# PHYSICS, CHEMISTRY & MATHEMATICS

**QP CODE: 100980**          **Common Test-1**

**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.

**BATCHES – PANINI426-G1 & PANINI426XII-1**

## 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 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.

**(iii)**    **Part-A (08-10) –** This section contains Three (03) Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: List-I and List-II.  **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question. Each question carries **+4 Marks** for correct answer and **-1 marks** for wrong answer.

**(iii)**    **Part-B –** This section contains **SIX (06)** questions numerical based questions. The answer to each question is a **NUMERICAL VALUE**. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places. Each question carries **+4 marks** for correct answer. **There is no negative marking.**

Name of the Candidate: _____
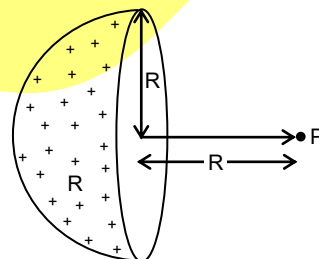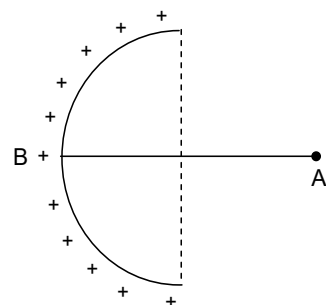
Batch: _____ Date of Examination: _____

Enrolment Number: _____

# 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.    Let V and E be the potential and the field respectively at a point. Which of the following assertions are correct?
      (A) If V = 0, E must be zero.                     (B) If V $\neq$ 0, E cannot be zero
      (C) If E $\neq$ 0, V cannot be zero.              (D) None of these.

2.    A, B and C are three large, parallel conducting plates, placed horizontally. A and C are rigidly fixed and earthed. B is given some charge. Under electrostatic and gravitational forces, B may be
      (A) in equilibrium midway between A and C
      (B) in equilibrium if it is closer to A than to C
      (C) in equilibrium if it is closer to C than to A
      (D) B can never be in stable equilibrium



3.    Consider a non-conducting hemisphere of radius R having charge per unit area equal to $\sigma$ find electric potential at point P due to the hemisphere



      (A) $\dfrac{\sigma}{2\varepsilon_0}\left(1-\dfrac{1}{\sqrt{2}}\right)R$                (B) $\dfrac{\sigma}{2\varepsilon_0}\left(1-\dfrac{1}{\sqrt{2}}\right)\sqrt{2}\,R$

      (C) $\dfrac{\sigma}{\varepsilon_0}\left(1-\dfrac{1}{\sqrt{2}}\right)R$                   (D) $\dfrac{\sigma}{4\varepsilon_0}R$

4.    A non-conducting wire is bent into a semicircle of radius R and a charge +Q is uniformly distributed over if as shown in figure.

      Find the ratio $\dfrac{V_A}{E_A}$ of potential to the magnitude of the electric

      field both evaluated at A of diameter AB.
      (A) R                                              (B) 2R
      (C) $R\ell n\left(1+\sqrt{2}\right)$               (D) $2R\ell n\left(1+\sqrt{2}\right)$



*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.    If the electric field $E$ is plotted, with distance from $q_1$ along the line joining of two, then ($E$ is positive along +ve $x$-axis) it looks as shown in figure. From the plot we can say that

(A) $q_1$ and $q_2$ both are negative

(B) $\left|\dfrac{q_1}{q_2}\right| = 4$

(C) $q_1$ is positive and $q_2$ is negative

(D) $\left|\dfrac{q_1}{q_2}\right| = \dfrac{1}{4}$
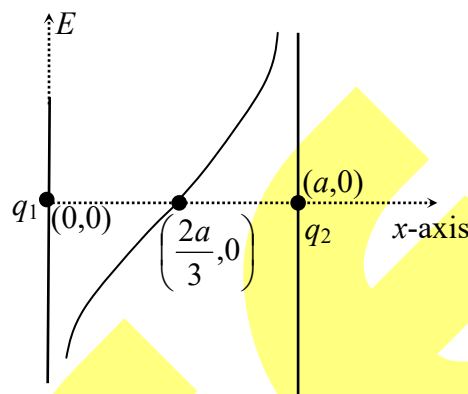
6.    Figure shows three concentric thin spherical shells A, B and C of radii R, 2R, and 3R. Shells A and C are given charges q and 2q and shell B is earthed. Then

(A) charge on inner surface of shell C is $\dfrac{4}{3}q$

(B) charge on outer surface of shell B is $-\dfrac{4}{3}q$

(C) charge on outer surface of shell C is $\dfrac{2}{3}q$

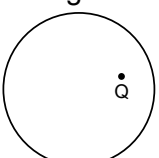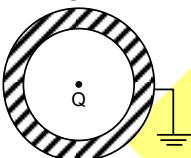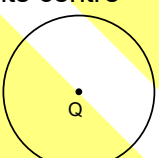(D) charge on outer surface of shell C is $\dfrac{4}{3}q$
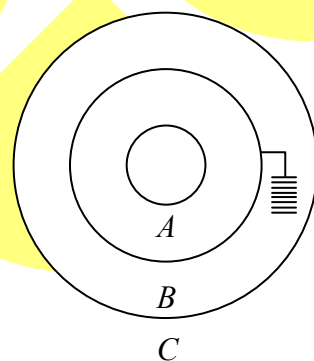
7.    A particle of mass m and charge q is projected in a region where an electric field is existing and given by $\vec{E} = E_c\hat{i}$, with a velocity $v_0\hat{j}$ from the origin at time t = 0, then choose the correct statements (assuming $m^2 v_0^2 = 2qE_0 m x_0$).

