass m overhangs a smooth table with its two third part lying on the table. If the kinetic energy of the chain as it completely slips off the table is $\frac{2}{x}mgl$, then find the value of 'x'.
6. If $\vec{A} \cdot \vec{B} = |\vec{A} \times \vec{B}|$ and $|\vec{A}|$ & $|\vec{B}|$ are $\frac{1}{\sqrt{2}}$ and 3 respectively, determine $|\vec{C}| = |\vec{A} \times \vec{B}|$.

Space For Rough Work

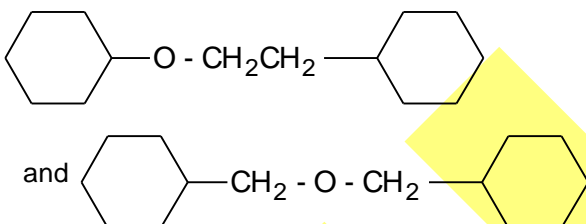
SECTION-2 : CHEMISTRY**PART – A****(Single Correct Choice Type)**

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

1. The most acidic substance out of the following is
 (A) $\text{H} - \text{CH}_2\text{COOH}$ (B) $\text{CH}_3 - \text{CH}_2\text{COOH}$
 (C) $\text{O}_2\text{N} - \text{CH}_2\text{COOH}$ (D) $\text{Cl} - \text{CH}_2\text{COOH}$

2. Which pair is not a metamer?

- (A) $\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$ and $\text{CH}_3\text{OCH}_2\text{CH}_2\text{CH}_3$
 $\text{CH}_3\text{OCH}_2\text{CH}_2\text{CH}_3$ and $\text{CH}_3\text{OCH}(\text{CH}_3)_2$
 (B)
 (C) $\text{CH}_3\text{OCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ and $\text{C}_2\text{H}_5\text{OCH}_2\text{CH}_2\text{CH}_3$

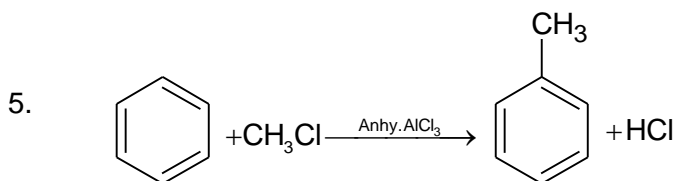
- (D) 

3. $2\text{CH}_3\text{Cl} + \text{Na} \xrightarrow{\text{Dry ether}}$ Product

Which hydrocarbon is formed in above reaction?

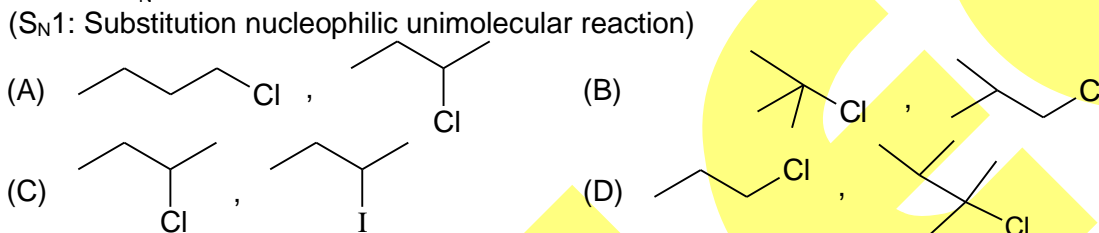
- (A) C_2H_4 (B) C_2H_2
 (C) C_2H_6 (D) CH_4
4. $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_2 - \text{C} \equiv \text{C} - \text{CH}_2 - \text{CH} = \text{CH}_2$
 How many moles of H_2 can be absorbed by one mole of above compound in presence of Ni-catalyst for complete saturation of it?
 (A) 2 (B) 7
 (C) 4 (D) 5

Space For Rough Work



The correct statement regarding above reaction is

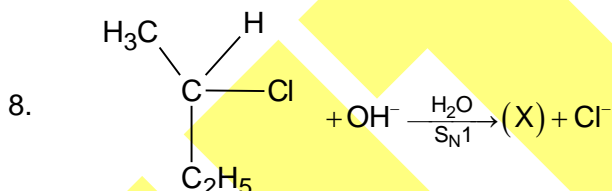
- (A) it is a nucleophilic substitution reaction
 (B) CH_3^+ is the reacting species which is generated from the reaction of CH_3Cl with anhy AlCl_3
 (C) the reactant is an aromatic compound whereas the heavier product is non-aromatic.
 (D) it is an electrophilic addition reaction
6. In which option, the left side molecule is more reactive than the right side molecule towards $\text{S}_{\text{N}}1$ reaction?
 ($\text{S}_{\text{N}}1$: Substitution nucleophilic unimolecular reaction)



(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.

