

JEE ADVANCED 2024

CHEMISTRY (PAPER 2)

PAPER SOLUTION

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.

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+}

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In a metal deficient oxide sample, $M_xY_2O_4$ (**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 value of **X** is _____.

(A) 0.25

(B) 0.33

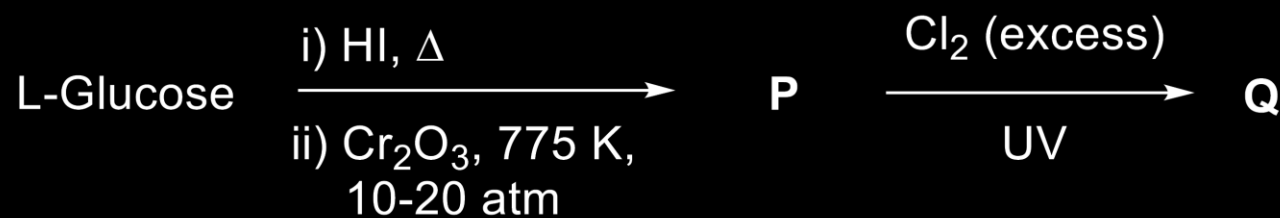
(C) 0.67

(D) 0.75

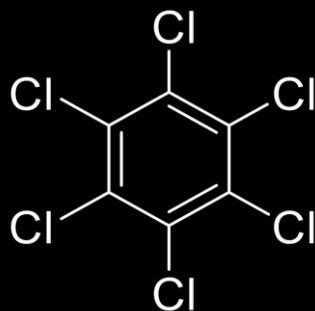
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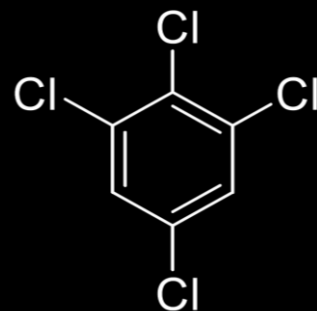
In the following reaction sequence, the major product **Q** is



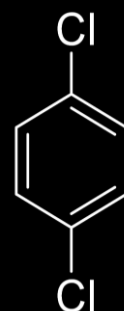
(A)



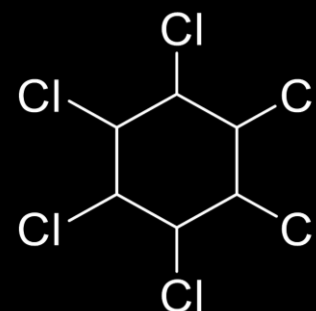
(B)



(C)



(D)



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

- (A) $[\text{PF}_4]^+[\text{PF}_6]^-$ and $[\text{PCl}_4]^+[\text{PF}_6]^-$
- (B) $[\text{PCl}_4]^+[\text{PCl}_4\text{F}_2]^-$ and $[\text{PCl}_4]^+[\text{PF}_6]^-$
- (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).

An aqueous solution of hydrazine (N_2H_4) 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 $\text{N}_2(\text{g})$.

Choose the correct statement(s) about the above process

- (A) OH^- ions react with N_2H_4 at the anode to form $\text{N}_2(\text{g})$ and water, releasing 4 electrons to the anode.
- (B) At the cathode, N_2H_4 breaks to $\text{N}_2(\text{g})$ 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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The compound(s) having peroxide linkage is(are)



SECTION 3 (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**.

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

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

Ans. 2500

SECTION 3 (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**.

Vessel-1 contains w_2 g of a non-volatile solute **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 **X** is 80% of that of **Y**. The van't Hoff factor for **X** is 1.2 times of that of **Y** for their respective concentrations.

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

Ans. 150

SECTION 3 (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**.

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



The amount of energy required to split the double strand DNA into two single strands is _____ kcal mol⁻¹.

[Given: Average energy per H-bond for A-T base pair = 1.0 kcal mol⁻¹, G-C base pair = 1.5 kcal mol⁻¹, and A-U base pair = 1.25 kcal mol⁻¹. Ignore electrostatic repulsion between the phosphate groups.]

Ans. 41

SECTION 3 (Maximum Marks: 24)

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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 $P \times 10^8$ 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; $\log_e 2 = 0.693$]

Ans. 143

SECTION 3 (Maximum Marks: 24)

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Among $[\text{Co}(\text{CN})_4]^{4-}$, $[\text{Co}(\text{CO})_3(\text{NO})]$, XeF_4 , $[\text{PCl}_4]^+$, $[\text{PdCl}_4]^{2-}$, $[\text{ICl}_4]^-$, $[\text{Cu}(\text{CN})_4]^{3-}$ and P_4 the total number of species with tetrahedral geometry is _____.

Ans. 3

SECTION 3 (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**.

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 _____.

Ans. 12

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**.

“PARAGRAPH I”

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]

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

Ans. 2

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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]

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

Ans. 93018

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“PARAGRAPH II”

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**.

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

Ans. 2

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

Ans. 3