CHEMISTRY

JEE–MAIN EXAMINATION – JUNE, 2022

24 June S - 01 Paper Solution

SECTION-A

1. If a rocket runs on a fuel (C_{15} H_{30}) and liquid oxygen, the weight of oxygen required and CO_2 released for every litre of fuel respectively are: (Given: density of the fuel is 0.756 g/mL)

(A) 1188 g and 1296 g (B) 2376 g and 2592 g

(C) 2592g and 2376 g (D) 3429 g and 3142 g

Ans. (C)

Sol. $C_{15}H_{30} + \frac{45}{2}O_2 \rightarrow 15CO_2 + 15H_2O$

Mass of fuel = 0.756×1000 g

No. of moles of fuel = $\frac{0.756 \times 1000}{210}$

Wt. of oxygen = $\frac{0.756 \times 1000}{210} \times \frac{45}{2} \times 32 = 2592g$

Wt of CO_2 = $\frac{0.756 \times 1000}{210} \times 15 \times 44 = 2376$ g

2. Consider the following pairs of electrons

(A) (a) $n = 3, l = 1, m_l = 1, m_s = +\frac{1}{2}$

(b) $n = 3, l = 2, m_l = 1, m_s = +\frac{1}{2}$

(B) (a) $n = 3, l = 2, m_l = -2, m_s = -\frac{1}{2}$

(b) $n = 3, l = 2, m_l = -1, m_s = -\frac{1}{2}$

(C) (a) $n = 4, l = 2, m_l = 2, m_s = +\frac{1}{2}$

(b) $n = 3, l = 2, m_l = 2, m_s = +\frac{1}{2}$

The pairs of electron present in degenerate orbitals is/are:

(A) Only A

(B) Only B

(C) Only C

(D) (B) and (C)

Ans. (B)

Sol. Based on "n + l" rule only (B) has pair of electron in degenerate orbitals

3. Match List – I with List - II

List – I		List – II	
(A)	$[PtCl_4]^{2-}$	**(I)**	sp^3d
(B)	BrF_5	**(II)**	d^2sp^3
(C)	PCl_5	**(III)**	dsp^2
(D)	$[Co(NH_3)_6]^{3+}$	**(IV)**	sp^3d^2

(A) (A)→(II), (B)→(IV), (C)→(I), (D)→(III)

(B) (A)→(III), (B)→(IV), (C)→(I), (D)→(II)

(C) (A)→(III), (B)→(I), (C)→(IV), (D)→(II)

(D) (A)→(II), (B)→(I), (C)→(IV), (D)→(III)

Ans. (B)

Sol. Answer (B)

List – I		List – II	
(A)	$[PtCl_4]^{2-}$	(III)	dsp^2
(B)	BrF_5	(IV)	sp^3d^2
(C)	PCl_5	(I)	sp^3d
(D)	$[Co(NH_3)_6]^{3+}$	(II)	d^2sp^3

4. For a reaction at equilibrium

$$A(g) \rightleftharpoons B(g) + \frac{1}{2}C(g)$$

the relation between dissociation constant (K), degree of dissociation (α) and equilibrium pressure (p) is given by :

(A) $K = \dfrac{\alpha^{\frac{1}{2}} p^{\frac{3}{2}}}{\left(1+\frac{3}{2}\alpha\right)^{\frac{1}{2}}(1-\alpha)}$

(B) $K = \dfrac{\alpha^{\frac{3}{2}} p^{\frac{1}{2}}}{(2+\alpha)^{\frac{1}{2}}(1-\alpha)}$

(C) $K = \dfrac{(\alpha p)^{\frac{3}{2}}}{\left(1+\frac{3}{2}\alpha\right)^{\frac{1}{2}}(1-\alpha)}$

(D) $K = \dfrac{(\alpha p)^{\frac{3}{2}}}{(1+\alpha)(1-\alpha)^{\frac{1}{2}}}$

Ans. (B)

Sol.

