JEE Main 2023 April 10 Shift 2 Chemistry Question Paper

Time Allowed :3 Hours	**Maximum Marks :**300	**Total Questions :**90

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 90 questions, out of which 75 are to attempted. The maximum marks are 300.
3. There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage.
4. Each part (subject) has two sections.
   (i) Section-A: This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and –1 mark for wrong answer.
   (ii) Section-B: This section contains 10 questions. In Section-B, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and –1 mark for wrong answer. For Section-B, the answer should be rounded off to the nearest integer

Chemistry

Section-A

61. The correct relationships between unit cell edge length 'a' and radius of sphere 'r' for face-centred and body-centred cubic structures respectively are:

(1) $2\sqrt{2}r = a$ and $\sqrt{3}r = 4a$

(2) $r = 2\sqrt{2}a$ and $4r = \sqrt{3}a$

(3) $r = 2\sqrt{2}a$ and $3r = 4a$

(4) $2\sqrt{2}r = a$ and $4r = \sqrt{3}a$

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62. The reaction used for preparation of soap from fat is:

(1) an addition reaction

(2) an oxidation reaction

(3) alkaline hydrolysis reaction

(4) reduction reaction

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63. Match List I with List II

LIST I		LIST II	
A	16 g of CH_4 (g)	I.	Weight 28 g
B	1 g of H_2 (g)	II	60.2×10^{23} electrons
C	1 mole of N_2 (g)	III	Weight 32 g
D	0.5 mol of SO_2 (g)	IV	Occupies 11.4 L volume at STP

Choose the correct answer from the options given below:

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

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

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

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

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64. The correct order of metallic character is:

(1) K > Be > Ca

(2) Be > Ca > K

(3) K > Ca > Be

(4) Ca > K > Be

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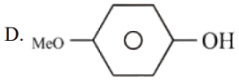
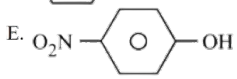
65. The correct order for acidity of the following hydroxyl compounds is:

A. CH_3OH B. $(CH_3)_3COH$

C.  D. 

E. 

Choose the correct answer from the options given below:

(1) E > C > D > A > B

(2) D > E > C > A > B

(3) E > D > C > B > A

(4) C > E > D > B > A

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66. Match List I with List II

LIST I Complex		LIST II Crystal Field splitting energy (Δ_0)	
A	$[Ti(H_2O)_6]^{2+}$	I.	– 1.2
B	$[V(H_2O)_6]^{2+}$	II	– 0.6
C	$[Mn(H_2O)_6]^{3+}$	III	0
D	$[Fe(H_2O)_6]^{3+}$	IV	– 0.8

Choose the correct answer from the options given below:

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

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

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

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

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67. In Carius tube, an organic compound 'X' is treated with sodium peroxide to form a mineral acid 'Y'. The solution of $BaCl_2$ is added to 'Y' to form a precipitate 'Z'. 'Z' is used for the quantitative estimation of an extra element. 'X' could be:

(1) Chloroxyleneol

(2) Methionine

(3) A nucleotide

(4) Cytosine

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68. Number of water molecules in washing soda and soda ash respectively are:

(1) 1 and 0

(2) 1 and 10

(3) 10 and 0

(4) 10 and 1

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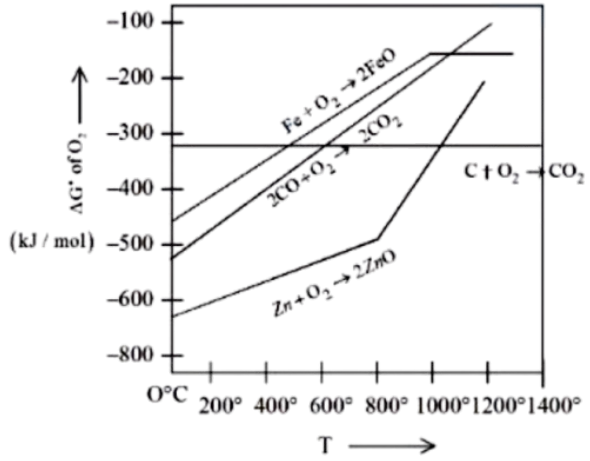
69. Gibbs energy vs T plot for the formation of oxides is given below. For the given diagram, the correct statement is:



