

PHYSICS, CHEMISTRY & MATHEMATICS

QP Code:

Common
Test- 2

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 **Three Parts: Part-A, B & Part-C** 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 Three 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 (07-12)** 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-C (13-18)** contains Six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (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 – All 2022 batches (A – lot)

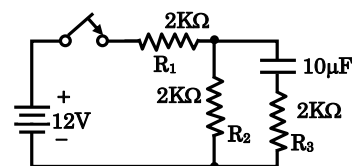
SECTION-1 : PHYSICS

PART – A

(Multi Correct Choice Type)

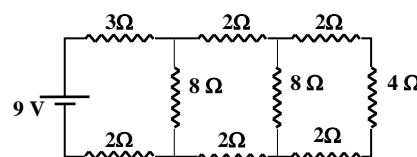
This section contains 6 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. In the circuit shown, the switch is turned on at $t = 0$, Then,
 (A) at $t = 0$, current supplied by battery is 4 mA
 (B) at $t = 0$, current in R_3 is 2 mA
 (C) in the steady state current supplied by battery is 3 mA
 (D) in the steady state current in R_3 is zero



1. **ABCD**

2. In the circuit shown in the figure, the current through
 (A) the 3Ω resistor is 0.50 A
 (B) the 3Ω resistor is 1.0 A
 (C) the 4Ω resistor is 0.50 A
 (D) the 4Ω resistor is 0.25 A



2. **BD**

3. Two heaters designed for the same voltage V have different power ratings. When connected individually across a source of voltage V , they produce H amount of heat each in time t_1 and t_2 respectively. When used together across the same source, they produce H amount of heat in time t .
 (A) if they are in series, $t = t_1 + t_2$ (B) if they are in series, $t = 2(t_1 + t_2)$
 (C) if they are in parallel, $t = 2(t_1 - t_2)$ (D) if they are in parallel, $t = \frac{t_1 t_2}{(t_1 + t_2)}$

3. **AD**

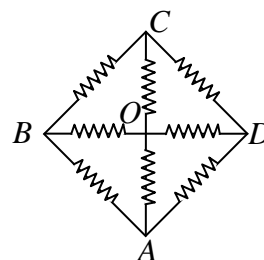
4. In the arrangement shown, the magnitude of each resistance is 2Ω . The equivalent resistance between O and A is given by

(A) $\frac{14}{15}\Omega$

(B) $\frac{7}{15}\Omega$

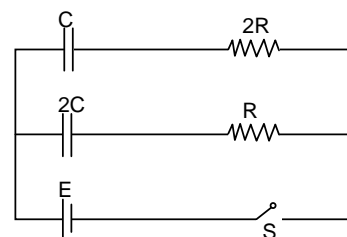
(C) $\frac{4}{3}\Omega$

(D) $\frac{5}{6}\Omega$



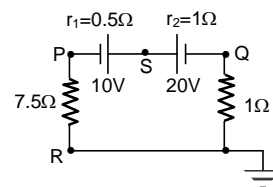
4. **A**

5. In the circuit shown in figure, switch S is closed at time $t = 0$, Select the correct statement(s)
 (A) Rate of increase of charge is same in both the capacitors
 (B) Ratio of charge stored in capacitors C and $2C$ at any time t would be 1 : 2
 (C) Time constant of both the capacitors are equal
 (D) Steady state charge in capacitors C and $2C$ are in the ratio of 1 : 2



5. **BCD**

6. Consider the following statements regarding the circuit shown. Choose the incorrect option.
- (A) potential at P is -7.5 V (B) potential at Q is -1 V
 (C) potential at R is non-zero (D) potential at S is 18 V



6. AC

PART – B

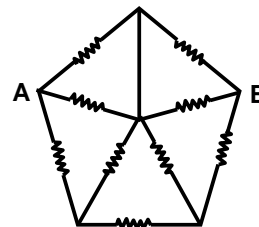
Integer Answer Type

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

7. A wire of length L and 3 identical cells of negligible internal resistance are connected in series, when the temperature of the wire is raised by (ΔT) in time t due to the current. The same temperature rise is observed in the same time when N similar cells are connected in series with a wire of length $2L$ but of same material and cross-section. Find the value of N .