(A) radius of curvature of the particle when its x-coordinate becomes $x_0$ is $2x_0$.

(B) radius of curvature of the particle when its x-coordinate becomes $x_0$ is $4\sqrt{2}\,x_0$.

(C) speed of the particle when its x-coordinate becomes $x_0$ is $\sqrt{2}v_0$.

(D) speed of the particle when its x-coordinate becomes $x_0$ is $2v_0$.

*Space For Rough Work*

**(Matching List Sets)**

This section contains **Three (03)** Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8.

| | List-I | | List-II |
|---|---|---|---|
| (P) | Electrically neutral thick conducting spherical shell, with point charge at its centre.  | (1) | Electric field everywhere inside the cavity due to charges induced on the inner surface of conductor is zero. |
| (Q) | Electrically neutral thin conducting spherical shell, with point charge to the right of its centre  | (2) | Electric field every where inside the cavity due to charges induced on the outer surface of conductor is zero |
| (R) | Electrically neutral thick conducting spherical shell, with point charge to the right of its centre. Shell is earth.  | (3) | Electric potential at the centre of the cavity due to charge induced on inner & outer surface of conductor is zero. |
| (S) | Electrically neutral thin conducting spherical shell, with point charge at its centre  | (4) | Electricity potential everywhere inside the cavity due charges induced on the inner and outer surface conductor is zero. |

The correct option is:
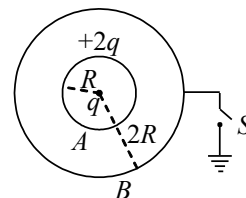(A) P–1,2 ; Q–3 ; R–2 ; S–1,3,4        (B) P–1 ; Q–2,3 ; R–2 ; S–1,2, 4
(C) P–1,2 ; Q–2,3 ; R–2 ; S–1,2,3,4        (D) P–1,2 ; Q–2 ; R–2 ; S–1,2,3,4

*Space For Rough Work*

9. Two concentric conducting shells *A* and *B* have radii *R* and 2*R*. A charge *q* is placed at the centre of the shells and a charge 2*q* is given to shell *A*.



| | List-I | | List-II |
|---|---|---|---|
| (A) | Charge on inner surface of shell *A* when switch is open | (1) | $-3q$ |
| (B) | Charge on inner surface of shell *B* when switch is open | (2) | zero |
| (C) | Charge on outer surface of shell *A* when switch is closed | (3) | $-q$ |
| (D) | Charge on outer surface of shell *B* when switch is closed | (4) | $3q$ |
| | | (5) | $2q$ |

The correct option is:
(A) P → 3 ; Q → 1 ; R → 2 ; S → 4      (B) P → 3 ; Q → 1 ; R → 4 ; S → 2
(C) P → 3 ; Q → 4 ; R → 1 ; S → 3      (D) P → 2 ; Q → 1 ; R → 4 ; S → 3

10. In list-I, circuit having different combination of capacitos are given and in list-II, value of Ceq. is given:

| | List-I (Circuit) | | List-II (C$_{eq}$) |
|---|---|---|---|
| (P) |  | (1) | $\dfrac{3C}{4}$ |
| (Q) |  | (2) | $\dfrac{5C}{12}$ |
| (R) |  | (3) | $\dfrac{2C}{3}$ |
| (S) |  | (4) | $\dfrac{3C}{2}$ |

For equivalent capacitance between points A and B, match list-I with list-II
(A) P → 4 ; Q → 2 ; R → 3 ; S → 1      (B) P → 4 ; Q → 1 ; R → 2 ; S → 3
(C) P → 4 ; Q → 1 ; R → 3 ; S → 2      (D) P → 4 ; Q → 2 ; R → 1 ; S → 3

*Space For Rough Work*

## (PART – B)

This section contains **SIX (06)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1.    A capacitor is made by stacking 10 equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is C then the resultant capacitance is 10nC. Find the value of 'n'.

2.    Three conducting concentric spherical shell of radii R, 2R and 3R carry some charge on them. The potential at the centre is 50 V and that of middle and outer shell is 20 V and 10 V respectively. Find the potential of the inner shell is $4v_1$. Fine the value of '$v_1$'.