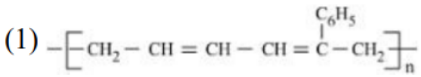
(1) At 600°C, C can reduce ZnO

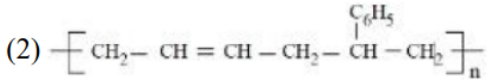
(2) At 600°C, C can reduce FeO

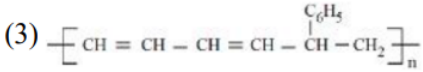
(3) At 600°C, CO cannot reduce FeO

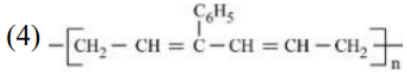
(4) At 600°C, CO can reduce ZnO

70. Buna-S can be represented as:

(1) 

(2) 

(3) 

(4) 

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71. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: Physical properties of isotopes of hydrogen are different.

Reason R: Mass difference between isotopes of hydrogen is very large.

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

(1) Both A and R are true but R is NOT the correct explanation of A

(2) A is false but R is true

(3) A is true but R is false

(4) Both A and R are true and R is the correct explanation of A

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72. The correct order of the number of unpaired electrons in the given complexes is

A. $[Fe(CN)_6]^{3-}$

B. $[FeF_6]^{3-}$

C. $[CoF_6]^{3-}$

D. $[Cr(oxalate)_3]^{3-}$

E. $[Ni(CO)_4]$

Choose the correct answer from the options given below:

(1) E < A < D < C < B

(2) A < E < C < B < D

(3) A < E < D < C < B

(4) E < A < B < D < C

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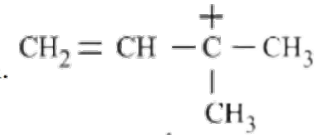
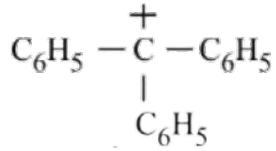
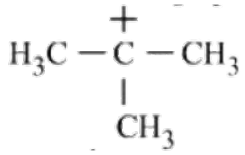
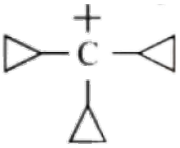
73. The decreasing order of hydride affinity for following carbonations is:

A. 

B. 

C. 

D. 

Choose the correct answer from the options given below:

(1) C, A, D, B

(2) A, C, B, D

(3) A, C, D, B

(4) C, A, B, D

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74. Incorrect method of preparation for alcohols from the following is:

(1) Ozonolysis of alkene.

(2) Hydroboration-oxidation of alkene.

(3) Reaction of alkyl halide with aqueous NaOH.

(4) Reaction of Ketone with RMgBr followed by hydrolysis.

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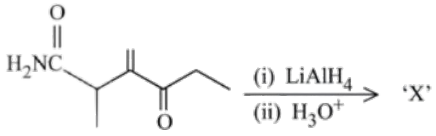
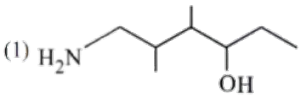
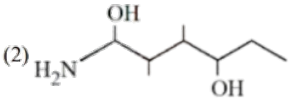
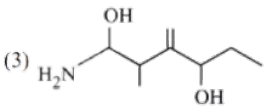
75. In the reaction given below:

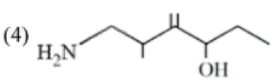


The product 'X' is:

(1) 

(2) 

(3) 

(4) 

The product 'X' is:

(1) $H_2N - CH_2 - CH_2OH$

(2) $H_2N - CH_2 - OH$

(3) $H_2N - CH_3$

(4) $H_2N - CH_2OH$

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76. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R. Assertion A: The energy required to form Mg^{2+} from Mg is much higher than that required to produce Mg^{+}. Reason R: Mg^{2+} is a small ion and carries more charge than Mg^{+}.