7. 6

8. The effective resistance between A & B of the shown network. Where resistance of each resistor is $R\Omega$, is $\frac{KR}{11}\Omega$. Then find the value of K .

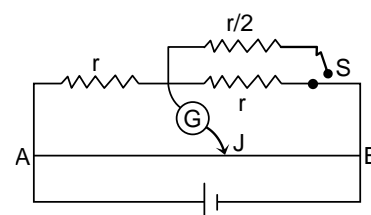


8. 8

9. A battery of emf 1.4 volt and internal resistance 2Ω is connected to a resistor of 100Ω through an ammeter. The resistance of the ammeter is $\frac{4}{3}\Omega$. A voltmeter has also been connected to find the potential difference across the resistor. If the ammeter reads 0.02 A and the resistance of voltmeter is $(100\text{ K})\Omega$ then find the value of K .

9. 2

10. The diagram shows a potentiometer with the wire AB, having uniform resistance per unit length. When the switch S is open, AJ is the balance length and when the switch is closed, AJ' is the balance length. If $AB = L$, then what is the value of AJ' in metre ?
 [Take $L = 4\text{ metre}$]

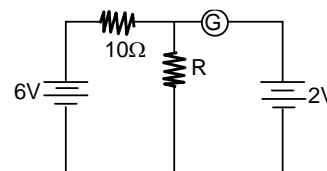


10. 3

11. When two identical batteries of internal resistance 1Ω each are connected in series across a resistor R , the rate of heat produced in R is J_1 . When the same batteries are connected in parallel across R , the rate is J_2 . If $J_1 = 2.25 J_2$ then the value of R in Ω is

11. 4

12. In the circuit, the galvanometer G reads zero. If the internal resistance of both batteries is zero, what must be the resistance of R(In Ω)

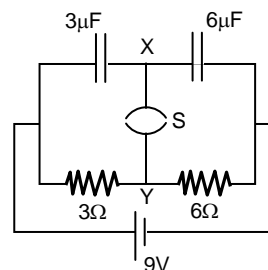


12. 5

PART – C (Numerical based)

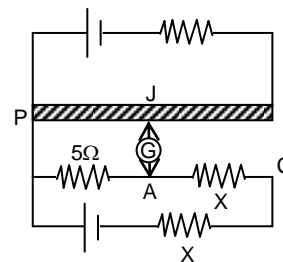
This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals).

13. A circuit is connected as shown in the figure with the switch S open. When the switch is closed, the total amount of charge that flows from Y to X in micro coulomb is



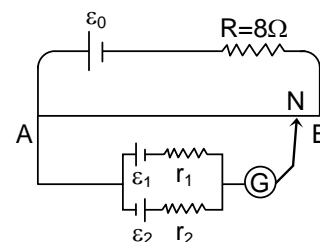
13. 27

14. The galvanometer is first connected at point A and zero deflection is observed at length PJ = 10 cm. In 2nd case it is connected at point c and zero deflection is observed at length 25 cm from point P. the value of unknown resistance x in Ohm is



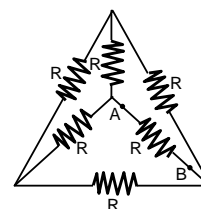
14. 7.5

15. A battery of emf $\epsilon_0 = 12V$ is connected across a 4m long uniform wire having resistance $4\Omega/m$. The cells of small emfs $\epsilon_1 = 2V$ and $\epsilon_2 = 4V$ having internal resistance 2Ω and 6Ω respectively, are connected as shown in the figure. If galvanometer shows no deflection at the point N, the distance of point N from the point A in cm is equal to :



