

**PHYSICS, CHEMISTRY & MATHEMATICS****QP CODE:100728****Paper – 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.

**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.
- \* **In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the 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 (08-11)** – This section contains Four (04) 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 **+3 Marks** for correct answer and **-1 marks** for wrong answer.
- (iii) **Part-B (01-06)** This section contains **SIX (06)** questions. The answer to each question is a **NON-NEGATIVE INTEGER**. For each question, enter the correct integer corresponding to the answer. Each question carries **+4 marks** for correct answer. **There is no negative marking.**

Name of the Candidate: \_\_\_\_\_

Batch: \_\_\_\_\_ Date of Examination: \_\_\_\_\_

Enrolment Number: \_\_\_\_\_

**Forthcoming  
Exam – FTRE on  
15th Sept. 2024.**

- \* In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the OMR sheet.

## SECTION – I: PHYSICS

### (PART – A)

#### (Single Correct Answer Type)

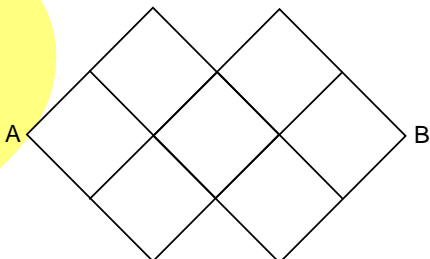
This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

- The electric field inside a sphere which carries a charge density proportional to the distance from the origin (centre)  $\rho = \alpha r$  ( $\alpha$  is a constant) is:
 

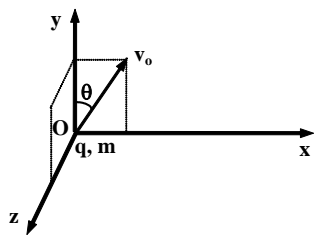
(F)  $\frac{\alpha r^3}{4\epsilon_0}$                       (T)  $\frac{\alpha r^2}{4\epsilon_0}$                       (R)  $\frac{\alpha r^2}{3\epsilon_0}$                       (E) none of these
- Electrical potential 'v' in space as a function of co-ordinates is given by,  $v = \frac{1}{x} + \frac{1}{y} + \frac{1}{z}$ . Then the electric field intensity at (1, 1, 1) is given by:
 

(F)  $-(\hat{i} + \hat{j} - \hat{k})$                       (T)  $\hat{i} + \hat{j} + \hat{k}$                       (R) zero                      (E)  $\frac{1}{\sqrt{3}}(\hat{i} + \hat{j} + \hat{k})$
- In the shown wire frame, each side of a square (the smallest square) has a resistance R. Equivalent resistance of the circuit between the points A and B is
 

(F) R  
(T) 2R  
(R) 4R  
(E) 8R


- A particle of mass m, carrying a charge q, is lying at the origin in a uniform magnetic field directed along X axis. At the instant  $t = 0$  it is given a velocity  $v_0$  at an angle  $\theta$  with the y axis, in the xy plane. The coordinates of the particle after two revolutions will be
 

(F)  $\left(0, 0, \frac{2\pi m v_0 \sin \theta}{qB}\right)$                       (T)  $\left(\frac{2\pi m v_0 \sin \theta}{qB}, 0, 0\right)$   
(R)  $\left(\frac{4\pi m v_0 \sin \theta}{qB}, 0, 0\right)$                       (E) (0, 0, 0)



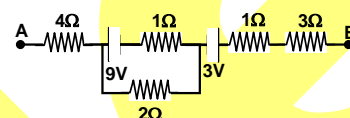
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**(One or More Than One Options Correct Type)**

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

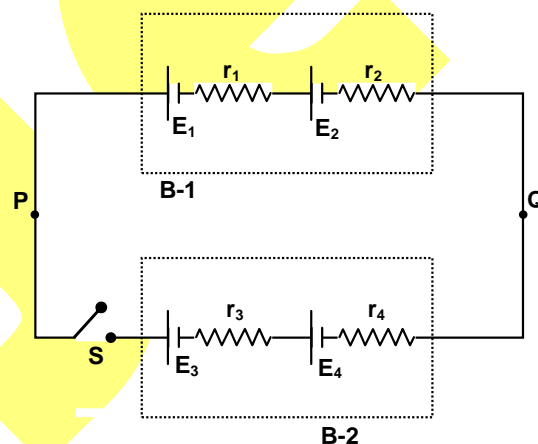
5. The electrostatic potential  $V$  at any point  $(x, y, z)$  in space is given by  $V = 4x^2$   
 (F) The  $y$  – and  $z$  – components of the electrostatic field at any point are zero  
 (T) the  $x$  – component at a point is given  $(-8x\hat{i})$   
 (R) The  $x$  – component at a point  $(1, 0, 2)$  is  $(-8\hat{i})$   
 (E) There is no potential drop along  $y$  and  $z$  axis

6. The potential difference between the points A and B in the circuit shown is 16 V. Which is/are the correct statement(s) out of the following?



- (F) The current through  $2\Omega$  resistor is 3.5 A  
 (T) The current through  $4\Omega$  resistor is 2.5 A  
 (R) The current through  $3\Omega$  resistor is 1.5 A  
 (E) The P.D. across the  $2\Omega$  resistor is 7V

7. A battery B-1 is made by using two cells of emf  $E_1$  and  $E_2$  and internal resistance  $r_1$  and  $r_2$  respectively. Another battery B-2 is made by using different cells of emf  $E_3$  and  $E_4$  and internal resistance  $r_3$  and  $r_4$  respectively. Now they are connected with points P and Q as shown in the figure. All cells are rechargeable. Now switch is closed at  $t = 0$ , then choose the correct option(s).