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

(1) Both A and R are true and R is the correct explanation of A

(2) A is true but R is false

(3) A is false but R is true

(4) Both A and R are true but R is NOT the correct explanation of A

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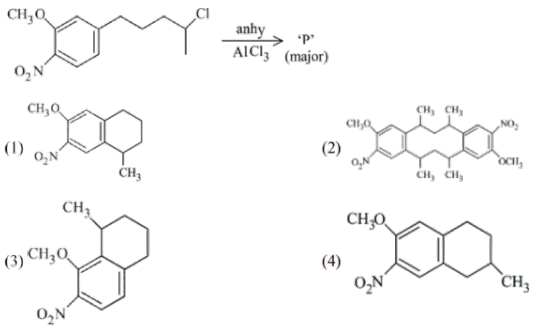
77. The major product 'P' formed in the given reaction is:



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78. Ferric chloride is applied to stop bleeding because -

(1) Blood absorbs $FeCl_3$ and forms a complex.

(2) $FeCl_3$ reacts with the constituents of blood which is a positively charged sol.

(3) Fe^{3+} ions coagulate blood which is a negatively charged sol.

(4) Cl^{-} ions cause coagulation of blood.

79. The delicate balance of CO_2 and O_2 is NOT disturbed by

(1) Burning of Coal

(2) Deforestation

(3) Burning of petroleum

(4) Respiration

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80. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: 3.1500 g of hydrated oxalic acid dissolved in water to make 250.0 mL solution will result in 0.1M oxalic acid solution.

Reason R: Molar mass of hydrated oxalic acid is 126 g mol^{-1}

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

(1) A is false but R is true

(2) A is true but R is false

(3) Both A and R are true but R is NOT the correct explanation of A

(4) Both A and R are true and R is the correct explanation of A

SECTION-B

81. The number of molecules from the following which contain only two lone pair of electrons is:

H_2O, N_2, CO, XeF_4, NH_3, NO, CO_2, F_2

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82. The specific conductance of 0.0025M acetic acid is 5×10^{-5} S cm^{-1} at a certain temperature. The dissociation constant of acetic acid is _____ $\times 10^{-7}$. (Nearest integer)

Consider limiting molar conductivity of CH_3COOH as 400 S cm^2 mol^{-1}.

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83. An aqueous solution of volume 300 cm^3 contains 0.63 g of protein. The osmotic pressure of the solution at 300 K is 1.29 mbar. The molar mass of the protein is _____ g mol^{-1}.

Given: $R = 0.083$ L bar $K^{-1}mol^{-1}$

Solution: Given:

- Volume (V) = 300 cm^3 = 0.3 L
- Mass (m) = 0.63 g
- Osmotic pressure (π) = 1.29 mbar = 1.29×10^3 bar
- Temperature (T) = 300 K
- R = 0.083 L bar K^1 mol^1

Solution: Using the formula: $\pi = cRT$, where c is the molarity.

1. Calculate molarity (c):

$$c = \frac{\pi}{RT} = \frac{1.29 \times 10^{-3} \text{ bar}}{0.083 \text{ L bar K}^{-1}\text{mol}^{-1} \times 300 \text{ K}}$$

$$c \approx 5.18 \times 10^{-5} \text{ mol/L}$$

2. Calculate moles (n):

$$n = c \times V = 5.18 \times 10^{-5} \text{ mol/L} \times 0.3 \text{ L}$$

$$n \approx 1.554 \times 10^{-5} \text{ mol}$$

3. Calculate molar mass (M):

$$M = \frac{m}{n} = \frac{0.63 \text{ g}}{1.554 \times 10^{-5} \text{ mol}}$$

$$M \approx 40540 \text{ g/mol}$$

Answer: The molar mass of the protein is approximately 40540 g/mol.

