

## FINAL JEE(Advanced) EXAMINATION – 2023

(Held On Sunday 04<sup>th</sup> June, 2023)

PAPER-1

TEST PAPER WITH ANSWER

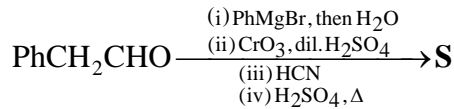
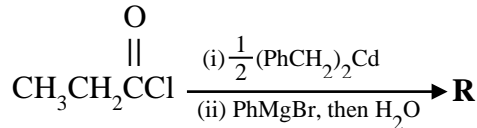
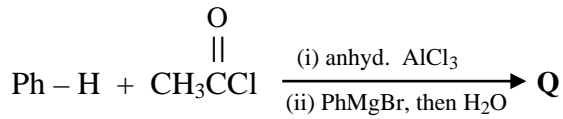
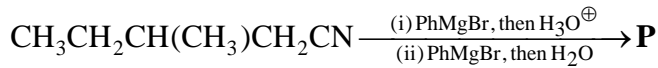
**CHEMISTRY****SECTION-1 : (Maximum Marks : 12)**

- This section contains **THREE (03)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:
  - Full Marks* : +4 **ONLY** if (all) the correct option(s) is(are) chosen;
  - Partial Marks* : +3 If all the four options are correct but **ONLY** three options are chosen;
  - Partial Marks* : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct;
  - Partial Marks* : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option;
  - Zero Marks* : 0 If none of the options is chosen (i.e. the question is unanswered);
  - Negative Marks* : -2 In all other cases.
- For example, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to correct answers, then
  - choosing **ONLY** (A), (B) and (D) will get +4 marks;
  - choosing **ONLY** (A) and (B) will get +2 marks;
  - choosing **ONLY** (A) and (D) will get +2 marks;
  - choosing **ONLY** (B) and (D) will get +2 marks;
  - choosing **ONLY** (A) will get +1 marks;
  - choosing **ONLY** (B) will get +1 marks;
  - choosing **ONLY** (D) will get +1 marks;
  - choosing no option (i.e. the question is unanswered) will get 0 marks; and
  - choosing any other combination of options will get -2 marks.

1. The correct statement(s) related to processes involved in the extraction of metals is(are)
  - (A) Roasting of Malachite produces Cuprite.
  - (B) Calcination of Calamine produces Zincite.
  - (C) Copper pyrites is heated with silica in a reverberatory furnace to remove iron.
  - (D) Impure silver is treated with aqueous KCN in the presence of oxygen followed by reduction with zinc metal.

**Ans. (B,C,D)**

2. In the following reactions, **P**, **Q**, **R**, and **S** are the major products.

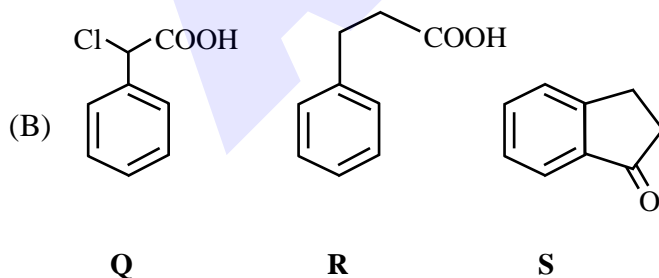
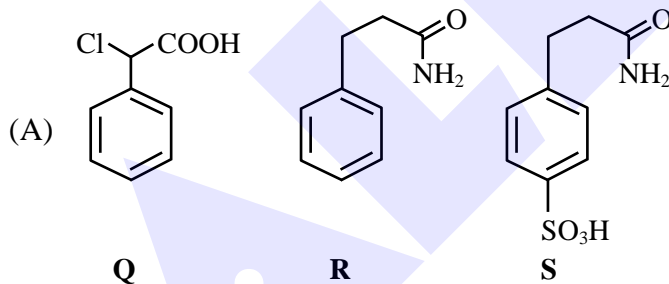
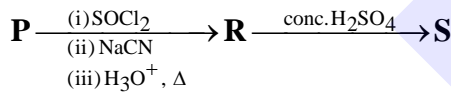
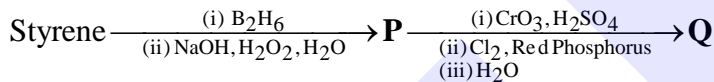


