

PHYSICS, CHEMISTRY & MATHEMATICS

QP Code:

Test- 14

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: –2 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 **–2 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 : _____

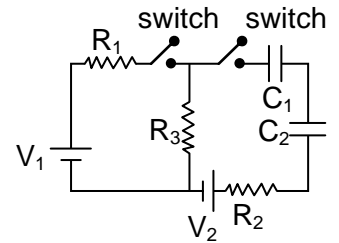
Batch : _____ Date of Examination : _____

Enrolment Number : _____

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 given circuit $C_1 = C$, $C_2 = 2C$, $V_1 = V_2 = V$ & $R_1 = R_2 = R_3 = R$ and all switches-are closed at $t = 0$ then choose the incorrect statement at time $t = RC$ (initially all capacitors are uncharged)



- (A) Current through V_1 is less than $\frac{V}{2eR}[e-1]$
- (B) Power delivered by V_2 is less than $\frac{V^2}{3eR}$
- (C) Current through V_1 is greater than $\frac{V}{2eR}[e-1]$
- (D) Power delivered by V_2 is greater than $\frac{V^2}{3eR}$

1. **ABD**

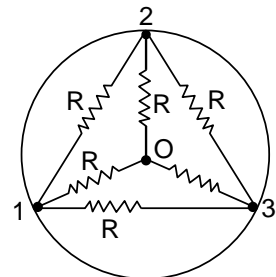
2. Capacitor C_1 of capacitance $1 \mu\text{F}$ and capacitor C_2 of capacitance $2 \mu\text{F}$ are separately charged fully by a common battery. The two capacitors are then separately allowed to discharge through equal resistors at time $t = 0$.

- (A) The current in each of the two discharging circuits is zero at $t = 0$
- (B) The current in two discharging circuits at $t = 0$ are equal but not zero
- (C) The current in two discharging circuits at $t = 0$ are unequal
- (D) Capacitor C_1 loses 50% of its initial charge sooner than C_2 loses 50% of its initial charge.

2. **BD**

3. As shown in the figure, equivalent resistance.

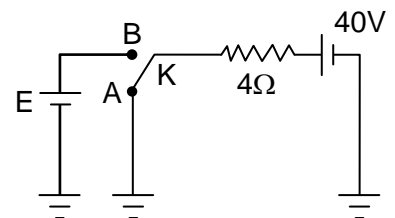
- (A) Between 1 and 3 is zero
- (B) Between O and 1 is $\frac{R}{3}$
- (C) Between O and 1, O and 2, O and 3 are equal.
- (D) Between 1 and 2, 2 and 3 and 3 and 1 are equal



3. **ABCD**

4. For the circuit as shown, find the correct options :

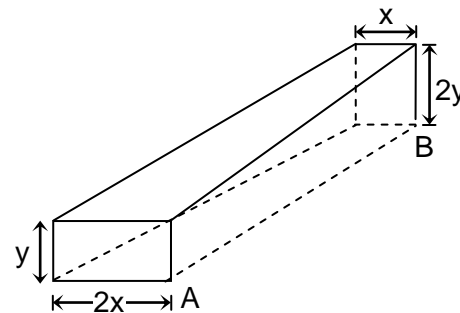
- (A) The emf of battery E will be 20 V so that ratio of currents flowing through 4Ω resistor in position A to position B of the key K is 2
- (B) The emf of battery E will be 32 V so that ratio of currents flowing through 4Ω resistor in position A to position B of the key K is 2



- (C) The emf of battery E will be 24 V so that ratio of currents flowing through 4Ω resistor in position A to position B of the key K is 2.5
- (D) The emf of battery E will be 30 V so that ratio of currents flowing through 4Ω resistor in position A to position B of the key K is 4.

4. **AC**

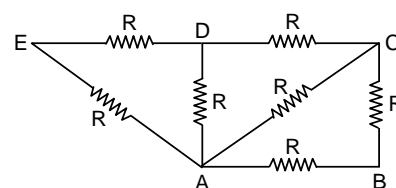
5. A conductor of varying cross-sectional area (as shown) is made of an isotropic material of resistivity ρ . The length of the conductor is L . The battery is connected across the conductor.