- (F) The potential difference across both the battery will be equal.  
 (T) Rate of heat dissipation in both batteries is equal.  
 (R) One battery will charge the other battery.  
 (E) Rate of loss in chemical energy of one battery is more than the rate of gain in chemical energy of the other.

Space For Rough Work

**(Matching List Sets)**

This section contains **FOUR (04)** 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 following:

List – I Systems		List – II Paths of charge Particles	
(P)	<p>The charge <math>q</math> is projected perpendicular to the electric field. Then it moves through the magnetic field</p>	(1)	
(Q)	<p>The charge is released from rest in a crossed <math>\vec{B}</math> and <math>\vec{E}</math></p>	(2)	
(R)	<p>The charge is projected perpendicular to <math>E</math> in a crossed <math>\vec{E}</math> and <math>\vec{B}</math></p>	(3)	
(S)	<p>The charge is projected at a non-zero angle <math>\theta (&lt; 90^\circ)</math> with the magnetic induction.</p>	(4)	
		(5)	

Which one of the following options is correct?

(F)  $P \rightarrow 1, Q \rightarrow 3, R \rightarrow 4, S \rightarrow 2$

(T)  $P \rightarrow 3, Q \rightarrow 1, R \rightarrow 5, S \rightarrow 4$

(R)  $P \rightarrow 3, Q \rightarrow 1, R \rightarrow 4, S \rightarrow 2$

(E)  $P \rightarrow 4, Q \rightarrow 5, R \rightarrow 4, S \rightarrow 2$

Space For Rough Work

9. If a parallel plate capacitor of capacitance  $C$  is charged with battery of emf  $V$  volt through a resistance  $R$

List-I		List-II	
(P)	The separation between the plates of capacitor is increased, keeping battery connected	(1)	Charge on the capacitor increases
(Q)	The separation between the plates of capacitor is decreased, keeping battery connected	(2)	Charge on the capacitor decreases
(R)	The separation between the plates of capacitor is increased, keeping battery disconnected	(3)	Electric potential energy between the space of the plates of the capacitor decreases
(S)	The separation between the plates of capacitor is decreased, keeping battery disconnected	(4)	Electric potential energy between the space of the plates of the capacitor increases
		(5)	Potential difference between the plates remains constant

Which one of the following options is correct?

(F)  $P \rightarrow 2,3,5$  ;  $Q \rightarrow 1,4,5$  ;  $R \rightarrow 5$  ;  $S \rightarrow 3$

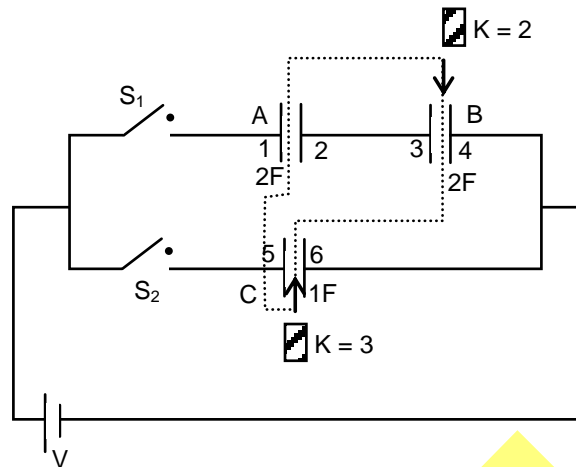
(T)  $P \rightarrow 2,3,5$  ;  $Q \rightarrow 1,4,5$  ;  $R \rightarrow 3$  ;  $S \rightarrow 5$

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

(E)  $P \rightarrow 1,5$  ;  $Q \rightarrow 2,5$  ;  $R \rightarrow 5$  ;  $S \rightarrow 3$

*Space For Rough Work*

10.



Change in quantities between initial and final situation is given in list-I and its numerical value in list-II.

List-I		List-II	
(P)	Change in amount of + charge on capacitor	(1)	0
(Q)	Change in energy	(2)	$\frac{1}{3}$
(R)	Change in potential difference	(3)	$\frac{1}{36}$
(S)	Final charge inside closed surface inclosing plate 2, 3 and 5 of different capacitor.]	(4)	$\frac{1}{6}$
		(5)	$\frac{1}{2}$

$S_1$  is closed and  $S_2$  open, and  $V = 1$  volt. In initial situation capacity are given. When capacitors are fully charged then dielectric of dielectric constant shown in figure is inserted in capacitor B to fill space between plates completely for final situation. Then for capacitor B. Choose correct option:

(F)  $P \rightarrow 2$  ;  $Q \rightarrow 3$  ;  $R \rightarrow 4$  ;  $S \rightarrow 1$

(T)  $P \rightarrow 1$  ;  $Q \rightarrow 2$  ;  $R \rightarrow 3$  ;  $S \rightarrow 4$

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

(E)  $P \rightarrow 2$  ;  $Q \rightarrow 4$  ;  $R \rightarrow 1$  ;  $S \rightarrow 3$

Space For Rough Work

11. In list-I, circuit having different combination of capacitors are given and in list-II, value of  $C_{eq}$ . Of charge is given.