Quick Tip

To calculate the molar mass from osmotic pressure, use the formula $n = \frac{\pi V}{RT}$, and then calculate molar mass as molar mass $= \frac{\text{mass}}{n}$.

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84. The difference in the oxidation state of Xe between the oxidised product of Xe formed on complete hydrolysis of XeF_4 and XeF_4 is _____

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85. The number of endothermic process/es from the following is

(A) I_2 (g) $\rightarrow$ 2I (g)

(B) HCl (g) $\rightarrow$ H (g) + Cl (g)

(C) H_2O (l) $\rightarrow$ H_2O (g)

(D) C (s) + O_2 (g) $\rightarrow$ CO_2 (g)

(E) Dissolution of ammonium chloride in water

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86. The number of incorrect statement/s from the following is

(A) The successive half lives of zero order reactions decreases with time.

(B) A substance appearing as reactant in the chemical equation may not affect the rate of reaction.

(C) Order and molecularity of a chemical reaction can be a fractional number.

(D) The rate constant units of zero and second order reaction are mol L^{-1} s^{-1} and mol^{-1} L s^{-1} respectively.

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87. The electron in the nth orbit of Li^{2+} is excited to $(n+1)$th orbit using the radiation of energy 1.47×10^{-17} J. The value of n is _____.

Given: $R_H = 2.18 \times 10^{-18}$ J

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88. For a metal ion, the calculated magnetic moment is 4.90 BM. This metal ion has _____ number of unpaired electrons.

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89. In alkaline medium, the reduction of permanganate anion involves a gain of ____ electrons.

Solution:

The reduction of permanganate anion (MnO_4^-) in alkaline medium involves the following process:

$$MnO_4^- \text{ (oxidation state of Mn} = +7) \rightarrow Mn^{4+} \text{ (oxidation state of Mn} = +4)$$

The reduction from Mn^{7+} to Mn^{4+} involves the gain of 3 electrons, as the change in oxidation number is from +7 to +4. Therefore, the reduction of permanganate anion involves the gain of 3 electrons.

Quick Tip

The number of electrons involved in the reduction process corresponds to the change in the oxidation state of the element. In this case, Mn changes from +7 to +4, which requires the gain of 3 electrons.

90.

$$A(g) \rightleftharpoons 2B(g) + C(g)$$

For the given reaction, if the initial pressure is 450 mmHg and the pressure at time t is 720 mmHg at a constant temperature T and constant volume V. The fraction of A(g) decomposed under these conditions is $x \times 10^{-1}$. The value of x is _____ (nearest integer)

Solution:

The reaction is given as:

$$A(g) \rightleftharpoons 2B(g) + C(g)$$

At time $t = 0$, the pressure of A is 450 mmHg, and at time $t = t$, the total pressure is 720 mmHg.

Let the extent of decomposition at time t be $2x$, so that the pressures of A, B, and C at time t are:

- Pressure of A = $450 - x$
- Pressure of B = $2x$
- Pressure of C = x

Thus, the total pressure at time t is:

$$P_t = P_A + P_B + P_C = (450 - x) + 2x + x = 720\,\text{mmHg}$$

Now, solving for x:

$$720 = 450 - x + 2x + x$$

$$720 = 450 + 2x$$

$$270 = 2x$$

$$x = 135$$

The fraction of A decomposed is:

$$\text{Fraction of A decomposed} = \frac{x}{450} = \frac{135}{450} = 0.3 = 3 \times 10^{-1}$$

Thus, the value of x is 3.

Quick Tip

For reactions involving changes in pressure, the change in pressure can be used to determine the extent of reaction. Here, the total pressure is related to the individual pressures of reactants and products at equilibrium.