- (A) The rate of generation of heat per unit length is maximum at ends A and B.
 (B) Drift velocity of conduction electrons is minimum at Middle cross-section.
 (C) Electric field intensity is same at ends A and B.
 (D) Resistance of the conductor is $\frac{2\rho L}{5xy} \log_e 2$.

5. **ABC**

6. Consider the following circuit:
 Each resistance is 'R'. Match the following:



- (A) Effective resistance between A & B $\left(\frac{13}{21}\right)R$
 (B) Effective resistance between A & C $\left(\frac{10}{21}\right)R$
 (C) Effective resistance between A & D $\left(\frac{10}{21}\right)R$
 (D) Effective resistance between A & E $\left(\frac{13}{21}\right)R$

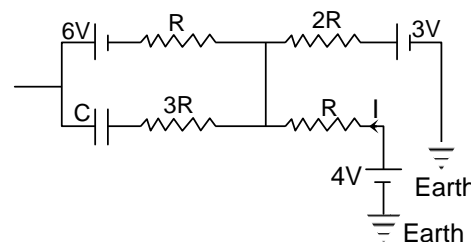
6. **ABCD**

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**.

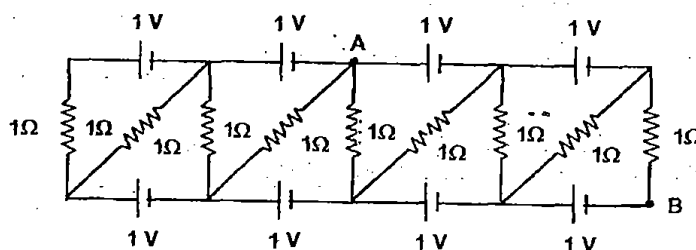
7. The diagram shows a part of a circuit. The capacitor is fully charged. What is the energy (in S.I. unit) stored in the capacitor?

$$\left[\text{Take } I = \frac{2V}{R} \text{ \& } CV^2 = \frac{8}{7} \text{ S.I. unit} \right]$$



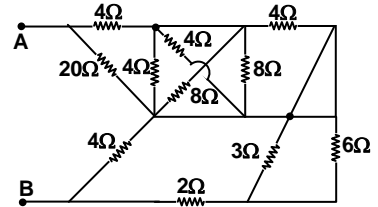
7. **7**

8. Consider the circuit shown in the figure. If the potential difference between points A and B is $(22/n)$ volts then find the value of n . All the cells are ideal and emf of each cell is 1 volts.



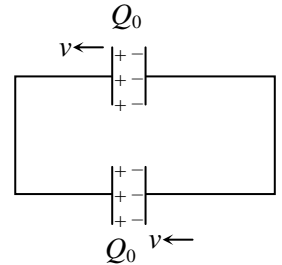
8. **9**

9. Find equivalent resistance between A and B.



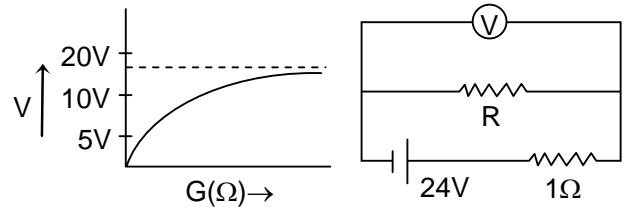
9. 6

10. Two identical capacitor connected as shown and having initial charge Q_0 . Separation between plates of capacitor is d_0 . Suddenly the left plate of upper capacitor and right plate of lower capacitor start moving with speed v towards left while other plate of capacitor remains fixed. (given $\frac{Q_0 v}{2d} = 1$ amp). Find the value of current (in amp) in the circuit.



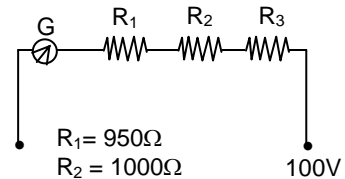
10. 2

11. A cell of internal resistance 1Ω is connected across a resistor. A voltmeter having variable resistance G is used to measure p.d. across resistor. The plot of voltmeter reading V against G is shown. What is value of external resistor R ?