3.    In the circuit shown, in steady state, charge across 4 μF capacitor is (in μC) 10q. Find the value of 'q'.
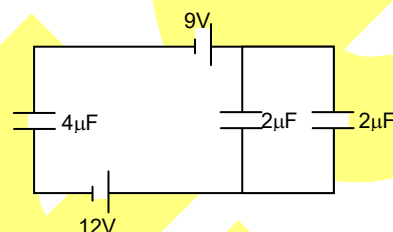


4.    A, B, C, D, E, F are conducting plates each of area A and only two conservative plates separated by a distance d. The net energy stored in the system after the switch S is closed is closed is $\dfrac{K \in_0 AV^2}{d}$ then value of K is _____ :
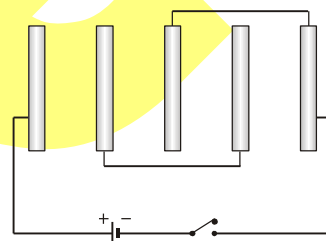


5.    A parallel plate capacitor of capacity $C_0$ is charged to a potential $V_0$. $E_1$ is energy stored in capacitor. When the battery is disconnected and plate separation is doubled and $E_2$ is energy stored in capacitor when charging battery is kept connected and separation between the capacitor is doubled then $\dfrac{E_2}{E_1}$.

6.    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'.
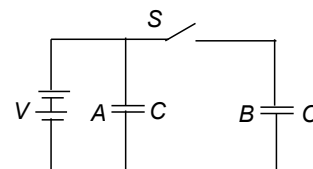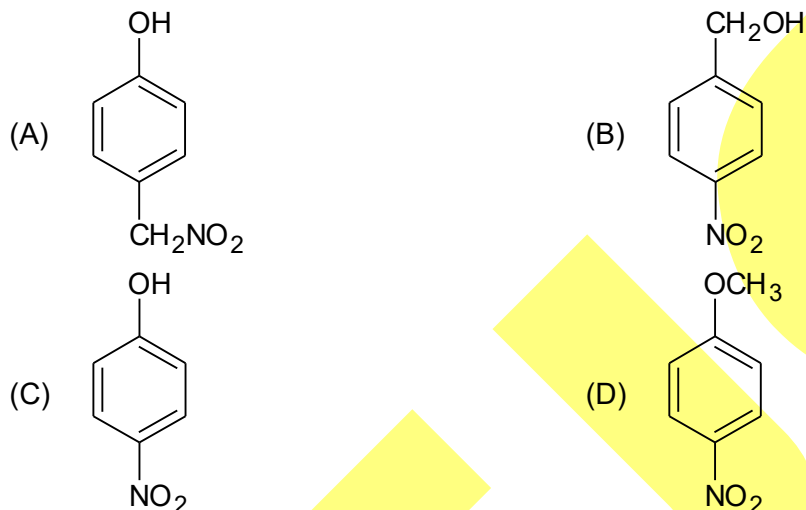


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# SECTION – II : CHEMISTRY

## (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.**
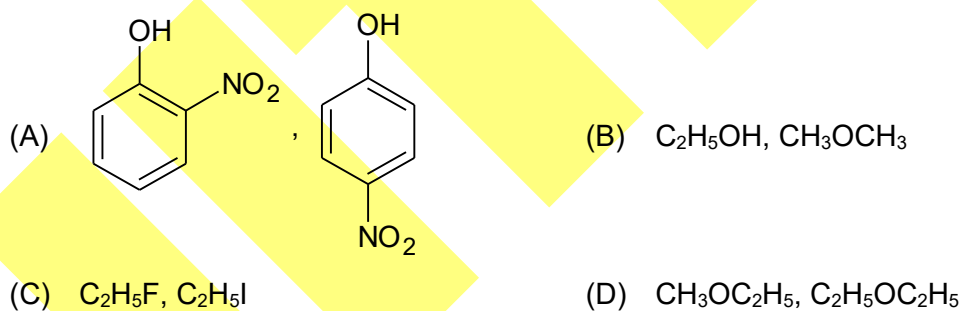
1.    Which substance forms $CH_3OCH_3$ when reacts with $CH_3 \overset{-}{O}K^+$ ?

(A) $CH_4$                                      (B) $CH_3OH$

(C) $CH_3I$                                     (D) $CH_2 = CH_2$

2.    Which contain the most acidic hydrogen atom?

(A)    [benzene ring with OH at top and $CH_2NO_2$ at bottom]

(B)    [benzene ring with $CH_2OH$ at top and $NO_2$ at bottom]

(C)    [benzene ring with OH at top and $NO_2$ at bottom]

(D)    [benzene ring with $OCH_3$ at top and $NO_2$ at bottom]
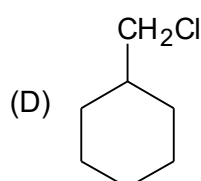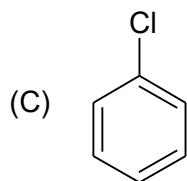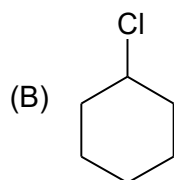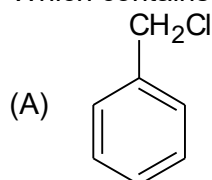
3.    In which of the following option, the boiling point of the left side compound is higher than that the right side compound?

