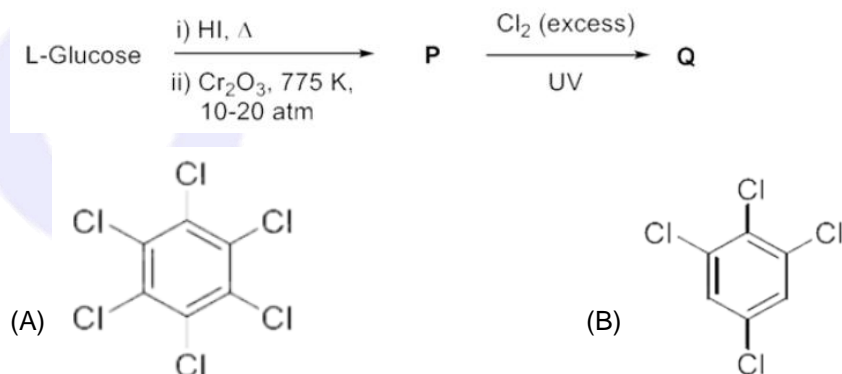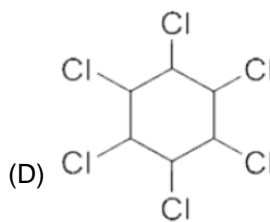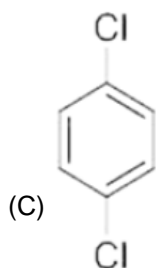# JEE (ADVANCED)-2024

PAPER-2

CHEMISTRY

SECTION 1 (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 <u>according to the following marking scheme</u>:

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.

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1. According to Bohr's model, the highest kinetic energy is associated with the electron in the

(A) First orbit of H atom

(B) First orbit of He^+

(C) Second orbit of He^+

(D) Second orbit of Li^{2+}

2. In a metal deficient oxide sample, Mx_2Y_4 (M and Y are metals), M is present in both +2 and +3 oxidation states and Y is in +3 oxidation state. If the fraction of M^{2+} ions present in M is $\frac{1}{3}$, the va**lue of X is**____

(A) 0.25   (B) 0.33   (C) 0.67   (D) 0.75

3. In the following reaction sequence, the major product Q **is**

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(C)

(D)

4. The species formed on fluorination of phosphorus pentachloride in a polar organic solvent are

(A) $\left[PF_4\right]^+\left[PF_6\right]^-$ and $\left[PCl_4\right]^+\left[PF_6\right]^-$

(B) $\left[PCl_4\right]^+\left[PCl_4F_2\right]^-$ and $\left[PCl_4\right]^+\left[PF_6\right]^-$

(C) PF_3 and PCl_3

(D) PF_5 and PCl_3

SECTION 2 (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;
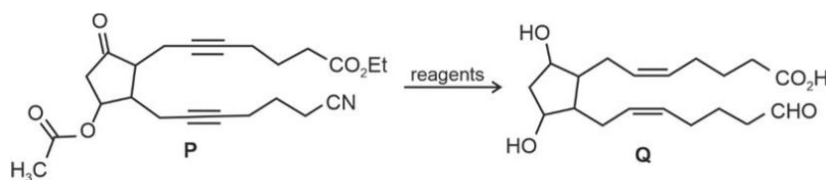
Zero Marks : 0 If unanswered;

Negative Marks : –2 In all other cases.

5. An aqueous solution of hydrazine $\left(N_2H_4\right)$ is electrochemically oxidized by O_2, thereby releasing chemical energy in the form of electrical energy. One of the products generated from the electrochemical reaction is $N_2(g)$.

Choose the correct statement(s) about the above process

(A) OH^- ions react with N_2H_4 at the anode to form $N_2(g)$ and water, releasing 4 electrons to the anode.

(B) At the cathode, N_2H_4 breaks to $N_2(g)$ and nascent hydrogen released at the electrode reacts with oxygen to form water.

(C) At the cathode, molecular oxygen gets converted to OH^-.

(D) Oxides of nitrogen are major by-products of the electrochemical process.

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6. The option(s) with correct sequence of reagents for the conversion of **P** to **Q** is(are)

(A) i) Lindlar's catalyst, H_2; ii) $SnCl_2/HCl$; iii) $NaBH_4$; iv) H_3O^+

(B) i) Lindlar's catalyst, H_2; ii) H_3O^+; iii) $SnCl_2/HCl$; iv) $NaBH_4$

(C) i) $NaBH_4$; ii) $SnCl_2/HCl$; iii) H_3O^+; iv) Lindlar's catalyst, H_2

(D) i) Lindlar's catalyst, H_2; ii) $NaBH_4$; iii) $SnCl_2/HCl$; iv) H_3O^+

7. The compound(s) having peroxide linkage is(are)

(A) $H_2S_2O_7$ (B) $H_2S_2O_8$ (C) $H_2S_2O_5$ (D) H_2SO_5

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 <u>according to the following marking scheme:</u>

  Full Marks   : +4 If **ONLY** the correct integer is entered;

  Zero Marks   : 0 In all other cases.