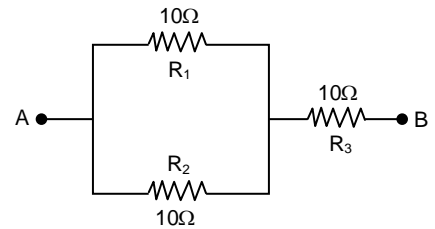
15. 25

16. Six equal resistances each of $R = 20\text{ ohm}$, are connected to form the network show in the figure. The resistance between AB in Ohm is



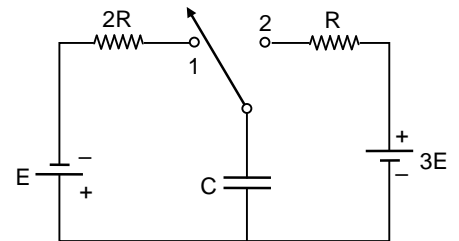
16. 10

17. Three equal resistance each of 10Ω are connected as shown in figure. The maximum power consumed by each resistor is $20W$. The maximum power consumed by the combination in Watt is:



17. **30**

18. Switch was initially at position 1 for a long time. Now, switch is shifted to position 2. Total heat produced in resistor R after that is $\left(\frac{K}{10}\right)CE^2$. Find the value of 'K'.

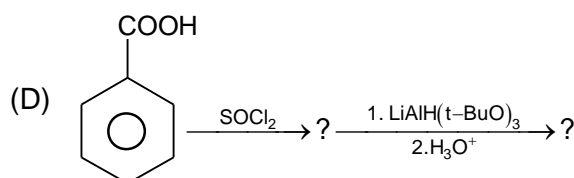
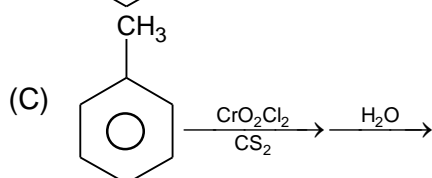
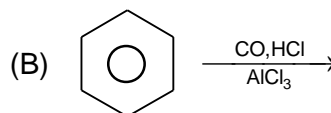
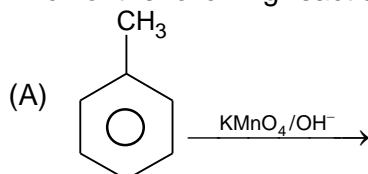


18. **80**

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

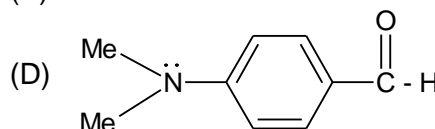
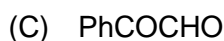
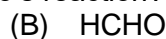
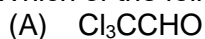
This section contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. Which of the following reactions gives benzaldehyde as the final product?



1. BCD

2. Which of the following do not give Cannizaro's reaction?

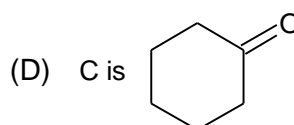
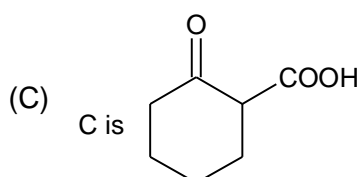
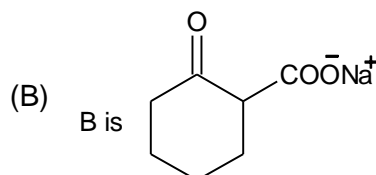
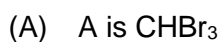
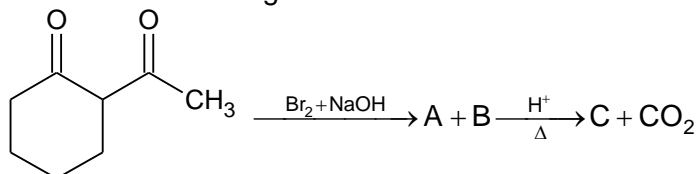