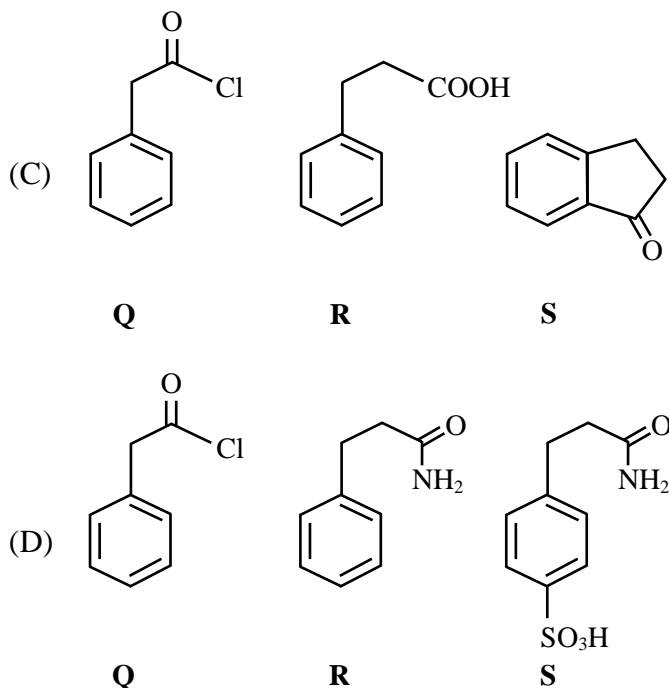
The correct statement(s) about **P**, **Q**, **R**, and **S** is(are)

- (A) Both **P** and **Q** have asymmetric carbon(s).  
 (B) Both **Q** and **R** have asymmetric carbon(s).  
 (C) Both **P** and **R** have asymmetric carbon(s).  
 (D) **P** has asymmetric carbon(s), **S** does **not** have any asymmetric carbon.

Ans. (C,D)

3. Consider the following reaction scheme and choose the correct option(s) for the major products **Q**, **R** and **S**.





Ans. (B)

**SECTION-2 : (Maximum Marks : 12)**

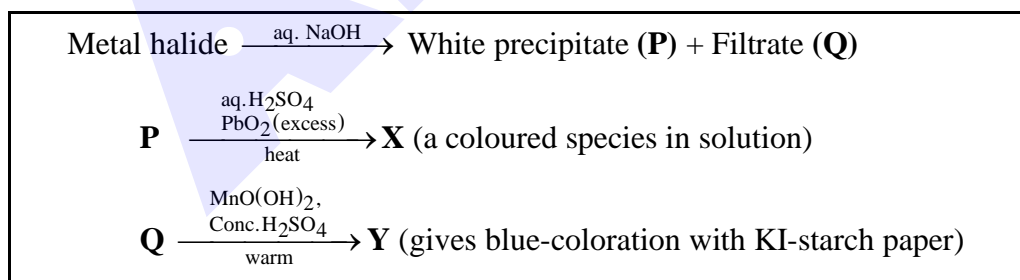
- This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:

*Full Marks* : +3 If **ONLY** the correct option is chosen;

*Zero Marks* : 0 If none of the options is chosen (i.e. the question is unanswered);

*Negative Marks* : -1 In all other cases.

