# JEE-MAIN EXAM JANUARY, 2025

**Date: - 29-01-2025 (SHIFT-1)**

## CHEMISTRY

### SECTION-A

**1.** 500 J of energy is transferred as heat to 0.5 mol of Argon gas at 298 K and 1.00 atm . The final temperature and the change in internal energy respectively are:

Given : $R = 8.3\,J\,K^{-1}\,mol^{-1}$

(1) 348 K and 300 J (2) 378 K and 500 J (3) 368 K and 500 J (4) 378 K and 300 J

**2.** 1.24 g of $AX_2$ (molar mass $124\,g\,mol^{-1}$ ) is dissolved in 1 kg of water to form a solution with boiling point of $100.0156^{\circ}C$, will $25.4\,g^2$ of $AY_2$ (molar mass $250\,g\,mol^{-1}$ ) in 2 kg of water constitutes a solution with a boiling point of $100.0260^{\circ}C$.

$K_b(H_2O) = 0.52\,K\,kg\,mol^{-1}$

Which of the following is correct?

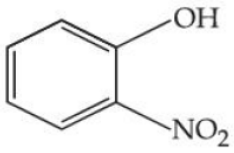
(1) $AX_2$ and $AY_2$ (both) are completely unionised.

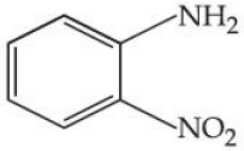
(2) $AX_2$ and $AY_2$ (both) are fully ionised.

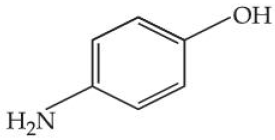
(3) $AX_2$ is completely unionised while $AY_2$ is fully ionised.

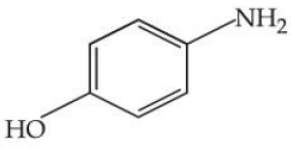
(4) $AX_2$ is fully ionised while $AY_2$ is completely unionised.

**3.** The steam volatile compounds among the following are :

(A) 


(B) 


(C) 


(D) 


Choose the correct answer from the options given below :

(1) (B) and (D) Only (2) (A) and (B) Only

(3) (A) and (C) Only (4) (A), (B) and (C) Only

**4.** The correct option with order of melting points of the pairs $(Mn, Fe), (Tc, Ru)$ and $(Re, Os)$ is :

(1) $Mn < Fe, Tc < Ru$ and $Os < Re$ (2) $Fe < Mn, Ru < Tc$ and $Re < Os$

(3) $Mn < Fe, Tc < Ru$ and $Re < Os$ (4) $Fe < Mn, Ru < Tc$ and $Os < Re$

**5.** For a $Mg\left|Mg^{2+}(aq)\right|\left|Ag^{+}(aq)\right|Ag$ the correct Nernst Equation is :

(1) $E_{cell} = E^{o}_{cell} + \frac{RT}{2F}\ln\frac{\left[Ag^{+}\right]^2}{\left[Mg^{2+}\right]}$ (2) $E_{cell} = E^{o}_{cell} - \frac{RT}{2F}\ln\frac{\left[Ag^{+}\right]^2}{\left[Mg^{2+}\right]}$

(3) $E_{cell} = E^{o}_{cell} - \frac{RT}{2F}\ln\frac{\left[Ag^{+}\right]}{\left[Mg^{2+}\right]}$ (4) $E_{cell} = E^{o}_{cell} - \frac{RT}{2F}\ln\frac{\left[Mg^{2+}\right]}{\left[Ag^{+}\right]}$

**6.** Choose the correct statements.

(A) Weight of a substance is the amount of matter present in it.

(B) Mass is the force exerted by gravity on an object.

(C) Volume is the amount of space occupied by a substance.

(D) Temperatures below $0^{\circ}C$ are possible in Celsius scale, but in Kelvin scale negative temperature is not possible.

(E) Precision refers to the closeness of various measurements for the same quantity.