2. AD

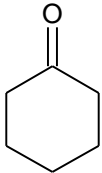
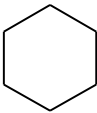
3. CH3CHO and c1ccccc1C=O can be distinguished by
 (A) Tollen's reagent (B) Fehling solution
 (C) Benedict solution (D) NH2OH/H+

3. BC

4. Which of the following are correct for the reaction?

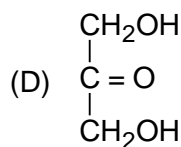
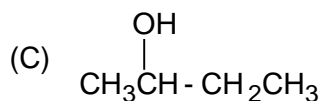
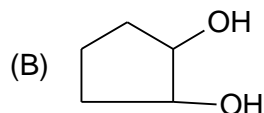
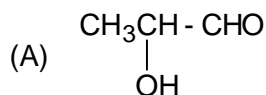


4. ABD

5. Which of the following reagent can convert  to  ?
- (A) Zn-Hg/Conc.HCl
(B) $\text{NH}_2\text{NH}_2/\text{KOH}$
(C) LiAlH_4
(D) NaBH_4

5. AB

6. Which compounds will be oxidized by HIO_4 ?



6. ABD

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**.

7. How many of the following compounds will not give $\text{>C}=\text{N}^-$ bonded product when reacted with acetone?
 $\text{C}_6\text{H}_5\text{NHCOCH}_3$, $(\text{CH}_3)_3\text{N}$, $\text{C}_6\text{H}_5\text{NHC}_6\text{H}_5$, $\text{C}_6\text{H}_5\text{NHNH}_2$, $(\text{C}_6\text{H}_5)_3\text{N}$, $\text{NH}_2\text{NHCONH}_2$, CH_3NH_2

7. 4



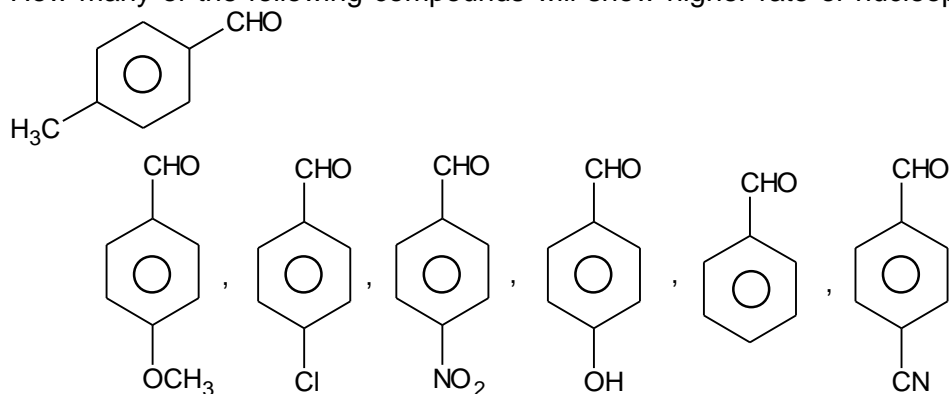
How many asymmetric carbon atom(s) is/are present in (P)?

8. 1

9. Find out the number of products obtained by cross-Cannizzaro's reaction between HCHO and $\text{C}_6\text{H}_5\text{CHO}$?