11. 5

12. A galvanometer has an internal resistance of 50Ω and current required for full scale deflection is 1 mA . The series resistance R_3 required (as shown in figure) to use it as a voltmeter with given range, as indicated in figure is $1.4n \times 10^4\Omega$, then $n =$

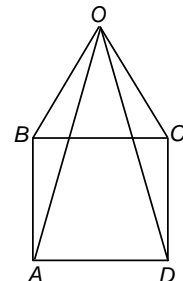


12. 7

PART – C (Numerical based)

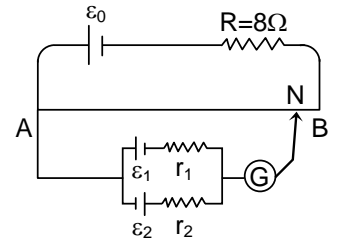
This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals).

1. Eight identical resistances 3 ohm , each are connected along edges of a pyramid having square base $ABCD$ as shown in figure. The equivalent resistance between A and D is



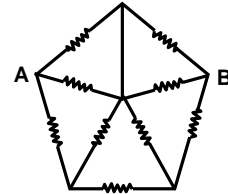
1. 1.60

2. 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 m) is equal to :



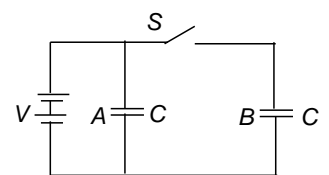
2. **0.25**

3. The effective resistance between A & B of the shown network. Where resistance of each resistor is 5 ohm, is K. Then find the value of K.



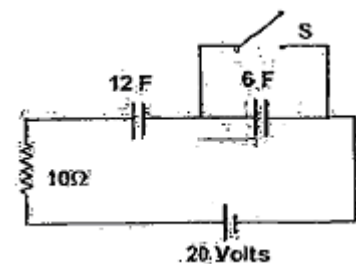
3. **3.64**

4. The figure shows two identical parallel plate capacitors connected to a battery with switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant (or relative permittivity) 3. The ratio of the total electrostatic energy stored in both capacitors before and after the introduction of the dielectric is x. Then find the value of 'x'.



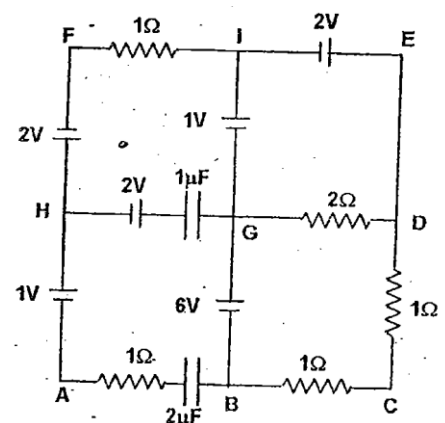
4. **0.60**

5. When steady state is reached, switch S is closed. Then the amount of heat rejected by the resistor is x KJoule. Then find the value of 'x'.



5. **1.60**

6. Four ideal batteries, two capacitors and six resistors are connected in a circuit as shown. Find the ratio of current in the branch GD and BC

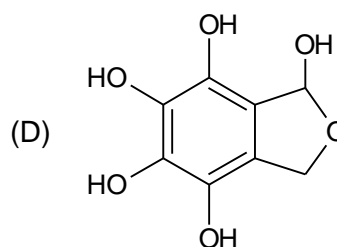
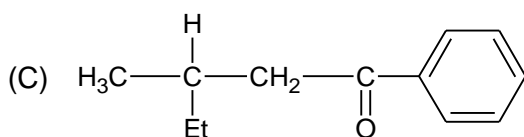
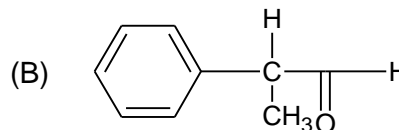
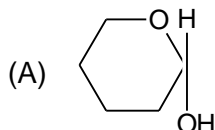


6. **0.33**

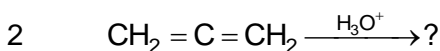
SECTION-2 : CHEMISTRY**PART – A****(Multi Correct Choice Type)**

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. In which of the following compounds, there will be either loss of optical activity or change of optical rotation, while keeping in very dilute acidic or basic aqueous solution?