4. In the scheme given below, **X** and **Y**, respectively, are



(A)  $\text{CrO}_4^{2-}$  and  $\text{Br}_2$

(B)  $\text{MnO}_4^{2-}$  and  $\text{Cl}_2$

(C)  $\text{MnO}_4^-$  and  $\text{Cl}_2$

(D)  $\text{MnSO}_4$  and  $\text{HOCl}$

Ans. (C)

5. Plotting  $1/\Lambda_m$  against  $c\Lambda_m$  for aqueous solutions of a monobasic weak acid (HX) resulted in a straight line with y-axis intercept of P and slope of S. The ratio P/S is

$[\Lambda_m = \text{molar conductivity}]$

$\Lambda_m^\circ = \text{limiting molar conductivity}$

$c = \text{molar concentration}$

$K_a = \text{dissociation constant of HX}$

- (A)  $K_a \Lambda_m^\circ$                       (B)  $K_a \Lambda_m^\circ / 2$                       (C)  $2 K_a \Lambda_m^\circ$                       (D)  $1 / (K_a \Lambda_m^\circ)$

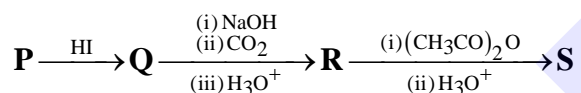
Ans. (A)

6. On decreasing the pH from 7 to 2, the solubility of a sparingly soluble salt (MX) of a weak acid (HX) increased from  $10^{-4} \text{ mol L}^{-1}$  to  $10^{-3} \text{ mol L}^{-1}$ . The  $pK_a$  of HX is:

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

Ans. (B)

7. In the given reaction scheme, P is a phenyl alkyl ether, Q is an aromatic compound; R and S are the major products.



The correct statement about S is

- (A) It primarily inhibits noradrenaline degrading enzymes.  
 (B) It inhibits the synthesis of prostaglandin.  
 (C) It is a narcotic drug.  
 (D) It is *ortho*-acetylbenzoic acid.

Ans. (B)

### SECTION-3 : (Maximum Marks : 24)

- 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 using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:  
 Full Marks : +4 **ONLY** If the correct integer is entered;  
 Zero Marks : 0 In all other cases.

8. The stoichiometric reaction of 516 g of dimethyldichlorosilane with water results in a tetrameric cyclic product X in 75% yield. The weight (in g) of X obtained is \_\_\_\_.

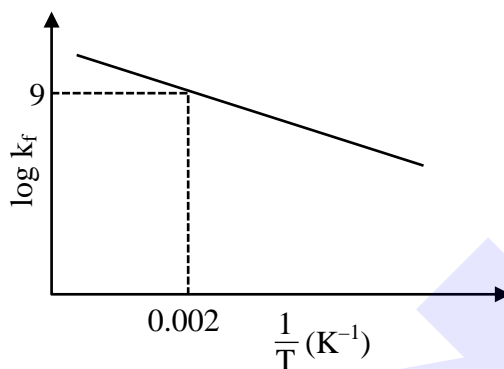
[Use, molar mass ( $\text{g mol}^{-1}$ ): H = 1, C = 12, O = 16, Si = 28, Cl = 35.5]

Ans. (222)

9. A gas has a compressibility factor of 0.5 and a molar volume of  $0.4 \text{ dm}^3 \text{ mol}^{-1}$  at a temperature of 800 K and pressure  $x \text{ atm}$ . If it shows ideal gas behaviour at the same temperature and pressure, the molar volume will be  $y \text{ dm}^3 \text{ mol}^{-1}$ . The value of  $x/y$  is \_\_\_\_.  
[Use: Gas constant,  $R = 8 \times 10^{-2} \text{ L atm K}^{-1} \text{ mol}^{-1}$ ]

Ans. (100)