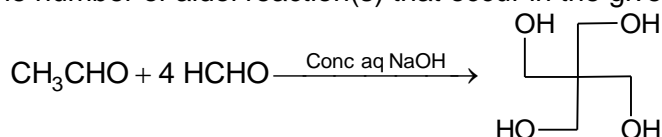
9. 2

10. How many of the following compounds will show higher rate of nucleophilic addition than



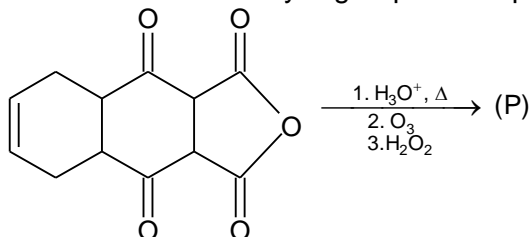
10. 4

11. The number of aldol reaction(s) that occur in the given transformation is:



11. 3

12. The total number of carboxylic groups in the product P is



12. 2

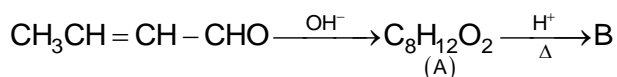
PART – C (Numerical based)

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

13. Aldehydes are oxidized by $\text{Cr}_2\text{O}_7^{2-} / \text{H}^+$ to give green coloured solution. What is the ratio of oxidation state of metal ion in green solution to that in dichromate ion is

13. 0.5

14. Consider the reaction



The number of stereoisomers for compound B is x then $\frac{x}{3}$ is

14. 2.66 (range 2.6 to 2.7)

15. Formaldehyde reacts with NH_3 to form product 'P'. The number of 3° amine group be 'P', then $\frac{P}{3}$ is

15. 1.33 (range 1.3 to 1.4)

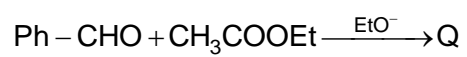
16. How many pi-bond(s) is/are present cinnamaldehyde?

16. 5

17. Acetone reacts in presence of conc. H_2SO_4 to form product 'X'. The degree of unsaturation in 'X' is

17. 4

18. Consider the reaction



Degree of unsaturation of Q be x then $\frac{x}{5}$ will be

18. 1.2

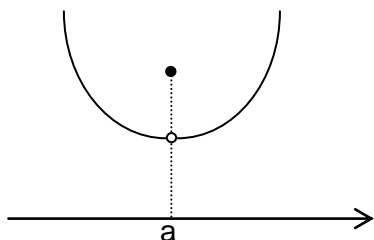
SECTION-3 : MATHEMATICS

PART – A

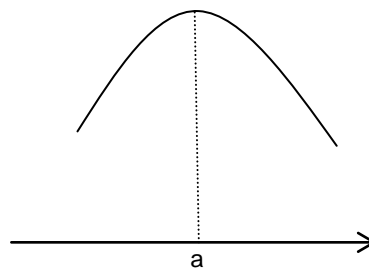
(Multi Correct Choice Type)

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.

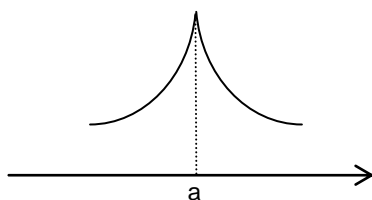
1. Which of the following graphs of a function $f(x)$ have a local-maxima at $x = a$?



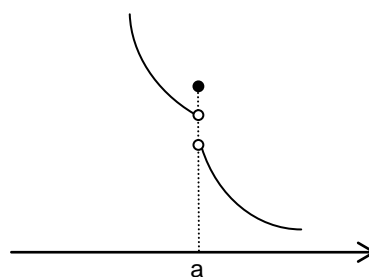
(A)



(B)



(C)



(D)

1. ABCD

2. Which of the following statements are correct?

- (A) All stationary points are critical points.
 (B) A tangent cannot cross the curve at its point of contact.
 (C) A monotonic function cannot have any critical point.
 (D) The local maximum value of a function may not be its greatest value in an interval.