1. ABD



Select the correct statement(s) regarding the (major) product formed in the above reaction.

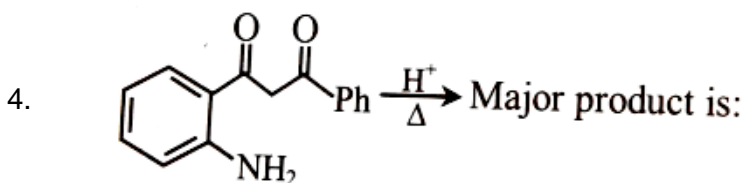
- (A) It decolourises Br_2/CCl_4 (B) It is oxidized by Tollen's reagent
(C) It reduces Fehling's solution (D) It gives iodoform test

2. D

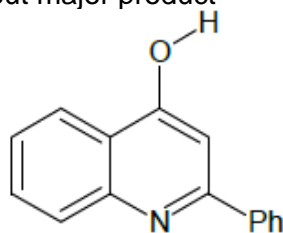
3. Glucose do not give positive test with following reagent

- (A) 2, 4-DNP test
(B) Schiff's test
(C) Hydrogen sulphite (NaHSO_3) addition test
(D) Bromine water test

3. ABC



Which is correct about major product



- (A) major product is (B) D.O.U is 11

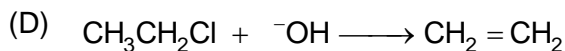
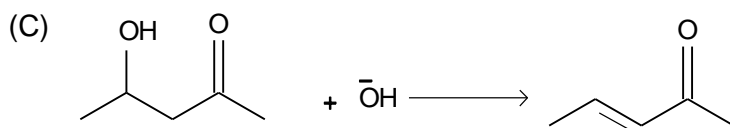
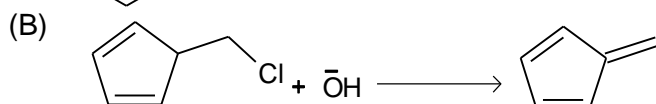
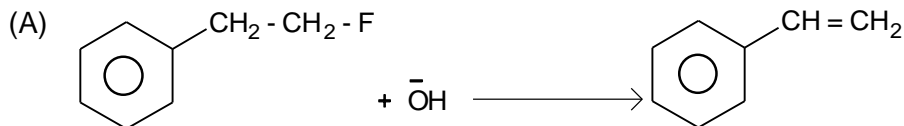
- (C) no. of hetero atom is 2 (D) is aromatic

4. ABCD

5. Which of the given statement(s) is/are correct?
 (A) Rate of ozonolysis of alkene is usually faster than alkyne
 (B) Rate of electrophilic addition of alkene is faster than that of alkyne
 (C) Rate of catalytic hydrogenation of alkene is faster than that of alkyne
 (D) Rate of nucleophilic addition of aldehyde is faster than ketone