Choose the correct answer from the options given below :

(1) (B), (C) and (D) Only (2) (A), (D) and (E) Only

(3) (A), (B) and (C) Only (4) (C), (D) and (E) Only

**7.** At temperature $T$, compound $AB_{2(g)}$ dissociates as $AB_{2(g)} \rightleftharpoons AB(g) + \frac{1}{2}B_{2(g)}$ having degree of dissociation $x$ (small compared to unity). The correct expression for $x$ in terms of $K_p$ and p is

(1) $\sqrt{K_p}$ (2) $\sqrt[4]{\frac{2K_p}{p}}$ (3) $\sqrt[3]{\frac{2K_p}{p}}$ (4) $\sqrt[3]{\frac{2K_p^2}{p}}$

**8.** If $a_0$ is denoted as the Bohr radius of hydrogen atom, then what is the de-Broglie wavelength $(\lambda)$ of the electron present in the second orbit of hydrogen atom? [ n : any integer]

(1) $\frac{2a_0}{n\pi}$ (2) $\frac{8\pi a_0}{n}$ (3) $\frac{4n}{\pi a_0}$ (4) $\frac{4\pi a_0}{n}$

**9.** The correct increasing order of stability of the complexes based on $\Delta_0$ value is :

I. $\left[Mn(CN)_6\right]^{3-}$ II. $\left[Co(CN)_6\right]^{4-}$

III. $\left[Fe(CN)_6\right]^{4-}$ IV. $\left[Fe(CN)_6\right]^{3-}$

(1) III < II < IV < I (2) $I < II < IV < III$ (3) IV < III < II < I (4) II < III < I < IV

**10.** The molar conductivity of a weak electrolyte when plotted against the square root of its concentration, which of the following is expected to be observed ?

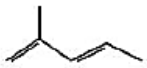
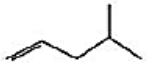
(1) A small decrease in molar conductivity is observed at infinite dilution.

(2) A small increase in molar conductivity is observed at infinite dilution.

(3) Molar conductivity increases sharply with increase in concentration.

(4) Molar conductivity decreases sharply with increase in concentration.

**11.** Match List - I with List - II.

| List - I (Structure) | | List - II (IUPAC Name) | |
|---|---|---|---|
| (A) | $H_3C-CH_2-\underset{\underset{C_2H_5}{|}}{CH}-CH_2-\underset{\underset{CH_3}{|}}{CH}-C_2H_5$ | (I) | 4-Methylpent-1-ene |
| (B) | $(CH_3)_2C\ (C_3H_7)_2$ | (II) | 3-Ethyl-5-methylheptane |
| (C) |  | (III) | 4,4-Dimethylheptane |
| (D) |  | (IV) | 2-Methyl-1,3-pentadiene |

(1) (A)-(III), (B)-(II), (C)-(IV), (D)-(I) (2) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

(3) (A)-(II), (B)-(III), (C)-(I), (D)-(IV) (4) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

**12.** Total number of nucleophiles from the following is :

$$NH_3, PhSH, (H_3C)_2S, H_2C=CH_2, \overset{\ominus}{O}H, H_3O^{\oplus}, (CH_3)_2CO, \rightleftharpoons NCH_3$$

(1) 5 (2) 7 (3) 4 (4) 6

**13.** Given below are two statements :

**Statement (I) :** The radii of isoelectronic species increases in the order.

$$Mg^{2+} < Na^{+} < F^{-} < O^{2-}$$

**Statement (II) :** The magnitude of electron gain enthalpy of halogen decreases in the order.

$$Cl > F > Br > I$$

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both Statement I and Statement II are correct

(2) Statement I is incorrect but Statement II is correct

(3) Both Statement I and Statement II are incorrect

(4) Statement I is correct but Statement II is incorrect

**14.** Match List - I with List - II.

| **List - I (Complex)** | | **List - II (Hybridisation & Magnetic characters)** |
|---|---|---|
| (A) | $[MnBr_4]^{2-}$ | (I) $d^2sp^3$ & diamagnetic |
| (B) | $[FeF_6]^{3-}$ | (II) $sp^3d^2$ & paramagnetic |
| (C) | $[Co(C_2O_4)_3]^{3-}$ | (III) $sp^3$ & diamagnetic |
| (D) | $[Ni(CO)_4]$ | (IV) $sp^3$ & paramagnetic |