	List-I (Circuit)	List-II ( $C_{eq}$ ) / Charge
(P)		(1) $\frac{3C}{4}$
(Q)		(2) $\frac{5C}{12}$
(R)		(3) $\frac{2C}{3}$
(S)		(4) $\frac{3C}{2}$

For equivalent capacitance between points A and B, match list-I with list-II

(F) P  $\rightarrow$  4 ; Q  $\rightarrow$  2 ; R  $\rightarrow$  3 ; S  $\rightarrow$  1

(T) P  $\rightarrow$  4 ; Q  $\rightarrow$  1 ; R  $\rightarrow$  2 ; S  $\rightarrow$  3

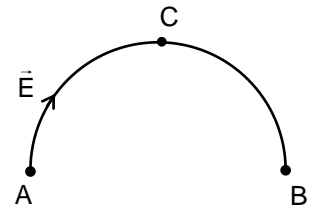
(R) P  $\rightarrow$  4 ; Q  $\rightarrow$  1 ; R  $\rightarrow$  3 ; S  $\rightarrow$  2

(E) P  $\rightarrow$  4 ; Q  $\rightarrow$  2 ; R  $\rightarrow$  1 ; S  $\rightarrow$  3

### (PART - B)

(Non - Negative Integer)

1. Semicircular electric field line is present in a space. The magnitude of electric field is constant at each point of electric field lines. A point charge is constrained to move along the field lines. The particle starts from rest and initially it is at point A. The magnitude of acceleration of the particle at C is  $a_1$  and it is  $a_2$  when reaches at B. The ratio of  $a_1$  and  $a_2$  is given by  $\sqrt{\frac{1+k_1}{1+k_2}}$ .

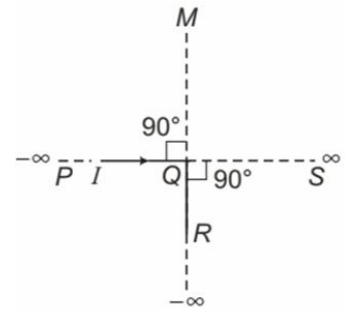


Find the value of  $\frac{k_2}{k_1}$ .

2. A particle of mass  $m = \sqrt{227}$  gm and charge  $q = 7\mu\text{C}$  is projected in a space where magnetic field is given by  $\vec{B} = y^2\hat{i} + z^2\hat{j} + x^2\hat{k}$ . The initial velocity of projection of particle is  $\vec{v} = \hat{i} - 2\hat{j} + 3\hat{k}$  from (1, 2, 1). Find radius of curvature of particle at  $t = 0$  in kilometer.

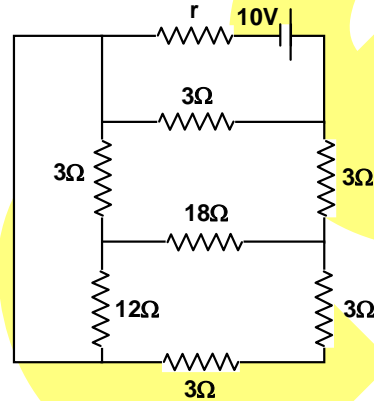
Space For Rough Work

3. An infinitely long conductor PQR is bent to form a right angle as shown in figure. A current  $I$  flows through PQR. The magnetic field due to this current at the point M is  $H_1$ . Now, another infinitely long straight conductor QS is connected at Q, so that current is  $I/2$  in QR as well as in QS, the current in PQ remaining unchanged. The magnetic field

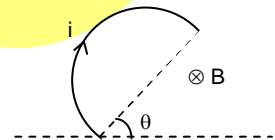


at M is now  $H_2$ . Find  $\left(\frac{3H_1}{H_2}\right)$ .

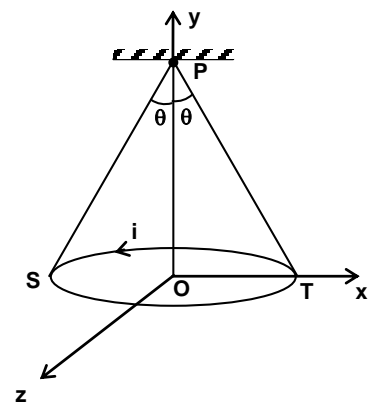
4. A battery of potential difference 10 V and internal resistance 'r' is connected to seven resistors as shown in the figure. If battery delivers maximum power to the circuit with internal resistance  $r = \frac{4}{13}\lambda$ , then find the value of  $\lambda$ .



5. A semicircular ring of radius R carrying current  $i$  is placed in a magnetic field of intensity B so that plane of wire is perpendicular to magnetic field as shown. Net force acting on the ring is  $KBiR$ . Find the value of K.



6. A ring of uniform mass density ( $m = 100 \text{ gm}$ ) and radius ( $R = 50 \text{ cm}$ ) is suspended by two strings PS and PT from the point P on y-axis in vertical plane. The ring is kept parallel to horizontal surface on x-z plane. Ring carries a current  $\left(i = \frac{7}{22} \text{ amp}\right)$  as shown in the figure. There exist a magnetic field ( $B = 1 \text{ Tesla}$ ) along negative x-axis. The tension in the string PS is  $T_1$  and in the string PT is  $T_2$ . Find the ratio  $\frac{T_1}{T_2}$ . (It is given that  $\theta = 60^\circ$ )