(A)    [benzene ring with OH at top and $NO_2$ adjacent (ortho)] , [benzene ring with OH at top and $NO_2$ at bottom (para)]

(B)    $C_2H_5OH$, $CH_3OCH_3$

(C)    $C_2H_5F$, $C_2H_5I$
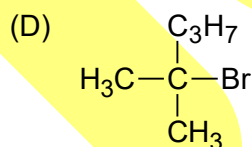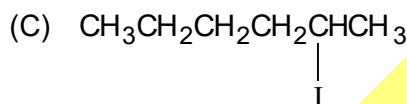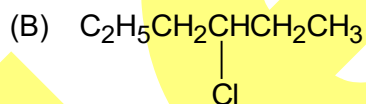
(D)    $CH_3OC_2H_5$, $C_2H_5OC_2H_5$

*Space For Rough Work*

4.    Which contains the strongest C – Cl bond?

(A)   $CH_2Cl$ attached to benzene ring

(B)   $Cl$ attached to cyclohexane

(C)   $Cl$ attached to benzene ring

(D)   $CH_2Cl$ attached to cyclohexane

**(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.    Which of the following compound(s) is/are more reactive than $CH_3CH_2CH_2CH_2CH_2CH_2Cl$ towards aqueous KOH by $S_N1$ path?

(A)
$$H_5C_2-\underset{\underset{CH_3}{|}}{\overset{\overset{C_2H_5}{|}}{C}}-Cl$$

(B)   $C_2H_5CH_2\underset{\underset{Cl}{|}}{C}HCH_2CH_3$

(C)   $CH_3CH_2CH_2CH_2\underset{\underset{I}{|}}{C}HCH_3$

(D)
$$H_3C-\underset{\underset{CH_3}{|}}{\overset{\overset{C_3H_7}{|}}{C}}-Br$$
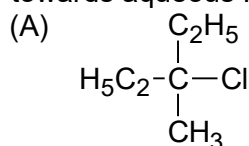
6.    Which reaction(s) is/are feasible [form the correct product(s)]?

(A)   $CH_3CH_2\underset{\underset{Cl}{|}}{C}HCH_3 \xrightarrow[\Delta]{\text{Alcoholic KOH}} CH_3-CH=CHCH_3 + CH_3CH_2CH=CH_2$
      (Cis– and trans–)

(B)   Cyclopentanol (OH) $\xrightarrow[\text{Heat}]{\text{Conc.}H_2SO_4}$ cyclopentene

(C)   Phenol (OH) $\xrightarrow{Br_2/H_2O}$ 2,4,6-tribromophenol

(D)   Anisole (OCH$_3$) $\xrightarrow{\text{Conc.HI}}$ iodobenzene $+CH_3OH$
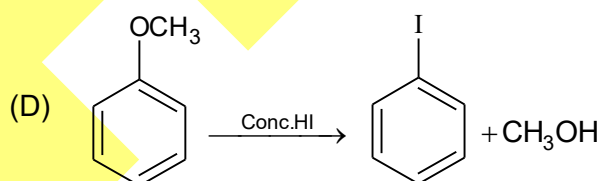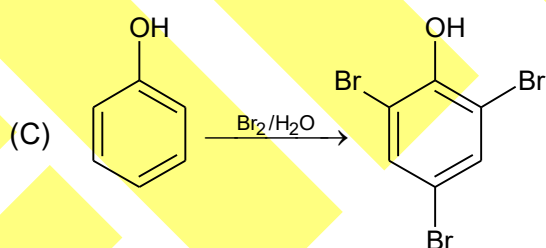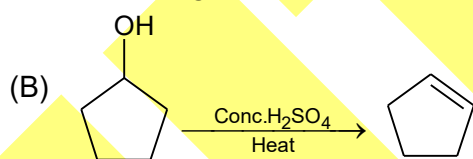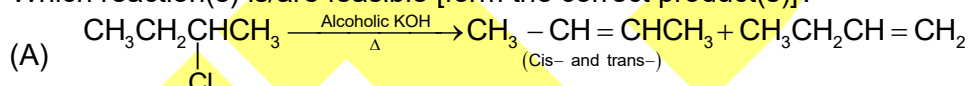
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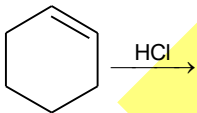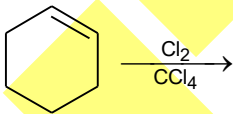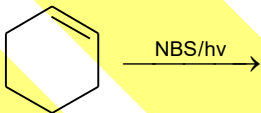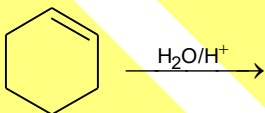
7.   Which chemical(s) do you need to prepare
$$\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{H_3C-C-OH}}$$ ?

(A) $\underset{\underset{CH_3}{|}}{H_3C-C=CH_2}$, $H_2O$, $H^+$

(B) $\underset{\overset{\|}{\overset{O}{}}}{H_3C-C-CH_3}$, $CH_3MgBr$, $H_2O/H^+$

(C) $\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{H_3C-C-Cl}}$, KOH, $H_2O$

(D) $\underset{H_3C}{\overset{H_3C}{}}C=C\underset{CH_3}{\overset{CH_3}{}}$ , $O_3$, Zn, $H_2O$, $CH_3Cl$