10. The plot of  $\log k_f$  versus  $1/T$  for a reversible reaction  $A(g) \rightleftharpoons P(g)$  is shown.

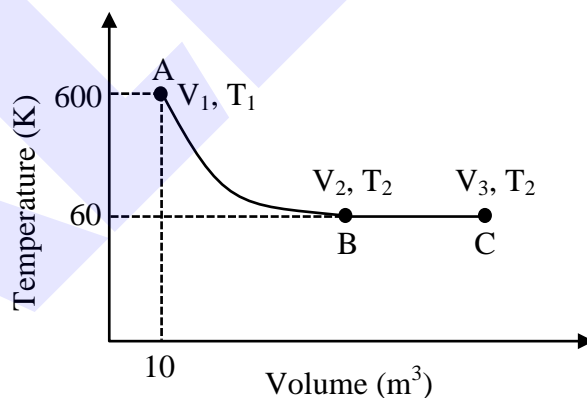


Pre-exponential factors for the forward and backward reactions are  $10^{15} \text{ s}^{-1}$  and  $10^{11} \text{ s}^{-1}$ , respectively. If the value of  $\log K$  for the reaction at 500 K is 6, the value of  $|\log k_b|$  at 250 K is \_\_\_\_\_.

[ $K$  = equilibrium constant of the reaction  
 $k_f$  = rate constant of forward reaction  
 $k_b$  = rate constant of backward reaction]

Ans. (5)

11. One mole of an ideal monoatomic gas undergoes two reversible processes ( $A \rightarrow B$  and  $B \rightarrow C$ ) as shown in the given figure :

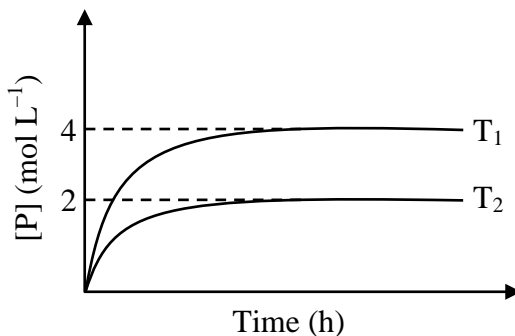


$A \rightarrow B$  is an adiabatic process. If the total heat absorbed in the entire process ( $A \rightarrow B$  and  $B \rightarrow C$ ) is  $RT_2 \ln 10$ , the value of  $2 \log V_3$  is \_\_\_\_\_.

[Use, molar heat capacity of the gas at constant pressure,  $C_{p,m} = \frac{5}{2} R$ ]

Ans. (7)

12. In a one-litre flask, 6 moles of A undergoes the reaction  $A(g) \rightleftharpoons P(g)$ . The progress of product formation at two temperatures (in Kelvin),  $T_1$  and  $T_2$ , is shown in the figure:

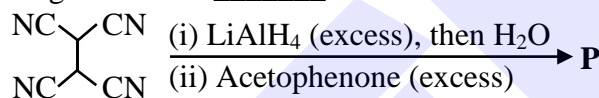


If  $T_1 = 2T_2$  and  $(\Delta G_2^\ominus - \Delta G_1^\ominus) = RT_2 \ln x$ , then the value of  $x$  is \_\_\_\_\_.

[ $\Delta G_1^\ominus$  and  $\Delta G_2^\ominus$  are standard Gibbs free energy change for the reaction at temperatures  $T_1$  and  $T_2$ , respectively.]

Ans. (8)

13. The total number of  $sp^2$  hybridised carbon atoms in the major product **P** (a non-heterocyclic compound) of the following reaction is \_\_\_\_\_.



Ans. (28)

#### SECTION-4 : (Maximum Marks : 12)

- 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.
- Answer to each question will be evaluated according to the following marking scheme:  
*Full Marks* : +3 **ONLY** if the option corresponding to the correct combination is chosen;  
*Zero Marks* : 0 If none of the options is chosen (i.e. the question is unanswered);  
*Negative Marks* : -1 In all other cases.

14. Match the reactions (in the given stoichiometry of the reactants) in List-I with one of their products given in List-II and choose the correct option.