Space For Rough Work



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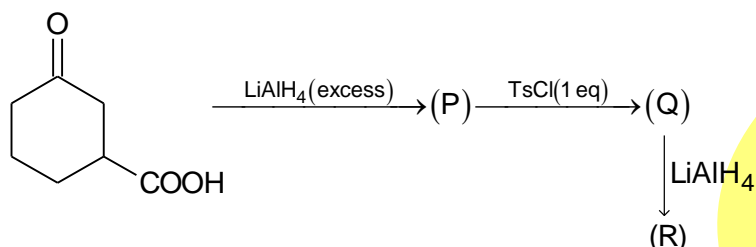
## SECTION - II: CHEMISTRY

### (PART - A)

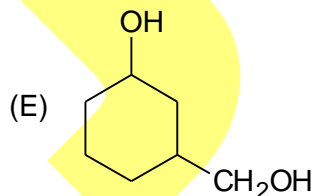
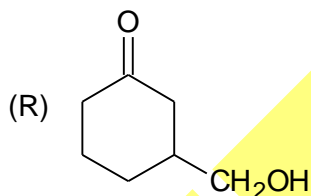
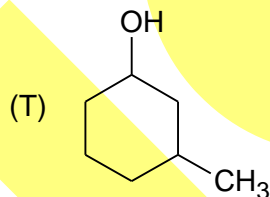
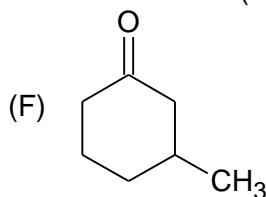
(Single Correct Answer Type)

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

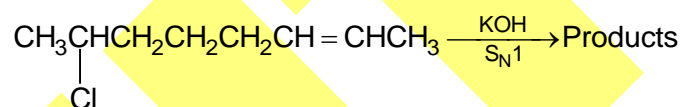
1.



In above reaction (R) is



2.

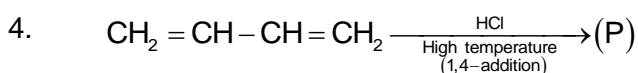
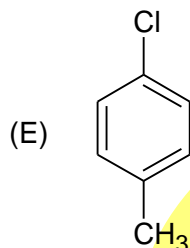
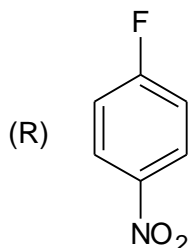
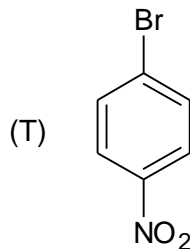
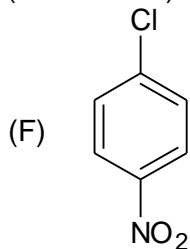


Choose correct statements about the products in above reaction?

- (F) Four pairs of enantiomers are formed.  
 (T) The product mixture has no optical activity but the individual isomeric products are optically active  
 (R) Three diastereomers are formed  
 (E) Two meso products are formed

Space For Rough Work

3. Which is most reactive towards  $\text{OH}^-$  ion according to aromatic nucleophilic substitution (bimolecular) reaction?

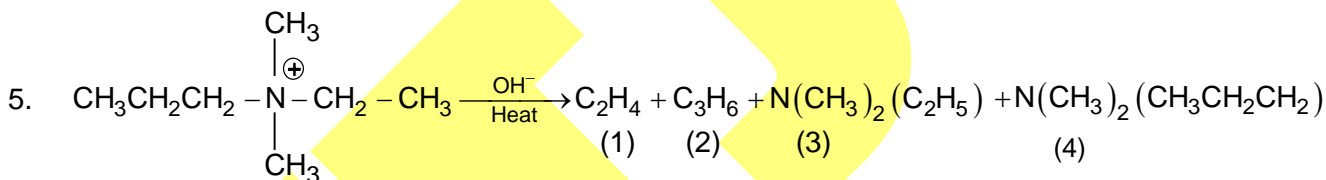


How many hydrogen atom(s) is/are present in the product(P) at allylic positions.

- (F) 5 (T) 3 (R) 4 (E) 2

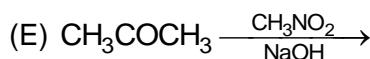
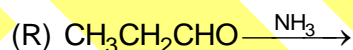
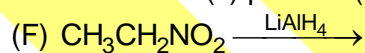
**(One or More Than One Options Correct Type)**

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.



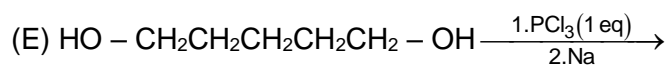
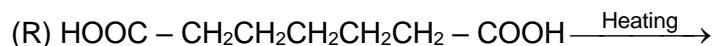
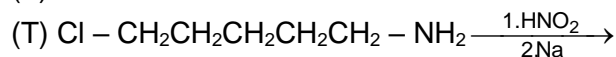
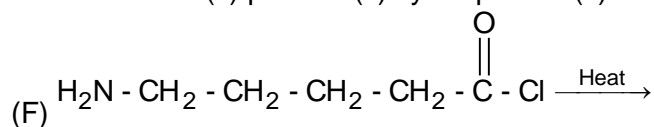
Choose correct statement(s) regarding the products.

- (F) yield of (1) is greater than that of (2)  
 (T) yield of (4) is greater than that of (3)  
 (R)  $\text{OH}^-$  eliminates the most acidic hydrogen from the reactant  
 (E)  $\text{OH}^-$  eliminates  $\beta$ -hydrogen from the reactant
6. Which reaction(s) produce(s) primary amine(s)?