5. ABD

6. Which is/are example involve E_{CB}^1 as major mechanism?



6. ABC

PART – B

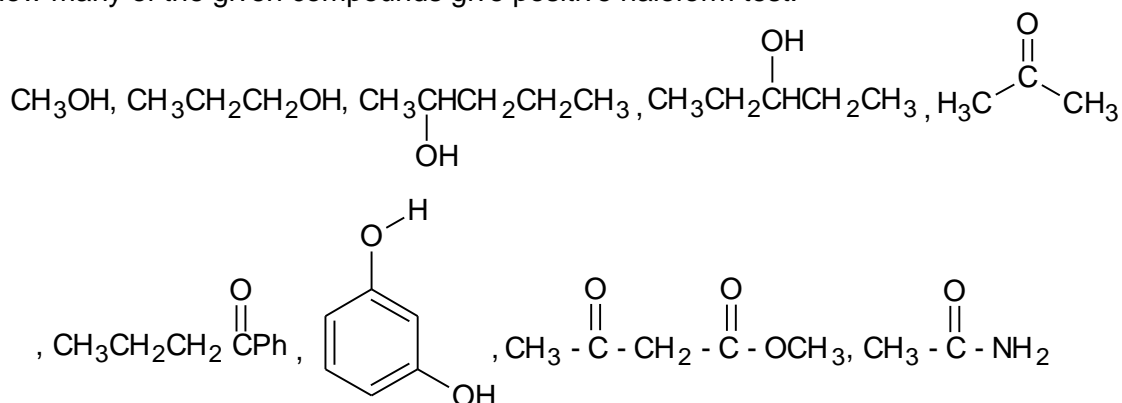
Integer Answer Type

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

7. When $\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$ reacts with NH_3 . The difference in no. of carbon and nitrogen in the product is

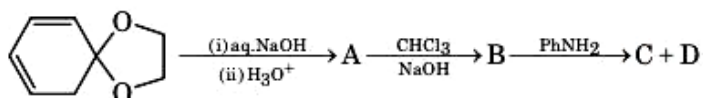
7. 2

8. How many of the given compounds give positive haloform test:



8. 3

9. Given sequence of reaction is :



How many of the following statement(s) are true regarding above reaction sequence and products.

- (i) Compound A is used for the formation of Aspirin.
- (ii) C and D are geometrical isomers.
- (iii) B on treatment with conc. NaOH followed by acidification forms an acid which is more acidic than o-toluic acid.
- (iv) B can reduce fehling solution.
- (v) Compound A when treated with $\text{Ph-N}_2^{\oplus}/\text{NaOH}$ then it forms yellow dye.
- (vi) Compound C or D is more basic than aniline.

9. 4

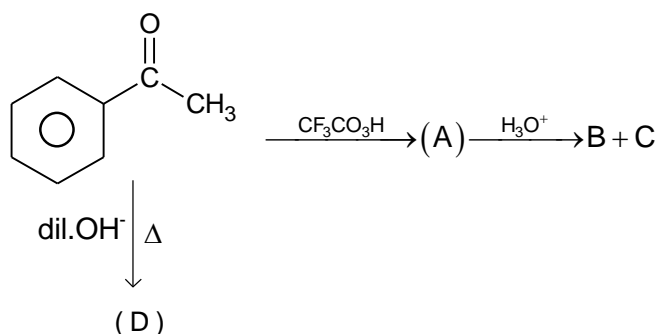
10. When toluene reacts with $\text{CrO}_2\text{Cl}_2/\text{CS}_2$ in Etard reaction. The equivalent weight of toluene in Etard reaction is $\frac{M}{x}$. The value of x is

10. 4

11. If $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$ is treated with dil. OH^- , in aldol reaction. Order of given aldol reaction is

11. 3

12.



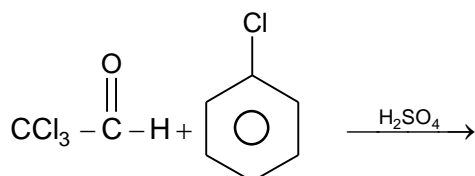
If compound 'C' show effervescence with NaHCO_3 . The difference in degree of unsaturation of D and B is

12. 6

PART – C (Numerical based)

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

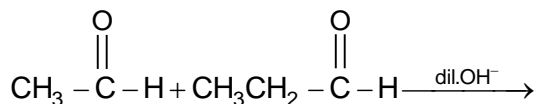
1.



The mol. Wt of organic product in above reaction is M. Value of $\frac{M}{8}$ is gm

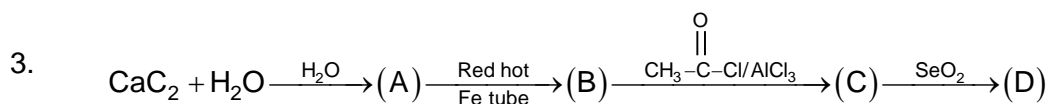
1. 44.31

2.