Choose the correct answer from the options given below :

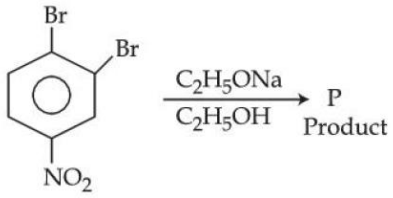
(1) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

(2) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)

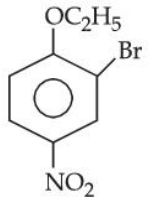
(3) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

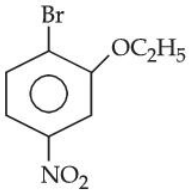
(4) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)

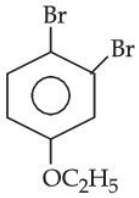
**15.** In the following substitution reaction :

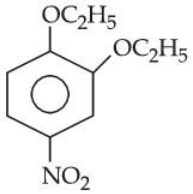



Product 'P' formed is :

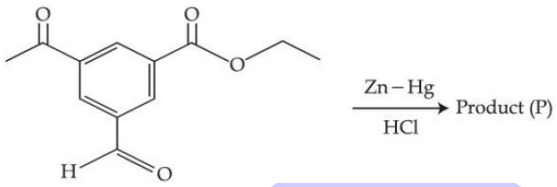
(1) 

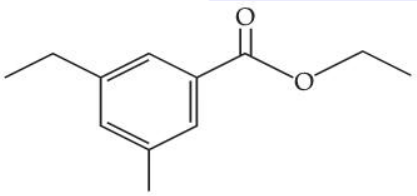

(2) 

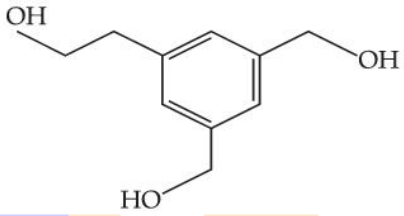

(3) 

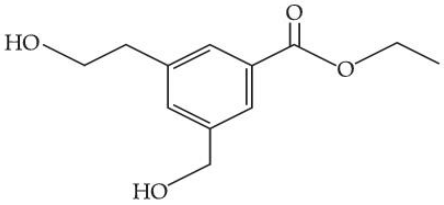

(4) 

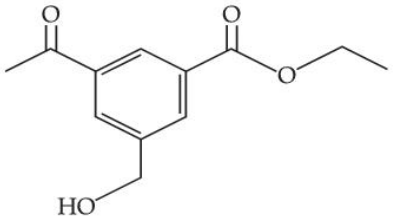

**16.** The product (P) formed in the following reaction is :




(1) 


(2) 


(3) 


(4) 


**17.** An element '$E$' has the ionisation enthalpy value of $374\,\text{kJ mol}^{-1}$. '$E$' reacts with elements A, B,C and D with electron gain enthalpy values of $-328, -349, -325$ and $-295\,\text{kJ mol}^{-1}$, respectively. The correct order of the products EA, EB, EC and ED in terms of ionic character is :

(1) $\text{ED} > \text{EC} > \text{EB} > \text{EA}$ (2) $\text{EA} > \text{EB} > \text{EC} > \text{ED}$

(3) $\text{ED} > \text{EC} > \text{EA} > \text{EB}$ (4) $\text{EB} > \text{EA} > \text{EC} > \text{ED}$

**18.** The reaction $A_2 + B_2 \rightarrow 2\text{AB}$ follows the mechanism

$$A_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} A + A \text{ (fast)}$$

$$A + B_2 \xrightarrow{k_2} AB + B \text{ (slow)}$$

$$A + B \rightarrow AB \text{ (fast)}$$

The overall order of the reaction is :