Space For Rough Work

7. Which reaction(s) produce(s) cyclic product(s)?



**(Matching List Sets)**

This section contains **FOUR (04)** 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 each entry in List-I to the correct entries in List-II

List - I		List - II	
(P)	$\text{CH}_3\text{CH}_2\text{COCH}_3 \xrightarrow[4.\text{Na/ether(dry)}]{1.\text{LiAlH}_4, 2.\text{dil.HCl}, 3.\text{SOCl}_2}$	(1)	$\text{CH}_3\text{CH}_2\text{NH}_2$
(Q)	$\text{CH}_3\text{CH}_2\text{COOH} \xrightarrow[3.\text{Br}_2/\text{KOH}]{1.\text{SOCl}_2, 2.\text{NH}_2^-}$	(2)	$\text{Br} - \text{CH}_2\text{CH}_2 - \text{Br}$
(R)	$\text{CH}_3\text{CH}_2\text{NH}_2 \xrightarrow[3.\text{Br}_2/\text{CS}_2]{1.\text{CH}_3\text{I}(3\text{ eq}), 2.\text{Ag}_2\text{O}/\text{H}_2\text{O}}$	(3)	$\begin{array}{c} \text{CH}_3\text{CH}_2\text{CHCH}_3 \\   \\ \text{CH}_3\text{CH}_2\text{CHCH}_3 \end{array}$
(S)	$\text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_2 \xrightarrow[3.\text{LiAlH}_4]{1.\text{Zn}/\text{HCl}, 2.\text{CHCl}_3/\text{KOH}}$	(4)	$\text{CH}_3\text{CH}_2\text{CH}_2\text{NHCH}_3$
		(5)	$\text{CH}_3\text{CH}_2\text{Br}$

The correct option is:

(F) (P) → (2), (Q) → (3), (R) → (1), (S) → (5)

(T) (P) → (3), (Q) → (1), (R) → (2), (S) → (4)

(R) (P) → (3), (Q) → (5), (R) → (2), (S) → (4)

(E) (P) → (2), (Q) → (1), (R) → (3), (S) → (5)

Space For Rough Work

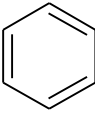
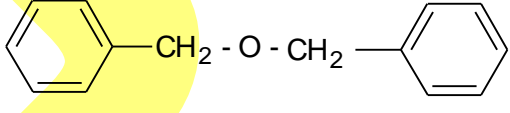

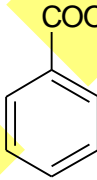
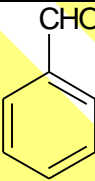
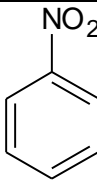
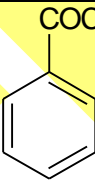
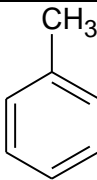
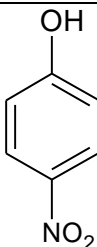
9. Match each entry in List-I to the correct entries in List-II

List - I (Reactions)		List - II (Reaction mechanism)	
(P)	$\text{CH}_3\text{Cl} \xrightarrow[\text{H}_2\text{O}]{\text{KOH}}$	(1)	$\text{S}_{\text{N}}1$
(Q)	$\text{H}_3\text{C}-\underset{\text{CH}_3}{\overset{\text{Cl}}{\text{C}}}-\text{CH}_3 \xrightarrow[\text{C}_2\text{H}_5\text{OH}]{\text{NaOC}_2\text{H}_5}$	(2)	E1
(R)	$\text{CH}_3\text{CH}_2\underset{\text{Cl}}{\text{CH}}\text{CH}_3 \xrightarrow{\text{CH}_3\text{OH}}$	(3)	E2
(S)	$\text{CH}_3\text{CH}_2\text{CH}_2-\overset{\oplus}{\text{S}}(\text{CH}_3)_2 \xrightarrow[\Delta]{\text{OH}^-}$	(4)	$\text{S}_{\text{N}}2$
		(5)	NGP

The correct option is:

(F) (P)  $\rightarrow$  (2), (Q)  $\rightarrow$  (3), (R)  $\rightarrow$  (1), (S)  $\rightarrow$  (3)(T) (P)  $\rightarrow$  (1), (Q)  $\rightarrow$  (2), (R)  $\rightarrow$  (3), (S)  $\rightarrow$  (4)(R) (P)  $\rightarrow$  (4), (Q)  $\rightarrow$  (3), (R)  $\rightarrow$  (1), (S)  $\rightarrow$  (5)(E) (P)  $\rightarrow$  (4), (Q)  $\rightarrow$  (2), (R)  $\rightarrow$  (1), (S)  $\rightarrow$  (3)

10. Match each entry in List-I to the correct entries in List-II

List - I (Reactions)		List - II (Products)	
(P)	 $\xrightarrow[\text{Conc. H}_2\text{SO}_4]{\text{Conc. HNO}_3}$	(1)	
(Q)	 $\xrightarrow[\text{Heat}]{\text{Conc. H}_2\text{SO}_4}$	(2)	
(R)	 $\xrightarrow{\text{Zn-Hg/Conc. HCl}}$	(3)	
(S)	 $\xrightarrow[2. \text{H}_3\text{O}^+]{1. \text{I}_2/\text{NaOH}/\Delta}$	(4)	
		(5)	

The correct option is:

(F) (P) → (2), (Q) → (1), (R) → (3), (S) → (5)