7. Which of the following compound(s) is/are more basic than NH_3 ?
 (A) CH_3NH_2 (B) $(\text{CH}_3)_2\text{NH}$
 (C) CH_3Cl (D) CH_3F

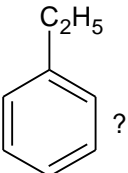


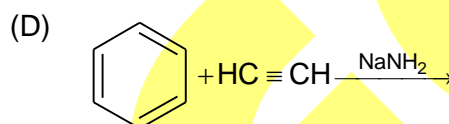
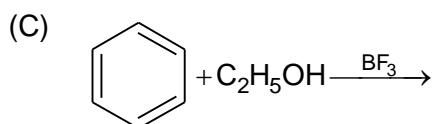
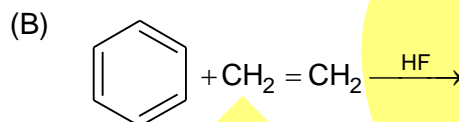
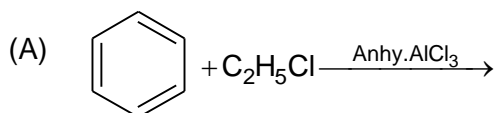
Correct statement regarding(X) is

- (A) it contain an alcoholic group
 (B) (X) is a mixture of two optically active isomers
 (C) 'X' contains a chiral carbon atom
 (D) 'X' can undergo ionization producing H^+ ion and an alkoxide ion

Space For Rough Work

9. Which of the following alkene form acetic acid(as the only product or one of the products) upon acidified KMnO_4 oxidation?
- (A) $\text{CH}_3\text{CH} = \text{CHCH}_3$ (B) $\text{CH}_3\text{CH} = \text{CH}_2$
 (C) $\text{CH}_3\text{CH} = \text{CHCH}_2\text{CH}_3$ (D) $\text{CH}_3\text{CH}_2\text{CH} = \text{CHCH}_2\text{CH}_3$

10. Which reaction(s) form(s)  ?



11. Which of the following pair of compound(s) is/are called functional isomer(s)?
- (A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3\text{OCH}_2\text{CH}_3$ (B) $\text{CH}_3\text{CH}_2\text{NH}_2$ and CH_3NHCH_3
 (C) CH_3CN and CH_3NC (D) $\text{CH}_3\text{CH}_2\text{COOCH}_3$ and $\text{CH}_3\text{COOC}_2\text{H}_5$
12. Which reaction(s) produce only $\text{CH}_3\text{CH} = \text{CHCH}_3$ (cis-or trans-or both isomers) ?
- (A) $\text{CH}_3 - \underset{\text{Cl}}{\text{CH}} - \underset{\text{Cl}}{\text{CH}} - \text{CH}_3 \xrightarrow[\Delta]{\text{Zn}}$ (B) $\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_3 \xrightarrow{\text{Na/Liquid NH}_3}$
 (C) $\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_3 \xrightarrow{\text{H}_2/\text{Ni}}$ (D) $\text{CH}_3\text{CH}_2\underset{\text{Cl}}{\text{CH}}\text{CH}_3 \xrightarrow[\Delta]{\text{Alcoholic KOH}}$

PART – B (Numerical Type)

1. If the number of alpha H-atoms present in the most stable carbocation with formula C_4H_9^+ is x, what is $\frac{x}{2}$?
2. An alkyl chloride upon reduction with LiAlH_4 forms CH_4 . What is the molar mass of the alkyl chloride in g mol^{-1} unit?

Space For Rough Work

3. An alkali polychloride upon hydrolysis forms a monocarboxylic acid. If the number of chlorine atoms present in the polychloride is 'x', what is the value of $\frac{x}{2}$?
4.
$$\begin{array}{c} \text{CH}_3\text{CH}_2\text{CH}-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$

The number of monochloro product(s) formed by above compound is 'x' without considering stereoisomer. What is the value of $\frac{x}{5}$?
5. If the number of geometrical isomer(s) possible for compound given below is x, what is the value of $\frac{x}{2}$?
- $$\text{CH}_3\text{CH}=\text{CH}-\text{CH}=\text{CHCH}_3$$
6. If the number of primary C – H bonds present in neo-pentane is x, what is the value of $\frac{x}{8}$?