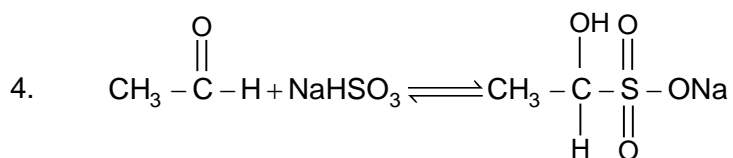
How many aldol products are generated?

2. 12.00



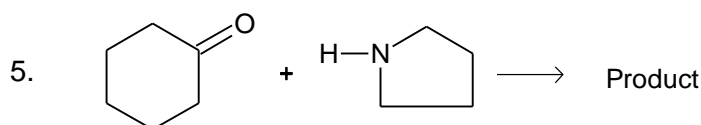
Find the molecular weight of $\frac{\text{D}}{6}$ is

3. 22.33



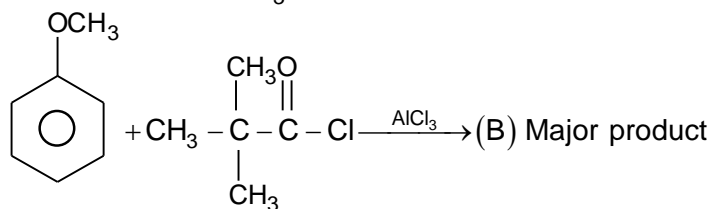
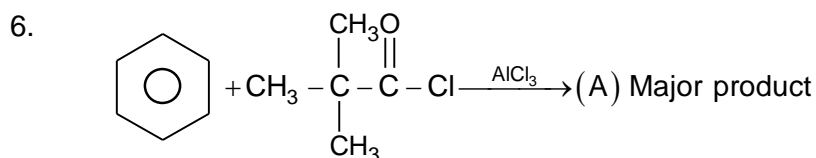
The formula weight of the actual anionic nucleophile is _____

4. 80



Find the $\frac{\text{Molecular weight}}{6}$ of product of above reaction

5. 25.16



The difference in mol. Wt of major product $\frac{\text{B} - \text{A}}{5}$ is

6. 13.60

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. A function $f : \mathbb{R} \rightarrow \mathbb{R}$ satisfies the functional equations
 $f(x-y) = f(x)f(y) - f(a-x)f(a+y)$ where 'a' is a given positive constant and
 $f(0) = 1$ then
 (A) f is even (B) f is odd
 (C) f is periodic (D) f is one – one
1. BC
2. Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a continuous function. If there exists $M > 0$ such that
 $|f(x) - f(y)| \geq M|x - y|$ then
 (A) f is one – one (B) f is onto
 (C) f is monotonic (D) f is bijective
2. ABCD
3. Which of the following functions are periodic
 (A) $f(x) = 1^{[x]} + (-1)^{[x]}$ (B) $g(x) = 1^{[5x]} + (-1)^{[5x]}$
 (C) $h(x) = 2^{[x]} - (-2)^{[x]}$ (D) $\phi(x) = 1^{[x]} - (-1)^{[x]}$
3. ABD
4. Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a function satisfying $f(2-x) = f(2+x)$ and $f(20-x) = f(x) \forall x \in \mathbb{R}$.
 Then which of the following is true
 (A) If $f(0) = 5$, then minimum possible number of values of x satisfying $f(x) = 5$ for
 $x \in [0, 170]$ is 21.
 (B) Graph of $y = f(x)$ is symmetrical about $x = 18$
 (C) Graph of $y = f(x)$ is symmetrical about $x = 8$
 (D) If $f(2) \neq f(6)$, then period of $f(x)$ can't be 1
4. ABD
5. If $f : \mathbb{R} \setminus \{0\} \rightarrow \mathbb{R}$, satisfies the functional equation
 $f(x) + f\left(1 - \frac{1}{x}\right) = \tan^{-1} x$
 then
 (A) $2f(x) = \tan^{-1} x + \cot^{-1}(1-x) - \tan^{-1}\left(1 - \frac{1}{x}\right)$ for $x \in (0, 1)$
 (B) $2f(x) = \tan^{-1} x - \cot^{-1}(1+x) + \tan^{-1}\left(1 - \frac{1}{x}\right)$ for $x \in (0, 1)$