(T) (P) → (2), (Q) → (3), (R) → (1), (S) → (4)

(R) (P) → (3), (Q) → (1), (R) → (4), (S) → (2)

(E) (P) → (3), (Q) → (4), (R) → (1), (S) → (5)

11. Match each entry in List-I to the correct entries in List-II

List – I (Hydrolysis)		List – II (Characteristics)	
(P)	$\text{CH}_3\text{COOC}_2\text{H}_5 \xrightarrow{\text{H}_2\text{O}}$	(1)	Hydrolysis is irreversible in both acidic and basic medium
(Q)	$\text{CH}_3\text{CH}_2\text{CONH}_2 \xrightarrow{\text{H}_2\text{O}}$	(2)	Two moles of the same compound is formed
(R)	$\text{CH}_3\text{CH}_2\text{COCl} \xrightarrow{\text{H}_2\text{O}}$	(3)	The rate of hydrolysis is higher than any other acid derivative containing same alkyl group
(S)	$\text{CH}_3\text{COOCOCH}_3 \xrightarrow{\text{H}_2\text{O}}$	(4)	The product yield is maximum if hydrolysis is done in basic medium than in acidic medium
		(5)	pH of solution decreases after hydrolysis

The correct option is:

(F) (P) → (3), (Q) → (2), (R) → (4), (S) → (5)

(T) (P) → (4), (Q) → (1), (R) → (3), (S) → (2)

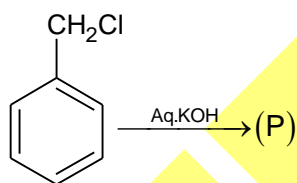
(R) (P) → (4), (Q) → (3), (R) → (5), (S) → (2)

(E) (P) → (3), (Q) → (4), (R) → (3), (S) → (5)

(PART – B)

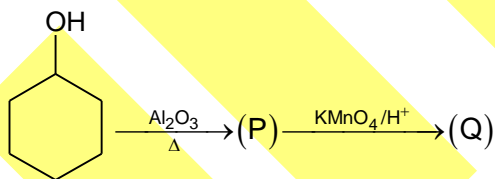
(Non – Negative Integer)

1.



How much  $\text{H}_2$  gas in gram is produced if two moles of (P) reacts with excess Na metal?

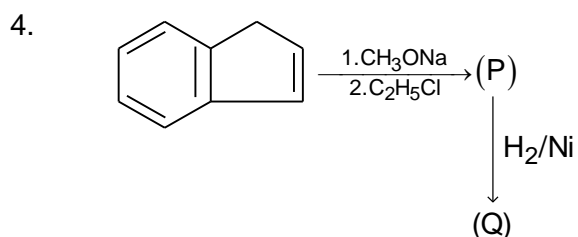
2.



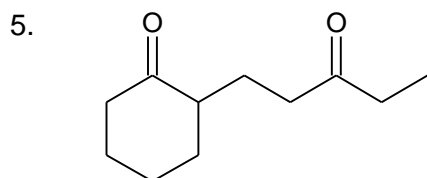
The sum of the number of carbon, hydrogen and oxygen atoms present in (Q) is

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3.  $\text{CH}_3\text{CH}_2\text{NHCH}_3 \xrightarrow{\text{HNO}_2} (\text{X})$   
 $x$  = number of 'N' atoms present in (X)  
 $y$  = number of 'O' atoms present in (X)  
 $z$  = number of hydrogen atoms present in (X)  
 What is the value of  $(x + y + z)$ ?



How many monochloro products excluding stereoisomers is/are formed by the product(Q)?



How many mono enols is/are possible for the above compound?

6.  $\text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-\overset{\text{OH}}{\text{CH}}-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-\text{COOH}$   
 How many moles of  $\text{CH}_3\text{MgBr}$  can completely react with one mole of above compound?

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- \* In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the OMR sheet.

## 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.  $\int_{-2012}^{2012} \min(\{x\}, \{-x\}) dx$  is equal to (where  $\{.\}$  denotes the fractional part)  
 (F) 0 (T) 503 (R) 1006 (E) 2012
2. If  $I_1 = \int_{-100}^{101} \frac{dx}{(5+2x-2x^2)(1+e^{2-4x})}$  and  $I_2 = \int_{-100}^{101} \frac{dx}{5+2x-2x^2}$  then  $\frac{I_1}{I_2}$  is  
 (F) 2 (T)  $\frac{1}{2}$  (R) 1 (E)  $-\frac{1}{2}$
3. Let  $f$  be a function defined as follows:
- $$f(x) = \begin{cases} x^3 + x^2 - 10x, & -1 \leq x < 0 \\ \cos x, & 0 \leq x < \frac{\pi}{2} \\ 1 + \sin x, & \frac{\pi}{2} \leq x \leq \pi \end{cases}$$
- The  $f(x)$  has  
 (F) a local minimum at  $x = \frac{\pi}{2}$  (T) a local maximum at  $x = \frac{\pi}{2}$   
 (R) an absolute minimum at  $x = -1$  (E) an absolute maximum at  $x = \pi$
4. Let  $I = \int_0^1 \frac{\sin x}{\sqrt{x}} dx$  and  $J = \int_0^1 \frac{\cos x}{\sqrt{x}} dx$ , then which one of the following is true?  
 (F)  $I < \frac{2}{3}$  and  $J > 2$  (T)  $I > \frac{2}{3}$  and  $J < 2$   
 (R)  $I > \frac{2}{3}$  and  $J > 2$  (E)  $I < \frac{2}{3}$  and  $J < 2$