**(Matching List Sets)**
This section contains **Three (03)** Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8.   Match the lists.
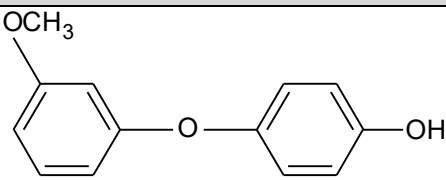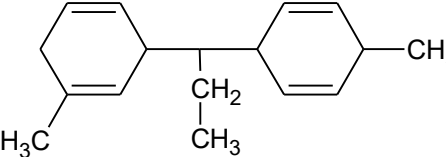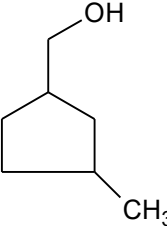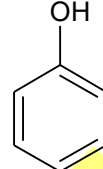
| | List – I (Reactions) | | List– II (Characteristics of products) |
|---|---|---|---|
| (P) | cyclohexene $\xrightarrow{HCl}$ | (1) | Major product shows optical isomerism |
| (Q) | cyclohexene $\xrightarrow[CCl_4]{Cl_2}$ | (2) | An unsaturated halide is formed |
| (R) | cyclohexene $\xrightarrow{NBS/hv}$ | (3) | The product reforms the reactant when the former is heated with conc. $H_2SO_4$ |
| (S) | cyclohexene $\xrightarrow{H_2O/H^+}$ | (4) | A secondary monochloride is formed |
| | | (5) | A saturated monobromide is formed |

(A) P → 1; Q → 3; R → 4; S → 5    (B) P → 4; Q → 1; R → 2; S → 3
(C) P → 2; Q → 4; R → 3; S → 2    (D) P → 4; Q → 1; R → 5; S → 3

*Space For Rough Work*

9.     Match the lists.

| | List – I | | List– II |
|---|---|---|---|
| (P) | OCH$_3$ attached to benzene ring; ring connected via –O– to another benzene ring bearing –OH <br> (Number of moles of HI consumed per mole of above reactants) | (1) | 1 |
| (Q) | Structure: diphenyl system with CH bridge bearing CH$_2$–CH$_3$ group; one ring with CH$_3$, other with H$_3$C substituent <br> (Number of moles of HCl that can be added to one mole of the reactant) | (2) | 2 |
| (R) | Cyclopentane ring with CH$_2$OH group and CH$_3$ group <br> (Number of alkenes formed by dehydration reaction) | (3) | 3 |
| (S) | OH on benzene ring (phenol) <br> (Number of nitro groups present in the molecule when it is treated with hot conc.HNO$_3$/Conc.H$_2$SO$_4$) | (4) | 4 |
| | | (5) | 6 |

(A) P $\rightarrow$ 2; Q $\rightarrow$ 5; R $\rightarrow$ 4; S $\rightarrow$ 3      (B) P $\rightarrow$ 1; Q $\rightarrow$ 5; R $\rightarrow$ 4; S $\rightarrow$ 3

(C) P $\rightarrow$ 2; Q $\rightarrow$ 1; R $\rightarrow$ 3; S $\rightarrow$ 4      (D) P $\rightarrow$ 1; Q $\rightarrow$ 4; R $\rightarrow$ 5; S $\rightarrow$ 3

*Space For Rough Work*

10.    Match the lists.

| List – I (Reactions) | | List– II (Products) | |
|---|---|---|---|
| (P) | $C_2H_5Cl + KOH \xrightarrow[\Delta]{Alcohol}$ | (1) | $(C_2H_5)_2S$ |
| (Q) | $C_2H_5Cl + KSH \xrightarrow{Ether}$ | (2) | $C_2H_5SH$ |
| (R) | $C_2H_5Cl + KCN \xrightarrow{DMSO}$ | (3) | $C_2H_5CN$(Major product) |
| (S) | $C_2H_5Cl + AgCN \xrightarrow{Acetone}$ | (4) | $C_2H_4$ |
| | | (5) | $C_2H_5NC$(Major product) |

(A) P → 4; Q → 1; R → 5; S → 3                    (B) P → 4; Q → 2; R → 3; S → 5
(C) P → 1; Q → 4; R → 5; S → 3                    (D) P → 4; Q → 1; R → 3; S → 5

## (PART – B)

This section contains **SIX (06)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1.    The reaction between $CH_4$ and $Cl_2$ forms four different products. Let(P) is the most acidic product among the four. Hydrolysis of (P) produces as carboxylic acid and HCl. If the molar mass of carboxylic acid in g mol$^{-1}$ unit is X, what is the value of $\frac{X}{10}$?

2.    If X number of the following reagent can convert $CH_3CH_2OH$ into $CH_3CH_2Cl$, what is the value of $\frac{X}{2}$?
       $PCl_5$, $PCl_3$, $Cl_2$, HCl, NaCl, $AlCl_3$, Anhy $ZnCl_2$/Conc. HCl, $CH_3Cl$, ClOH, KCl, $SOCl_2$, $POCl_3$

3.
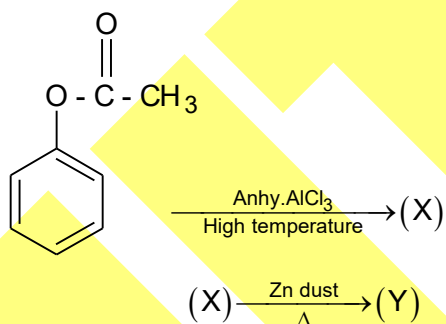


If the molar mass difference between (X) and (Y) in g mol$^{-1}$ unit is y, the value of $\frac{y}{5}$ is