---

8. To form a complete monolayer of acetic acid on $1g$ of charcoal, $100\,mL$ of $0.5M$ acetic acid was used. Some of the acetic acid remained unadsorbed. To neutralize the unadsorbed acetic acid, $40\,mL$ of $1M\,NaOH$ solution was required. If each molecule of acetic acid occupies $P \times 10^{-23}\,m^2$ surface area on charcoal, the value of P is _____ .

[Use given data : Surface area of charcoal $=1.5 \times 10^2\,m^2\,g^{-1}$; Avogadro's number $\left(N_A\right) = 6.0 \times 10^{23}\,mol^{-1}$]

9. Vessel- 1 contains $w_2 g$ of a non-volatile solute $\mathbf{X}$ dissolved in $w_1 g$ of water. Vessel-2 contains $w_2 g$ of another non-volatile solute Y dissolved in $w_1 g$ of water. Both the vessels are at the same temperature and pressure. The molar mass of $\mathbf{X}$ is 80% of that of $\mathbf{Y}$. The van't Hoff factor for $\mathbf{X}$ is 1.2 times of that of $\mathbf{Y}$ for their respective concentrations.

The elevation of boiling point for solution in Vessel-1 is _____% of the solution in Vessel- 2.

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10. For a double strand DNA, one strand is given below:

$$5' \; \overline{A \;|\; G \;|\; T \;|\; C \;|\; A \;|\; C \;|\; G \;|\; T \;|\; A \;|\; A \;|\; G \;|\; T \;|\; C} \; 3'$$

The amount of energy required to split the double strand DNA into two single strands is _____ $kcalmol^{-1}$.

[Given: Average energy per H-bond for A-T base pair $= 1.0 kcalmol^{-1}, G - C$ base pair $= 1.5 kcalmol^{-1}$, and

$A - U$ base pair $= 1.25 kcalmol^{-1}$. Ignore electrostatic repulsion between the phosphate groups.]

11. A sample initially contains only U-238 isotope of uranium. With time, some of the U-238 radioactively decays into Pb-206 while the rest of it remains undisintegrated.

When the age of the sample is **P** 10_8 years, the ratio of mass of Pb-206 to that of U-238 in the sample is found to be 7. The value of **P** is_____.

[Given : Half-life of U-238 is 4.5 10_9 years; $log_e 2 = 0.693$]

12. Among $\left[Co(CN)_4\right]^4, \left[Co(CO)_3\left(NO_2\right)\right], XeF_4, \left[PCl_4\right]^+, \left[PdCl_4\right]^{2-}, \left[Cl_4\right]^-, \left[Cu(CN)_4\right]^{3-}$ and P_4 the total

number of species with tetrahedral geometry is _____.

13. An organic compound **P** having molecular formula $C_6H_6O_3$ gives ferric chloride test and does not have intramolecular hydrogen bond. The compound **P** reacts with 3 equivalents of NH_2OH to produce oxime **Q**. Treatment of **P** with excess methyl iodide in the presence of KOH produces compound **R** as the major product.

Reaction of **R** with excess *iso*-butylmagnesium bromide followed by treatment with H_3O_+ gives compound **S** as the major product.

The total number of methyl (CH_3) group(s) in compound **S** is _____.

SECTION 4 (Maximum Marks: 12)

- This section contains **TWO (02)** paragraphs.

- Based on each paragraph, there are **TWO (02)** questions.

- The answer to each question is a **NUMERICAL VALUE.**

- For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.

- If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

- Answer to each question will be evaluated <u>according to the following marking scheme</u>:

  Full Marks   : +3 If ONLY the correct numerical value is entered in the designated place;

  Zero Marks   : 0 In all other cases.

PARAGRAPH Question 14 to 15

An organic compound **P** with molecular formula $C_9H_{18}O_2$ decolorizes bromine water and also shows positive iodoform test. **P** on ozonolysis followed by treatment with H_2O_2 gives **Q** and **R**. While compound **Q** shows positive iodoform test, compound **R** does not give positive iodoform test. **Q** and **R** on oxidation with pyridinium chlorochromate (PCC) followed by heating give **S** and **T**, respectively. Both **S** and **T** show positive iodoform test.

Complete copolymerization of 500 moles of **Q** and 500 moles of **R** gives one mole of a single acyclic copolymer **U**. [Given, atomic mass: H =1, C = 12, O =16]

14. Sum of number of oxygen atoms in **S** and **T** is _____.

15. The molecular weight of **U** is _____.

PARAGRAPH II Question 16 to 17

When potassium iodide is added to an aqueous solution of potassium ferricyanide, a reversible reaction is observed in which a complex **P** is formed. In a strong acidic medium, the equilibrium shifts completely towards **P**. Addition of zinc chloride to **P** in a slightly acidic medium results in a sparingly soluble complex **Q**.

16. The number of moles of potassium iodide required to produce two moles of **P** is _____.

17. The number of zinc ions present in the molecular formula of **Q** is _____.

ANSWER KEY

1.	(B)	2.	(D)	3.	(D)	4.	(B)	5.	(A,C)	6.	(A,C,D)	7.	(B,D)
8.	2500	9.	150	10.	41	11.	143	12.	3	13.	12	14.	2
15.	102018	16.	2	17.	3								

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