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**(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  $f(x) = |x-1| - [x]$  where  $[x]$  is the greatest integer less than or equal to  $x$ , then  
 (F)  $f(1+0) = -1, f(1-0) = 0$  (T)  $f(1+0) = 0 = f(1-0)$   
 (R)  $\lim_{x \rightarrow 1} f(x)$  exists (E)  $\lim_{x \rightarrow 1} f(x)$  does not exist
6. A curve  $g(x) = \int x^{27} (1+x+x^2)^6 (6x^2+5x+4) dx$  is passing through origin, then  
 (F)  $g(1) = \frac{3^7}{7}$  (T)  $g(1) = \frac{2^7}{7}$  (R)  $g(-1) = \frac{1}{7}$  (E)  $g(-1) = \frac{3^7}{14}$
7. Let  $f(x) = a_5x^5 + a_4x^4 + a_3x^3 + a_2x^2 + a_1x$ , where  $a_i$ 's are real and  $f(x) = 0$  has a positive root  $\alpha_0$ . Then  
 (F)  $f'(x) = 0$  has a root  $\alpha_1$  such that  $0 < \alpha_1 < \alpha_0$   
 (T)  $f'(x) = 0$  has at least one real root  
 (R)  $f'(x) = 0$  has at least two real roots  
 (E) cannot say

**(Matching List Sets)**

This section contains **FOUR (04) 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 entries of Column – I with one or more than one entries of column – II. Note that  $[x]$ ,  $\{x\}$  and  $\text{sgn } x$  denote largest integer less than or equal to  $x$ , fractional part of  $x$  and signum function of  $x$  respectively.

List – I		List - II	
(P)	Let $f : [-1, 1] \rightarrow \mathbb{R}$ be defined by $f(x) = \sqrt[3]{x} + \sin^{-1} x$ , then $f(x)$ is	(1)	Odd
(Q)	Let $f : \mathbb{R} \rightarrow \{-1, 0, 1\}$ be defined by $f(x) = \text{sgn} \left( \frac{1- x }{1+ x } \right)$ then $f(x)$ is	(2)	Even
(R)	Let $f : [-4, 2] \rightarrow [0, 3]$ be defined by $f(x) = \sqrt{8-2x-x^2}$ then $f(x)$ is	(3)	Bijjective
(S)	Let $f : (-\infty, 0] \rightarrow [0, \infty)$ be defined by $f(x) = \frac{2^{-[x]}}{2^{\{x\}}} - 2^{ x }$ then $f(x)$ is	(4)	One – One
		(5)	Many – one

(F)  $P \rightarrow 4, Q \rightarrow 2, R \rightarrow 5, S \rightarrow 5$

(T)  $P \rightarrow 1, Q \rightarrow 3, R \rightarrow 3, S \rightarrow 1$

(R)  $P \rightarrow 2, Q \rightarrow 1, R \rightarrow 3, S \rightarrow 5$

(E)  $P \rightarrow 2, Q \rightarrow 2, R \rightarrow 5, S \rightarrow 3$

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9. Match the following columns:

List - I		List - II	
(P)	Suppose $f(n) = \log_2(3) \cdot \log_3(4) \cdot \log_4(5) \dots \log_{n-1}(n)$ then the sum $\sum_{k=2}^{100} f(2^k)$ equals	(1)	5010
(Q)	Let $f(x) = \sqrt{1+x} \sqrt{1+(x+1)} \sqrt{1+(x+2)(x+4)}$ then $\int_0^{100} f(x) dx$ is	(2)	5050
(R)	In an A.P. the series containing 99 terms, the sum of all the odd numbered terms is 2550. The sum of all 99 terms of the A.P. is	(3)	5100
(S)	$\lim_{x \rightarrow 0} \frac{\prod_{r=1}^{100} (1+rx) - 1}{x}$ equals	(4)	5049
		(5)	5501

(F) P  $\rightarrow$  4, Q  $\rightarrow$  2, R  $\rightarrow$  5, S  $\rightarrow$  5

(T) P  $\rightarrow$  1, Q  $\rightarrow$  3, R  $\rightarrow$  3, S  $\rightarrow$  1

(R) P  $\rightarrow$  2, Q  $\rightarrow$  1, R  $\rightarrow$  3, S  $\rightarrow$  5

(E) P  $\rightarrow$  4, Q  $\rightarrow$  3, R  $\rightarrow$  4, S  $\rightarrow$  2

10. In the following  $[ ]$  and  $\{ \}$  are greatest integer function and fractional part function respectively. Match the functions in List - I with the properties in List - II

(Note:  $x \in (-2, 2)$ )

List - I		List - II	
(P)	$f_1(x) = \left[ \frac{4x}{\pi} \right] \operatorname{sgn}(x^2 - x + 1)$	(1)	Not differentiable at exactly 5 points
(Q)	$f_2(x) = \cos^{-1} \left( \operatorname{sgn} \left( \cos \frac{2x-1}{2} \pi \right) \right)$	(2)	Not differentiable at exactly 3 points
(R)	$f_3(x) = \max. (\{x+1\}, \{5-x\})$	(3)	Not differentiable at more than 5 points
(S)	$f_4(x) = \sqrt{x^2} + [x]^2$	(4)	Not differentiable at less than 3 points.
		(5)	Differentiable everywhere