*Space For Rough Work*

4.

$$CH_3 - \underset{\underset{Cl}{|}}{\overset{\overset{Cl}{|}}{CH}} - \underset{\overset{Cl}{|}}{\overset{}{CH}} - CH_2 - \underset{\underset{Cl}{|}}{\overset{\overset{Cl}{|}}{C}} - CH_2 - CCl_3$$
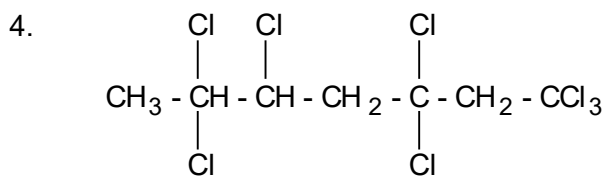
If x = the number of geminal chlorine atoms present in the molecule and
y = the number of primary chlorine atoms present in the molecule, then the value of $\left(\dfrac{2x+y}{10}\right)$ is

5.    When gas(A) is passed through the solution of $C_6H_5MgBr$ in ether, followed by acidification of the resulting solution, produces phenol. If the number of electrons present in a molecule of gas(A) is X, what is the value of $\dfrac{X}{10}$?

6.

$$CH_3 - \underset{\underset{\overset{\cdots}{Cl^{35}}}{\diagup\; H}}{C} - CH_2 - CH_3 \xrightarrow{\ NaCl^{37}\ } CH_3 - \underset{\underset{Cl^{37}\quad H}{}}{C} - CH_2 - CH_3 + NaCl^{35}$$
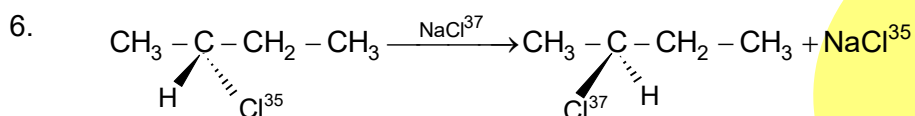
If the ratio of rate of racemization to the rate of reaction is expressed as x : y. What is the value of $\left(\dfrac{x+y}{5}\right)$?

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*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 $f$ be function defined as $f : \left(0, e^{\frac{-3}{2}}\right] \to \left[\frac{-1}{4}, \infty\right), f(x) = (\ln x)^2 + 3\ln x + 2,$ then $f^{-1}(x)$ equals:

    (A) $\log\left(\dfrac{-3 + \sqrt{4x+1}}{2}\right)$

    (B) $\log\left(\dfrac{-3 - \sqrt{4x+1}}{2}\right)$

    (C) $e^{\frac{-3+\sqrt{4x+1}}{2}}$

    (D) $e^{\frac{-3-\sqrt{4x+1}}{2}}$

2.  Let $g : R \to \left[\dfrac{\pi}{6}, \dfrac{\pi}{2}\right)$ is defined by $g(x) = \sin^{-1}\left(\dfrac{x^2 - c}{1 + x^2}\right)$. Then the possible values of 'c' for which g is surjective function, is:

    (A) $\left\{\dfrac{1}{2}\right\}$

    (B) $\left(-1, -\dfrac{1}{2}\right]$

    (C) $\left\{-\dfrac{1}{2}\right\}$

    (D) $\left[-\dfrac{1}{2}, 1\right)$

3.  The function $f : [0, 2] \to [1, 4],$ defined by $f(x) = x^3 - 5x^2 + 7x + 1,$ is:

    (A) one – one and onto

    (B) onto but not one – one

    (C) one – one but not onto

    (D) neither one – one nor onto

4.  Let $S_n = \displaystyle\sum_{r=0}^{n-1} \cos^{-1}\left(\dfrac{n^2 + r^2 + r}{\sqrt{n^4 + r^4 + 2r^3 + 2n^2r^2 + 2n^2r + n^2 + r^2}}\right),$ then the value of $S_{100}$, is:

    (A) $\dfrac{\pi}{12}$

    (B) $\dfrac{\pi}{3}$

    (C) $\dfrac{\pi}{6}$

    (D) $\dfrac{\pi}{4}$

*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.**
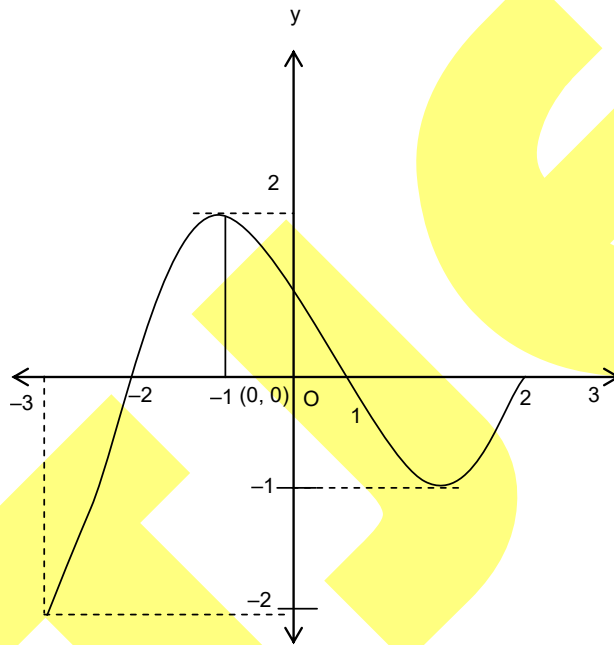
5.      Let $\alpha = 3\cos^{-1}\left(\dfrac{5}{\sqrt{28}}\right) + 3\tan^{-1}\left(\dfrac{\sqrt{3}}{2}\right)$ and $\beta = 4\sin^{-1}\left(\dfrac{7\sqrt{2}}{10}\right) - 4\tan^{-1}\left(\dfrac{3}{4}\right)$, then which of the