Space For Rough Work

SECTION-3 : MATHEMATICS

PART – A

(Single Correct Choice Type)

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

1. The domain of the function $f(x) = \sin^{-1}\left(\frac{|x|+5}{x^2+1}\right)$ is $(-\infty, -a] \cup [a, \infty)$ then a is equal to
- (A) $\frac{\sqrt{17}-1}{2}$ (B) $\frac{\sqrt{17}}{2}$
 (C) $\frac{\sqrt{17}}{2} + 1$ (D) $\frac{1+\sqrt{17}}{2}$
2. If $R = \{(x, y) : x, y \in Z, x^2 + 3y^2 \leq 8\}$ is a relation on the set of integers Z , then the domain R^{-1} is:
- (A) $\{-2, -1, 0, 1, 2\}$ (B) $\{-2, -1, 1, 2\}$
 (C) $\{-1, 0, 1\}$ (D) $\{0, 1\}$
3. If a function $f(x)$ defined by
- $$f(x) = \begin{cases} ae^x + be^{-x}, & -1 \leq x < 1 \\ cx^2, & 1 \leq x \leq 3 \\ ax^2 + 2cx, & 3 < x \leq 4 \end{cases}$$
- be continuous for some $a, b, c \in R$ and $f'(0) + f'(2) = e$, then the value of a is
- (A) $\frac{1}{e^2 - 3e + 13}$ (B) $\frac{e}{e^2 - 3e + 13}$
 (C) $\frac{e}{e^2 + 3e + 13}$ (D) $\frac{e}{e^2 - 3e - 13}$
4. $\lim_{x \rightarrow 0} \left(\tan\left(\frac{\pi}{4} + x\right) \right)^{\frac{1}{x}}$ is equal to
- (A) 2 (B) e
 (C) e^2 (D) 1

Space For Rough Work

5. Let $f : (-1, \infty) \rightarrow \mathbb{R}$ be defined by $f(0) = 1$ and $f(x) = \frac{1}{x} \log_e(1+x)$, $x \neq 0$. Then the function f :
- (A) increases in $(-1, 0)$ and decreases in $(0, \infty)$
 (B) increases in $(-1, \infty)$
 (C) decreases in $(-1, \infty)$
 (D) decreases in $(-1, 0)$ and increases in $(0, \infty)$
6. The function, $f(x) = (3x - 7)x^{2/3}$, $x \in \mathbb{R}$, is increasing for all x lying in:
- (A) $(-\infty, \frac{14}{15})$ (B) $(-\infty, 0) \cup (\frac{3}{7}, \infty)$
 (C) $(-\infty, -\frac{14}{15}) \cup (0, \infty)$ (D) $(-\infty, 0) \cup (\frac{14}{15}, \infty)$

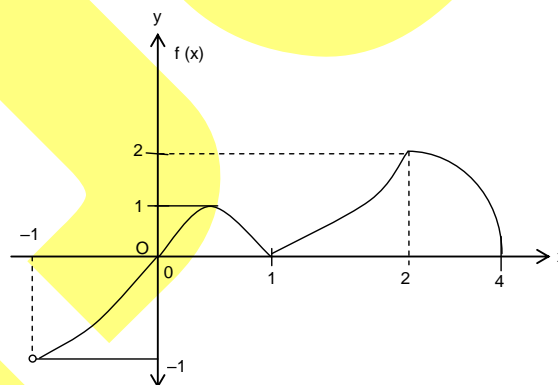
(Multi Correct Choice Type)

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.

7. If $f : \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = e^{-|x|} - e^x$ is given function, then which of the following are correct:
- (A) $f(x)$ is a many – one and into function (B) f is many one onto function
 (C) range of f is $[0, \infty]$ (D) range of f is $(-\infty, 0]$

8. If graph of a function $f(x)$ which is defined in $[-1, 4]$ is shown in the adjacent figure then identify the correct statement(s).