(F) P  $\rightarrow$  1, Q  $\rightarrow$  3, R  $\rightarrow$  2, S  $\rightarrow$  4

(T) P  $\rightarrow$  2, Q  $\rightarrow$  3, R  $\rightarrow$  4, S  $\rightarrow$  4

(R) P  $\rightarrow$  1, Q  $\rightarrow$  2, R  $\rightarrow$  3, S  $\rightarrow$  3

(E) P  $\rightarrow$  1, Q  $\rightarrow$  2, R  $\rightarrow$  3, S  $\rightarrow$  2

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11. Consider  $f(x) = |\ln|x|| - kx^2$ ,  $x \neq 0$ . Match the List - I with the value of  $k$  in List - II

List - I		List - I	
(P)	$f(x) = 0$ has two distinct solutions	(1)	$k = 0$
(Q)	$f(x) = 0$ has four distinct solutions	(2)	$k = \frac{1}{2e}$
(R)	$f(x) = 0$ has six distinct solutions	(3)	$k \in \left(\frac{1}{2e}, \infty\right)$
(S)	$f(x) =$ has no solution	(4)	$k \in (-\infty, 0)$
		(5)	$k \in \left(0, \frac{1}{2e}\right)$

(F)  $P \rightarrow 1, Q \rightarrow 3, R \rightarrow 4, S \rightarrow 5$

(T)  $P \rightarrow 3, Q \rightarrow 2, R \rightarrow 5, S \rightarrow 4$

(R)  $P \rightarrow 1, Q \rightarrow 4, R \rightarrow 5, S \rightarrow 2$

(E)  $P \rightarrow 3, Q \rightarrow 4, R \rightarrow 2, S \rightarrow 4$

### (PART - B)

(Non - Negative Integer)

- Let  $f: (0, \infty) \rightarrow \mathbb{R}$  and  $F(x^2) = \int_0^{x^2} f(t) dt$ . If  $F(x^2) = x^2(1+x)$ , then  $f(4)$  is equal to \_\_\_\_\_
- $\lim_{x \rightarrow 2^+} \left( \frac{2\{x\} - 4}{[x] - 3} \right)$  is equal to, where  $\{.\}$  and  $[.]$  represents fractional part of  $x$  and greatest integer function \_\_\_\_\_
- Suppose  $\int \frac{1 - 7 \cos^2 x}{\sin^7 x \cos^2 x} dx = \frac{g(x)}{\sin^7 x} + C$ , where  $C$  is an arbitrary constant of integration. Then find the value of  $g'(0) + g''\left(\frac{\pi}{4}\right)$ .
- Let  $A = \{1, 2, 3, 4\}$  and  $B = \{3, 4, 5, 6, 7\}$  are two sets. Let  $m$  is the number of one - one functions  $f: A \rightarrow B$  such that  $f(i) \neq i \forall i \in A$  and  $n$  is the number of one - one functions  $f: A \rightarrow B$  such that  $|f(i) - i| \leq 3 \forall i \in A$ , then find the value of  $(m + n)$
- Let  $g: \mathbb{R} - \left\{\frac{3}{2}\right\} \rightarrow \mathbb{R} - \left\{\frac{3}{2}\right\}$  be defined as  $g(x) = \frac{3x+5}{2x-3}$ . If  $g_{2014}(x) = \frac{px-q}{-rx+s}$ , where  $g_{2014}(x) = \underbrace{g(g(g(\dots)))}_{2014 \text{ times}}(x)$ , then find the value of  $(p+q+r+s)$ .
- A cubic function  $f(x)$  vanishes at  $x = -2$  and has relative minimum/maximum at  $x = -1$  and  $x = \frac{1}{3}$  if  $\int_{-1}^1 f(x) dx = \frac{14}{3}$ . The value of  $f(0)$  is \_\_\_\_\_

Space For Rough Work

# FIITJEE INTERNAL TEST

**BATCHES – Two Year CRP325 Batches**

**Phase Test – 4**

**Paper – 1**

**Code: 100728**

**JEE ADVANCED LEVEL**

**ANSWER KEY**

**ANSWER KEYS**

## Physics

### PART – A

- |         |        |        |      |
|---------|--------|--------|------|
| 1. B    | 2. B   | 3. B   | 4. C |
| 5. ABCD | 6. ACD | 7. ACD | 8. C |
| 9. A    | 10. A  | 11. B  |      |
- 
- |      |      |      |      |
|------|------|------|------|
| 1. 4 | 2. 2 | 3. 2 | 4. 7 |
| 5. 2 | 6. 3 |      |      |

## Chemistry

### PART – A

- |        |       |         |      |
|--------|-------|---------|------|
| 1. B   | 2. B  | 3. C    | 4. A |
| 5. ABD | 6. AB | 7. ABCD | 8. B |
| 9. D   | 10. C | 11. B   |      |
- 
- |       |       |       |       |
|-------|-------|-------|-------|
| 1. 2  | 2. 20 | 3. 11 | 4. 11 |
| 5. 11 | 6. 5  |       |       |

## Mathematics

### PART – A

- |       |       |        |      |
|-------|-------|--------|------|
| 1. C  | 2. B  | 3. B   | 4. D |
| 5. AD | 6. AC | 7. ABC | 8. A |
| 9. D  | 10. D | 11. B  |      |
- 
- |      |      |      |       |
|------|------|------|-------|
| 1. 4 | 2. 4 | 3. 5 | 4. 94 |
| 5. 2 | 6. 2 |      |       |