2. AD

3. Let 'f' be a differentiable function $\forall x \in \mathbb{R}$ where $f(1) = 2$ and $f(3) = 7$ and

$f'(x) \geq 2 \forall x \in \mathbb{R}$ then integral value of $f(2)$ can be

- (A) 5 (B) 4
 (C) 3 (D) 2

3. AB

4. Which of the following statements are correct?

(A) $\sin x < x \forall x \in \left(0, \frac{\pi}{2}\right)$

(B) $99^{\frac{1}{99}} > 98^{\frac{1}{98}}$

(C) $e^\pi > \pi^e$

(D) $x > \tan^{-1} x \quad \forall x \in \mathbb{R}^+$

4. **ACD**5. The extreme values of the function $f(x) = \frac{1}{\sin x + 4} - \frac{1}{\cos x - 4}$, where $x \in \mathbb{R}$ are :

(A) $\frac{4}{8 - \sqrt{2}}$

(B) $\frac{2\sqrt{2}}{8 - \sqrt{2}}$

(C) $\frac{2\sqrt{2}}{4\sqrt{2} + 1}$

(D) $\frac{4\sqrt{2}}{8 + \sqrt{2}}$

5. **AC**6. For the curve $y = be^{x/a}$, which of the following are **INCORRECT**?

(A) Length of sub-tangent is constant

(B) Length of sub-normal is constant

(C) Length of tangent is constant

(D) Length of normal is constant

6. **BCD****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**.

$$7. \text{ Let } f(x) = \begin{cases} (x+1)^3 & -2 < x \leq -1 \\ x^{2/3} - 1 & -1 < x \leq 1 \\ -(x-1)^2 & 1 < x < 2 \end{cases}$$

If n_1, n_2 are the number of maxima and minima of $f(x)$ then $n_1 + n_2$ is

7. **3**

8. Find the smallest integral value of p for which the function $f(x) = 6px - p \sin 4x - 5x - \sin 3x$ is monotonic increasing and has no critical points on \mathbb{R} .

8. **5**

9. The volume of a cube is increasing at a rate of $7 \text{ cm}^3 / \text{sec}$. The rate at which the surface area of the cube is increasing when edge length is 4 cm is (in cm^2 / sec)

9. **7**

10. A polynomial $y = f(x)$ of degree 4 increases in the interval $(-\infty, 1) \cup (2, 3)$ and decreases in the interval $(1, 2) \cup (3, \infty)$ and satisfy $f(0) = 1$ and $f'(0) = 6$. Find the value of $f(2)$.

10. **3**

11. If $f(x) = \begin{cases} |x-1| + \lambda, & x \leq 1 \\ 2x+3, & x > 1 \end{cases}$ has a local minima at $x=1$, then maximum value of λ equals to

11. 5

12. Consider a function $f(x) = \frac{3x+a}{x^2+3}$ which has greatest value equal to $3/2$.
Then value of the constant number 'a' is equal to

12. 3

PART – C (Numerical based)

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

13. If 60 is expressed as sum of two numbers such that the product of one number and square of other number is maximum, then what will be the larger number?

13. 40

14. If the function $f(x) = 2x^2 - \ln x$ (where $x > 0$) is increasing in the interval (a, ∞) , then the value of $a + \frac{1}{a}$ will be _____.

14. 2.50

15. A line through origin is tangent to $y = x^3 + x + 16$. Then slope of the line is

15. 13

16. The length of subnormal of the curve $y^2 = 27x$ at any point is equal to

16. **13.50**

17. If the tangent to the curve $y = \frac{x}{x^2-3}, x \in \mathbb{R}, (x \neq \pm\sqrt{3})$ at a point $(\alpha, \beta) \neq (0, 0)$ on it is parallel to the line $2x + 6y - 11 = 0$ then $|6\alpha + 2\beta| =$

17. 19.00

18. The angle of intersection between the curves $x = \sqrt{y}$ and $x^3 + 6y = 7$ at $(1, 1)$ (in degrees) is

18. **90**

ANSWERS

SECTION-1 : PHYSICS

PART – A

PART – B

SECTION – 2 : CHEMISTRY

PART – A

PART – B

SECTION – 3 : MATHEMATICS

PART – A

PART – B