- (A) domain of $f(|x| - 1)$ is $[-5, 5]$
 (B) range of $f(|x| + 1)$ is $[0, 2]$
 (C) range of $f(-|x|)$ is $[-1, 0]$
 (D) domain of $f(|x|)$ is $[-3, 3]$



9. The angle between tangents to the curves $y = x^2$ and $x = y^2$ at $(1, 1)$ is:
- (A) $\cos^{-1} \frac{4}{5}$ (B) $\sin^{-1} \frac{3}{5}$
 (C) $\tan^{-1} \frac{3}{4}$ (D) $\tan^{-1} \frac{1}{3}$

Space For Rough Work

10. If $\phi(x) = f(x) + f(2a - x)$ and $f''(x) > 0$, $a > 0$, $0 \leq x \leq 2a$, then:
 (A) $\phi(x)$ increases in $(a, 2a)$ (B) $\phi(x)$ increases in $(0, a)$
 (C) $\phi(x)$ decreases in $(a, 2a)$ (D) $\phi(x)$ decreases in $(0, a)$

11. Let $f(x) = \begin{cases} \frac{\ln(1+2x)}{x}, & -\frac{1}{2} < x < 0 \\ 2\cos x, & x = 0 \\ \frac{e^{2x} - 1}{x}, & 0 < x < 1 \\ e^2 - 1, & x \geq 1 \end{cases}$ then:

- (A) $f(x)$ is continuous at $x = 0$ (B) $f(x)$ is not differentiable at $x = 0$
 (C) $f(x)$ is continuous at $x = 1$ (D) $\lim_{x \rightarrow 0^+} [f(x)] = 1$

[Note : $[k]$ denotes greatest integer less than or equal to k]

12. Let $f(x) = \max.(|x|, [x], \cos x)$, $-\frac{\pi}{2} < x \leq \frac{\pi}{2}$ then:

[Note : $[x]$ denotes greatest integer less than or equal to x .]

- (A) $f(0) = 1$ (B) $f'(0) = 0$
 (C) $f(x) = 1$ has 3 solutions (D) $f\left(\frac{\pi}{2}\right) = 0$

PART - B (Numerical Type)

1. If the tangent to the curve $y = x + \sin y$ at a point (a, b) is parallel to the line joining $\left(0, \frac{3}{2}\right)$ and $\left(\frac{1}{2}, 2\right)$, then $|b - a| =$
2. If $y = mx + 4$ is a tangent to both the parabolas, $y^2 = 4x$ and $x^2 = 2by$, then $|b|$ is equal to:
3. If $\lim_{x \rightarrow 1} \frac{x + x^2 + x^3 + \dots + x^n - n}{x - 1} = 820$, ($n \in \mathbb{N}$) then the value of n is equal to _____
4. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function which satisfies $f(x + y) = f(x) + f(y) \forall x, y \in \mathbb{R}$. If $f(1) = 2$ and $g(n) = \sum_{k=1}^{n-1} f(k)$, $n \in \mathbb{N}$, then the value of n for which $g(n) = 20$ is
5. Let $[t]$ denote the greatest integer $\leq t$. If for some $\lambda \in \mathbb{R} - \{0, 1\}$, $\lim_{x \rightarrow 0} \left| \frac{1 - x + |x|}{\lambda - x + [x]} \right| = L$, then L is equal to:
6. The value of $(0.16)^{\log_{2.5} \left(\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots \text{to } \infty \right)}$ is equal to _____.

Space For Rough Work

BATCH – NWCMSW425A1**QP Code: 100690****ANSWERS****SECTION-1 : PHYSICS****PART – A**

- | | | | |
|------|---------|---------|--------|
| 1. C | 2. A | 3. C | 4. C |
| 5. A | 6. A | 7. ABCD | 8. AD |
| 9. C | 10. ABC | 11. AD | 12. AC |

PART – B

- | | | | |
|---------|--------|---------|------|
| 1. 1.75 | 2. 8 | 3. 2.50 | 4. 2 |
| 5. 4.5 | 6. 1.5 | | |

SECTION – 2 : CHEMISTRY**PART – A**

- | | | | |
|--------|---------|---------|--------|
| 1. C | 2. B | 3. C | 4. C |
| 5. B | 6. B | 7. AB | 8. ABC |
| 9. ABC | 10. ABC | 11. ABC | 12. AB |

PART – B

- | | | | |
|---------|----------|--------|--------|
| 1. 4.50 | 2. 50.50 | 3. 1.5 | 4. 0.8 |
| 5. 1.5 | 6. 1.5 | | |

SECTION – 3 : MATHEMATICS**PART – A**

- | | | | |
|-------|--------|---------|---------|
| 1. D | 2. C | 3. B | 4. C |
| 5. C | 6. D | 7. AD | 8. ABC |
| 9. BC | 10. AC | 11. ABC | 12. ABC |

PART – B

- | | | | |
|------|--------|-------|------|
| 1. 1 | 2. 128 | 3. 40 | 4. 5 |
| 5. 2 | 6. 4 | | |