#### List-I

- (P)  $P_2O_3 + 3H_2O \rightarrow$   
 (Q)  $P_4 + 3NaOH + 3H_2O \rightarrow$   
 (R)  $PCl_5 + CH_3COOH \rightarrow$   
 (S)  $H_3PO_2 + 2H_2O + 4AgNO_3 \rightarrow$

#### List-II

- (1)  $P(O)(OCH_3)Cl_2$   
 (2)  $H_3PO_3$   
 (3)  $PH_3$   
 (4)  $POCl_3$   
 (5)  $H_3PO_4$

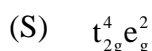
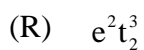
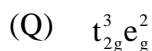
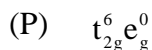
- (A) P  $\rightarrow$  2; Q  $\rightarrow$  3; R  $\rightarrow$  1; S  $\rightarrow$  5  
 (B) P  $\rightarrow$  3; Q  $\rightarrow$  5; R  $\rightarrow$  4; S  $\rightarrow$  2  
 (C) P  $\rightarrow$  5; Q  $\rightarrow$  2; R  $\rightarrow$  1; S  $\rightarrow$  3  
 (D) P  $\rightarrow$  2; Q  $\rightarrow$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

Ans. (D)

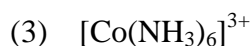
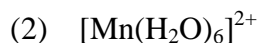
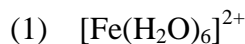
15. Match the electronic configurations in List-I with appropriate metal complex ions in List-II and choose the correct option.

[Atomic Number: Fe = 26, Mn = 25, Co = 27]

**List-I**



**List-II**



(A) P → 1; Q → 4; R → 2; S → 3

(B) P → 1; Q → 2; R → 4; S → 5

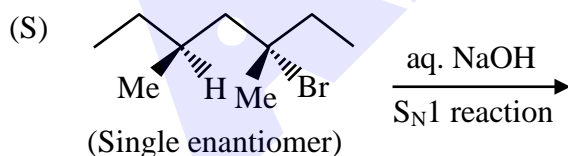
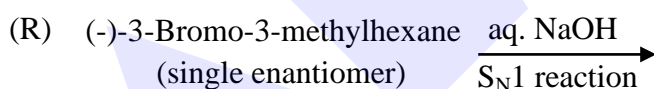
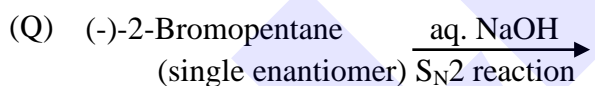
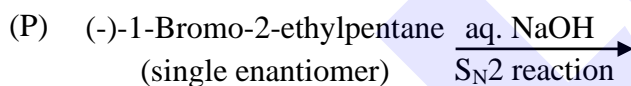
(C) P → 3; Q → 2; R → 5; S → 1

(D) P → 3; Q → 2; R → 4; S → 1

Ans. (D)

16. Match the reactions in List-I with the features of their products in List-II and choose the correct option.

**List-I**



**List-II**

(1) Inversion of configuration

(2) Retention of configuration

(3) Mixture of enantiomers

(4) Mixture of structural isomers

(5) Mixture of diastereomers

(A) P → 1; Q → 2; R → 5; S → 3

(B) P → 2; Q → 1; R → 3; S → 5

(C) P → 1; Q → 2; R → 5; S → 4

(D) P → 2; Q → 4; R → 3; S → 5

Ans. (B)

17. The major products obtained from the reactions in List-II are the reactants for the named reactions mentioned in List-I. Match List-I with List-II and choose the correct option.

**List-I**

**List-II**

- |                              |     |  |
|------------------------------|-----|--|
| (P) Etard reaction           | (1) | Acetophenone $\xrightarrow{\text{Zn-Hg, HCl}}$                                     |
| (Q) Gattermann reaction      | (2) | Toluene $\xrightarrow[\text{(ii) SOCl}_2]{\text{(i) KMnO}_4, \text{KOH, } \Delta}$ |
| (R) Gattermann-Koch reaction | (3) | Benzene $\xrightarrow[\text{anhyd. AlCl}_3]{\text{CH}_3\text{Cl}}$                 |
| (S) Rosenmund reduction      | (4) | Aniline $\xrightarrow[273-278 \text{ K}]{\text{NaNO}_2/\text{HCl}}$                |
|                              | (5) | Phenol $\xrightarrow{\text{Zn, } \Delta}$  |

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

**Ans. (D)**