following does not hold(s) good?
(A) $\alpha < \pi$ but $\beta > \pi$                                   (B) $\alpha > \pi$ but $\beta < \pi$
(C) Both $\alpha$ and $\beta$ are equal                    (D) $\cos(\alpha + \beta) = 0$

6.      The figure illustrates graph of the function $y = f(x)$ defined in $[-3, 2]$. Identify the correct statement (s) :



(A) Range of $y = f(-|x|)$ is $[-2, 2]$                 (B) Domain of $y = f(|x|)$ is $[-2, 2]$
(C) Domain of $y = f(|x|+1)$ is $[-1, 1]$          (D) Range of $y = f(|x|+1)$ is $[-1, 0]$

7.      Which of the following is(are) correct?
(A) Domain of $f(x) = \sin^{-1}\left(\cos^{-1} x + \tan^{-1} x + \cot^{-1} x\right)$ is null set

(B) Domain of $f(x) = \cos^{-1}\left(\tan^{-1} x + \cot^{-1} x + \sin^{-1} x\right)$ is $[-1, -\cos 1]$

(C) Domain of $f(x) = \sin^{-1}\left(\cos^{-1} x\right)$ is $[\cos 1, 1]$

(D) Domain of $f(x) = \cos^{-1}\left(\sin^{-1} x\right)$ is $[-\sin 1, \sin 1]$

*Space For Rough Work*

**(Matching List Sets)**

This section contains **Three (03)** Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8.  Let 'f' be a function defined in [–2, 3] given as:

$$f(x) = \begin{cases} 3(x+1)^{1/3}, & -2 \le x < 0 \\ -(x-1)^2, & 0 \le x < 1 \\ 2(x-1)^2, & 1 \le x < 2 \\ -x^2 + 4x - 3, & 2 \le x \le 3 \end{cases}$$

|       | List – I                                                                                              |     | List – II |
|-------|-------------------------------------------------------------------------------------------------------|-----|-----------|
| (P)   | The number of integers in the range of $f(x)$ is                                                      | (1) | 2         |
| (Q)   | The number of integral values of x which are in the domain of $f(1-|x|)$, is                          | (2) | 4         |
| (R)   | The number of integers in the range of $\left|f(-|x|)\right|$, is                                     | (3) | 6         |
| (S)   | The number of integral values of k for which the equation $f(|x|) = k$ has exactly four distinct solutions is | (4) | 7         |
|       |                                                                                                       | (5) | 1         |

The correct option is
(A) (P) → (3)   (Q) → (4)   (R) → (2)   (S) → (1)
(B) (P) → (5)   (Q) → (2)   (R) → (3)   (S) → (1)
(C) (P) → (5)   (Q) → (3)   (R) → (2)   (S) → (1)
(D) (P) → (3)   (Q) → (2)   (R) → (5)   (S) → (4)

9.  Consider $f(x) = \tan^{-1}\left(\dfrac{\left(\sqrt{12}-2\right)x^2}{x^4+2x^2+3}\right)$ and m and M are respectively minimum and maximum

values of f(x) and $x = a (a > 0)$ is the point in the domain of $f(x)$ where $f(x)$ attains its maximum value.

|       | List – I                                                                                                   |     | List – II |
|-------|------------------------------------------------------------------------------------------------------------|-----|-----------|
| (P)   | If $\sin^{-1} 2\sqrt{x} = 3\tan^{-1}\left(\tan(m+M)\right)$ then $8x$ equals                                | (1) | 0         |
| (Q)   | If $\cos^{-1} x + \cos^{-1} y = 3\left\{\tan^{-1}\left(\tan\dfrac{7M}{2}\right) + \tan^{-1}\left(m + \tan\dfrac{3\pi}{8}\right)\right\}$ then $(x+y)$ equals | (2) | 2         |
| (R)   | The value of $\tan\left(\sec^{-1}\left(\dfrac{2}{a^2}\right) + M\right)$ equals                             | (3) | –2        |
| (S)   | If $\alpha$ and $\beta$ are roots of the equation $x^2 - \left(\tan\left(3\sin^{-1}(\sin M)\right)\right)x + a^4 = 0$, then $\alpha\beta - (\alpha+\beta)$ equals | (4) | 1         |
|       |                                                                                                            | (5) | –1        |

