

JEE(ADVANCED)-2024 (EXAMINATION)

(Held On Sunday 26<sup>th</sup> MAY, 2024)

CHEMISTRY

TEST PAPER WITH ANSWER

PAPER-2

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 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.

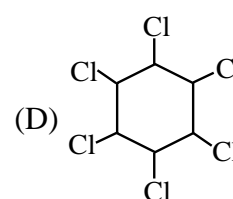
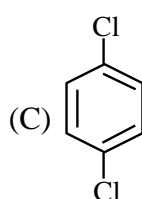
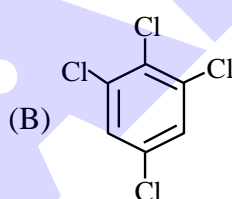
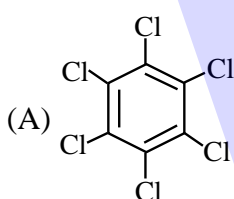
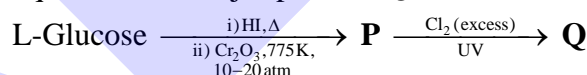
1. According to Bohr's model, the highest kinetic energy is associated with the electron in the :  
 (A) first orbit of H atom (B) first orbit of He<sup>+</sup>  
 (C) second orbit of He<sup>+</sup> (D) second orbit of Li<sup>2+</sup>

Ans. (B)

2. In a metal deficient oxide sample, M<sub>x</sub>Y<sub>2</sub>O<sub>4</sub> (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<sup>2+</sup> 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

Ans. (D)

3. In the following reaction sequences, the major product Q is:



Ans. (D)

4. The species formed on fluorination of phosphorus pentachloride in a polar organic solvent are :  
 (A) [PF<sub>4</sub>]<sup>+</sup> [PF<sub>6</sub>]<sup>-</sup> and [PCl<sub>4</sub>]<sup>+</sup> [PF<sub>6</sub>]<sup>-</sup> (B) [PCl<sub>4</sub>]<sup>+</sup> [PCl<sub>4</sub>F<sub>2</sub>]<sup>-</sup> and [PCl<sub>4</sub>]<sup>+</sup> [PF<sub>6</sub>]<sup>-</sup>  
 (C) PF<sub>3</sub> and PCl<sub>3</sub> (D) PF<sub>5</sub> and PCl<sub>3</sub>

Ans. (B)

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**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:
 

<i>Full Marks</i>	:	+4	<b>ONLY</b> if (all) the correct option(s) is(are) chosen;
<i>Partial Marks</i>	:	+3	If all the four options are correct but <b>ONLY</b> three options are chosen;
<i>Partial Marks</i>	:	+2	If three or more options are correct but <b>ONLY</b> two options are chosen, both of which are correct;
<i>Partial Marks</i>	:	+1	If two or more options are correct but <b>ONLY</b> one option is chosen and it is a correct option;
<i>Zero Marks</i>	:	0	If unanswered;
<i>Negative Marks</i>	:	-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 option(s) will get -2 marks.

5. An aqueous solution of hydrazine ( $\text{N}_2\text{H}_4$ ) is electrochemically oxidized by  $\text{O}_2$ , 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)  $\text{OH}^-$  ions react with  $\text{N}_2\text{H}_4$  at the anode to form  $\text{N}_2(\text{g})$  and water, releasing 4 electrons to the anode.
- (B) At the cathode,  $\text{N}_2\text{H}_4$  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  $\text{OH}^-$ .
- (D) Oxides of nitrogen are major by-products of the electrochemical process.

Ans. (A,C)

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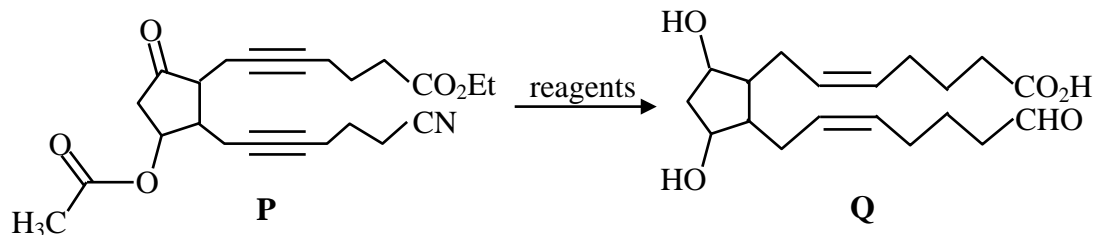


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6. The option(s) with correct sequence of reagents for the conversion of **P** to **Q** is(are) :



- (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)  $H_3O^+$

Ans. (C,D)

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)  $H_2SO_5$

Ans. (B,D)

**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 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 0.5 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)

9. 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)

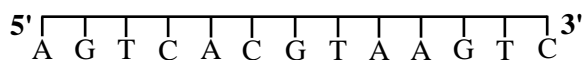
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10. For a double strand DNA, one strand is given below:



The amount of energy required to split the double strand DNA into two single strands is \_\_\_\_\_ kcal mol<sup>-1</sup>.  
[Given : Average energy per H-bond for A-T base pair = 1.0 kcal mol<sup>-1</sup>, G-C base pair = 1.5 kcal mol<sup>-1</sup>, and A-U base pair = 1.25 kcal mol<sup>-1</sup>. Ignore electrostatic repulsion between the phosphate groups.]

Ans. (41)

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  $P \times 10^8$  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  $4.5 \times 10^9$  years;  $\log_e 2 = 0.639$ ]

Ans. (143)

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

Ans. (5)

13. An organic compound  $P$  having molecular formula  $\text{C}_6\text{H}_6\text{O}_3$  gives ferric chloride test and does not have intramolecular hydrogen bond. The compound  $P$  reacts with 3 equivalents of  $\text{NH}_2\text{OH}$  to produce oxime  $Q$ . Treatment of  $P$  with excess methyl iodide in the presence of  $\text{KOH}$  produces compound  $R$  as the major product. Reaction of  $R$  with excess *iso*-butylmagnesium bromide followed by treatment with  $\text{H}_3\text{O}^+$  gives compound  $S$  as the major product.

The total number of methyl ( $-\text{CH}_3$ ) 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**.
- For each question, enter the correct numerical value of the answer using the mouse and the on-screen 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 according to the following marking scheme:  

Full Marks	: +3	If ONLY the correct numerical value is entered in the designated place;
Zero Marks	: 0	In all other cases.

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*"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]

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

Ans. (2)

*"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]

15. The molecular weight of **U** is \_\_\_\_\_.

Ans. (93018)

*"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**.

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

Ans. (2)

*"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**.

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

Ans. (3 or 2)

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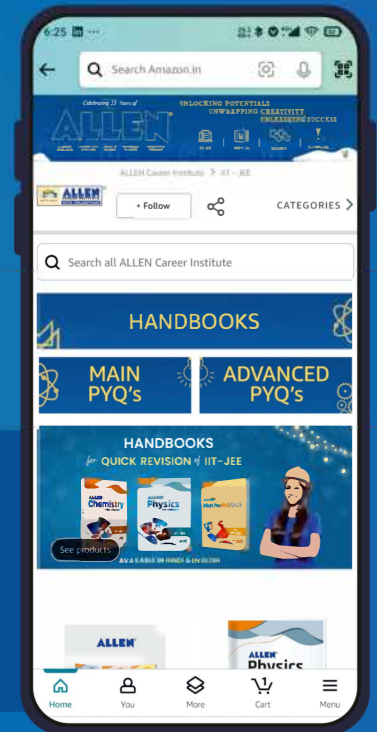
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