(1) 2.5 (2) 1.5 (3) 3 (4) 2

**19.** Match List - I with List - II.

| **List - I (Carbohydrate)** | **List - II (Linkage Source)** |
|---|---|
| (A) Amylose | (I) $\beta-C_1-C_4$, plant |
| (B) Cellulose | (II) $\alpha-C_1-C_4$, animal |
| (C) Glycogen | (III) $\alpha-C_1-C_4, \alpha-C_1-C_6$, plant |
| (D) Amylopectin | (IV) $\alpha-C_1-C_4$, plant |

Choose the correct answer from the options given below :

(1) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

(2) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)

(3) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

(4) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

**20.** The standard reduction potential values of some of the p-block ions are given below. Predict the one with the strongest oxidising capacity.

(1) $E^{\ominus}_{Al^{3+}/Al} = -1.66\,V$ (2) $E^{\ominus}_{Tl^{3+}/Tl} = +1.26\,V$

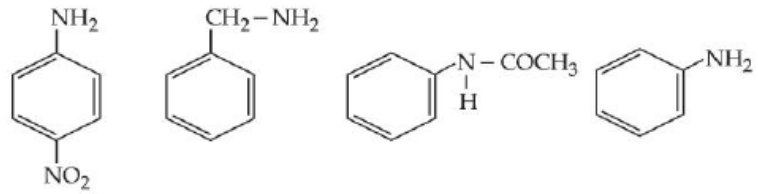
(3) $E^{\ominus}_{Sn^{4+}/Sn^{2+}} = +1.15\,V$ (4) $E^{\ominus}_{Pb^{4+}/Pb^{2+}} = +1.67\,V$

## SECTION-B

**21.** If $A_2B$ is $30\%$ ionised in an aqueous solution, then the value of van't Hoff factor (i) is ____ $\times 10^{-1}$.

**22.** The sum of sigma ($\sigma$) and pi ($\pi$) bonds in Hex-1,3-dien-5-yne is

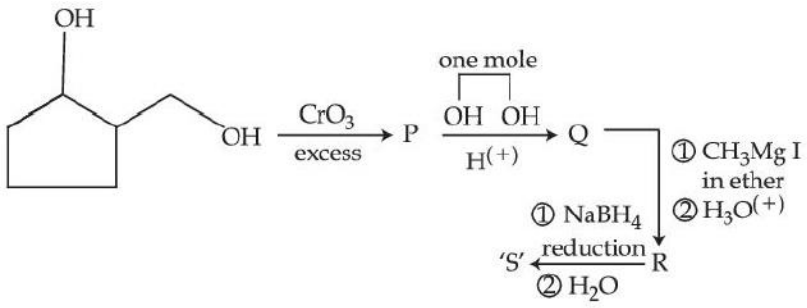
**23.** Given below are some nitrogen containing compounds




Each of them is treated with HCl separately. 1.0 g of the most basic compound will consume _____mg of HCl .

(Given molar mass in $gmol^{-1}$ $C:12, H:1, O:16, Cl:35.5$ )

**24.**




0.1 mole of compound '$S$' will weigh _____ g.

(Given molar mass in $gmol^{-1}$ $C:12, H:1, O:16$)

**25.** The molar mass of the water insoluble product formed from the fusion of chromite ore ( $FeCr_2O_4$ ) with $Na_2CO_3$ in presence of $O_2$ is _____ $gmol^{-1}$.

## NTA ANSWERS

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | (2) | 2. | (4) | 3. | (2) | 4. | (1) | 5. | (1) | 6. | (4) | 7. | (4) |
| 8. | (2) | 9. | (2) | 10. | (4) | 11. | (2) | 12. | (1) | 13. | (1) | 14. | (4) |
| 15. | (1) | 16. | (1) | 17. | (4) | 18. | (2) | 19. | (4) | 20. | (4) | 21. | (16) |
| 22. | (15) | 23. | (341) | 24. | (13) | 25. | (160) | | | | | | |