The correct option is
(A) (P) → (5)   (Q) → (3)   (R) → (2)   (S) → (4)
(B) (P) → (4)   (Q) → (3)   (R) → (4)   (S) → (2)
(C) (P) → (5)   (Q) → (3)   (R) → (2)   (S) → (1)
(D) (P) → (3)   (Q) → (2)   (R) → (5)   (S) → (4)

10.    If $S_n = \sum_{r=1}^{n} r!$ then for $n > 6 \left( \text{given} \sum_{r=1}^{6} r! = 873 \right)$

| | List – I | | List – II |
|---|---|---|---|
| (P) | $\sin^{-1}\left( \sin\left( S_n - 7\left[ \dfrac{S_n}{7} \right] \right) \right)$ | (1) | $5 - 2\pi$ |
| (Q) | $\cos^{-1}\left( \cos\left( S_n - 7\left[ \dfrac{S_n}{7} \right] \right) \right)$ | (2) | $2\pi - 5$ |
| (R) | $\tan^{-1}\left( \tan\left( S_n - 7\left[ \dfrac{S_n}{7} \right] \right) \right)$ | (3) | $6 - 2\pi$ |
| (S) | $\cot^{-1}\left( \cot\left( S_n - 7\left[ \dfrac{S_n}{7} \right] \right) \right)$ | (4) | $5 - \pi$ |
| | | (5) | $\pi - 4$ |

(where [ ] denotes greatest integer function)

The correct option is
(A) (P) → (5)   (Q) → (3)   (R) → (2)   (S) → (4)
(B) (P) → (5)   (Q) → (2)   (R) → (3)   (S) → (1)
(C) (P) → (1)   (Q) → (2)   (R) → (1)   (S) → (4)
(D) (P) → (3)   (Q) → (2)   (R) → (5)   (S) → (4)

# (PART – B)

This section contains **SIX (06)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1.    Find the value of expression $\left[ \dfrac{18}{35} \right] + \left[ \dfrac{18(2)}{35} \right] + \left[ \dfrac{18(3)}{35} \right] + \cdots\cdots \left[ \dfrac{18(33)}{35} \right] + \left[ \dfrac{18(34)}{35} \right]$

[Note : [y] denotes the greatest integer function less than or equal to y.]

2.    If $f(x) = x^3 - 3x + \sin^{-1}\left( a^2 - 3a + 2 \right)$. Then the smallest positive integer 'a' for which $f(x) = 0$ has three distinct real solution.

*Space For Rough Work*

3.    Find the number of integers in the range of the function $f(x) = \cos x \left( \sin x + \sqrt{\sin^2 x + \dfrac{1}{2}} \right)$.

4.    If $\displaystyle\lim_{n\to\infty} \sum_{k=2}^{n} \cos^{-1} \left( \dfrac{1 + \sqrt{(k-1)k(k+1)(k+2)}}{k(k+1)} \right) = \dfrac{120\pi}{k}$ then find the value of k.

5.    The set of real values of 'x' satisfying the equality $\left[\dfrac{3}{x}\right] + \left[\dfrac{4}{x}\right] = 5$ (where [ ] denotes the greatest integer function) belongs to the interval $\left(a, \dfrac{b}{c}\right]$ where $a, b, c \in N$ and $\dfrac{b}{c}$ is in its lowest form. Find the value of $a + b + c + abc$.

6.    If range of the function $f(x) = \left(\cos^{-1}\dfrac{x}{2}\right)^2 + \pi \sin^{-1}\dfrac{x}{2}\left(\sin^{-1}\dfrac{x}{2}\right)^2 + \dfrac{\pi^2}{12}\left(x^2 + 6x + 8\right)$ is $\left[a\pi^2, b\pi^2\right]$, then find the value of $2(a+b)$.

*Space For Rough Work*

# FIITJEE INTERNAL TEST

## BATCHES – PANINI426-G1 & PANINI426XII-1

## Common Test – 1
## Code: 100980
## JEE ADVANCED LEVEL
## ANSWER KEY
### ANSWER KEYS

### Physics
**PART – A**

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

**PART – B**

| 1. | 0.90 | 2. | 12.50 | 3. | 0.60 | 4. | 0.38 |
|----|------|----|-------|----|------|----|------|
| 5. | 0.25 | 6. | 0.60 | | | | |

### Chemistry
**PART – A**

| 1. | C | 2. | C | 3. | B | 4. | C |
|----|---|----|---|----|---|----|---|
| 5. | ABCD | 6. | ABC | 7. | ABC | 8. | B |
| 9. | D | 10. | B | | | | |

**PART – B**

| 1. | 4.6 | 2. | 2.5 | 3. | 3.2 | 4. | 1.7 |
|----|-----|----|-----|----|-----|----|-----|
| 5. | 1.6 | 6. | 0.6 | | | | |

### Mathematics
**PART – A**

| 1. | D | 2. | C | 3. | B | 4. | D |
|----|---|----|---|----|---|----|---|
| 5. | ABD | 6. | ABCD | 7. | ABCD | 8. | A |
| 9. | B | 10. | C | | | | |

**PART – B**

| 1. | 289 | 2. | 1 | 3. | 3 | 4. | 720 |
|----|-----|----|---|----|---|----|-----|
| 5. | 20 | 6. | 5 | | | | |