(C) $\int_0^1 f(x) dx = \frac{3\pi}{8}$

(D) $\int_0^1 f(x) dx = \frac{3\pi}{4}$

5. AC

6. If $f : \mathbb{R} \rightarrow \mathbb{R}$ is a continuous function satisfying $f(x) = f(4x) + \left[\sin\left(\frac{1}{1+x^2}\right) \right] \forall x \in \mathbb{R}$,where $[\cdot]$ denote GIF then(A) $f(x)$ is many one(B) $f(x)$ is one – one(C) $f(x)$ is periodic(D) $f(x)$ is onto

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. The number of functions $f : \mathbb{R} \rightarrow \mathbb{R}$ satisfying the functional equation

$$f\left(\left(f(x)\right)^2 + f(y)\right) = xf(x) + y \quad \forall x, y \in \mathbb{R}$$

is _____.

7. 2

8. The value of 'a' for which $f(x) = x^3 + x^2 + a \cos x$ is injective is _____.

8. 2

9. Let $f : \mathbb{R} \rightarrow [a, 6]$, where $f(x) = \frac{x^2 - 2x + d}{x^2 + 3x + d}$ be on ONTO function then

$$7a + d = \underline{\hspace{2cm}}$$

9. 6

10. Let f be a periodic function satisfying $f\left(x + \frac{1}{2}\right) + f(x+1) = f\left(x + \frac{3}{2}\right) + f(x)$ and

$$|f(x)| \leq 2 \quad \forall x \in \mathbb{R}. \text{ Then period of } f(x) \text{ is } \underline{\hspace{2cm}}.$$

10. 1

11. If $f(x) = 4x^3 - x^2 - 2x + 1$ and $g(x) = \begin{cases} \min.m\{f(t) : 0 \leq t \leq x\} & ; 0 \leq x \leq 1 \\ 3 - x & ; 1 < x \leq 2 \end{cases}$ then value of

$$g\left(\frac{1}{4}\right) + g\left(\frac{3}{4}\right) + g\left(\frac{5}{4}\right) = \underline{\hspace{2cm}}.$$

11. 2

12. Let $f(x) = 2x(2-x)$; $0 \leq x \leq 2$. Then number of solutions of the equation

$$f(f(f(x))) = \frac{x}{2}$$

12. 8

PART – C (Numerical based)

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

13. If $x[x[x[x]]] = 2001$, then $x = \underline{\hspace{2cm}}$ (where $[.]$ denotes the Greatest Integer Function)

13. 6.99 (range 6.9 to 7)

14. If $\left[x + \frac{19}{100}\right] + \left[x + \frac{20}{100}\right] + \dots + \left[x + \frac{91}{100}\right] = 546$ then $[100x] = \underline{\hspace{2cm}}$ (where $[.]$ denotes the Greatest Integer Function)

14. 743

15. If the equation $||x-5|-3| = px+2$, where $p \in \mathbb{R}$ has only three real and distinct roots then reciprocal of the sum of possible values of p is

15. -20

16. Each student of a small school must be a member of at least one of the THREE school clubs. It is known that each club has 35 members. It is not known that how many students are members of TWO of the THREE clubs but it is known that 10 students are members of all the THREE clubs. Let M and m be the largest and least possible number of students in the school respectively then $M+m$ equals

16. 133

17. Consider set $A = \{a_1, a_2, a_3, a_4\}$. Let $A \times A$ denote the Cartesian product. The number of reflexive relations possible on set A is _____.

17. 4096

18. Consider set $A = \{a_1, a_2, a_3, a_4\}$. Let $A \times A$ denote the Cartesian product. The number of symmetric relations possible on set A is _____.

18. 1024

ANSWERS

SECTION-1 : PHYSICS

PART – A

PART – B

SECTION – 2 : CHEMISTRY

PART – A

PART – B

SECTION – 3 : MATHEMATICS

PART – A

PART – B