	A(g)	$\rightleftharpoons$	$B(g) + \frac{1}{2}C(g)$
Initial : P_i		**0**	**0**
At eq.:	$P_i(1-\alpha)$	$P_i.\alpha$	$P_i\frac{\alpha}{2}$

Now, equilibrium pressure (p) ,

$$P = P_i \times \left(1+\frac{\alpha}{2}\right)$$

$$\therefore\ P_A = \left(\frac{1-\alpha}{1+\frac{\alpha}{2}}\right)P$$

$$P_B = \left(\frac{\alpha}{1+\frac{\alpha}{2}}\right)P$$

$$P_C = \left(\frac{\frac{\alpha}{2}}{1+\frac{\alpha}{2}}\right)P$$

$$\therefore K = \frac{P_c^{\frac{1}{2}} \times P_B}{P_A}$$

$$K = \frac{\alpha^{\frac{3}{2}} p^{\frac{1}{2}}}{(2+\alpha)^{\frac{1}{2}}(1-\alpha)}$$

5. Given below are two statements :

Statement I : Emulsions of oil in water are unstable and sometimes they separate into two layers on standing.

Statement II :For stabilisation of an emulsion, excess of electrolyte is added.

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

(A) Both Statement I and Statement II are correct.

(B) Both Statement I and Statement II are incorrect.

(C) Statement I is correct but Statement II is incorrect.

(D) Statement I is incorrect but Statement II is correct.

Ans. (C)

Sol. Statement I : Fact

Statement II: The principle emulsifying agents for O/W emulsions are proteins, gums natural and synthetic soaps etc…

6. Given below are the oxides:

Na_2O, As_2O_3, N_2O, NO and Cl_2O_7

Number of amphoteric oxides is:

(A) 0 (B) 1

(C) 2 (D) 3

Ans. (B)

Sol. Na_2O = Basic As_2O_3 = Amphoteric

N_2O = Neutral NO = Neutral

Cl_2O_7 = Acidic

7. Match List – I with List – II

	List - I		List - II
(A)	Sphalerite	(I)	$FeCO_3$
(B)	Calamine	(II)	PbS
(C)	Galena	(III)	$ZnCO_3$
(D)	Siderite	(IV)	ZnS

Choose the most appropriate answer from the options given below:

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

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

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

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

Ans. (A)

Sol.

	List - I		List - II
(A)	Sphalerite	(IV)	ZnS
(B)	Calamine	(III)	$ZnCO_3$
(C)	Galena	(II)	PbS
(D)	Siderite	(I)	$FeCO_3$

8. The highest industrial consumption of molecular hydrogen is to produce compounds of element:

(A) Carbon (B) Nitrogen

(C) Oxygen (D) Chlorine

Ans. (B)

Sol. Nitrogen . Around 55% of hydrogen around would goes to ammonia production

9. Which of the following statements are correct ?

(A) Both LiCl and $MgCl_2$ are soluble in ethanol.

(B) The oxides Li_2O and MgO combine with excess of oxygen to give superoxide.

(C) LiF is less soluble in water than other alkali metal fluorides.

(D) Li_2O is more soluble in water than other alkali metal oxides.

Choose the most appropriate answer from the options given below:

(A) (A) and (C) only (B) (A), (C) and (D) only

(C) (B) and (C) only (D) (A) and (C) only

Ans. (A)

Sol. (A) Both LiCl and $MgCl_2$ are soluble in ethanol

(B) Li and Mg do not form superoxide

(C) LiF has high lattice energy

(D) Li_2O is least soluble in water than other alkali metal oxides

10. Identify the correct statement for B_2H_6 from those given below.

(A) In B_2H_6, all B-H bonds are equivalent.

(B) In B_2H_6 there are four 3-centre-2-electron bonds.

(C) B_2H_6 is a Lewis acid.

(D) B_2H_6 can be synthesized form both BF_3 and $NaBH_4$.

(E) B_2H_6 is a planar molecule.

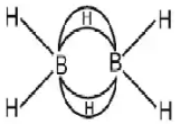
Choose the most appropriate answer from the options given below :

(A) (A) and (E) only (B) (B), (C) and (E) only

(C) (C) and (D) only (D) (C) and (E) only

Ans. (C)

Sol. (A) (B)



Two 3 centre – 2 – electron bonds

(C) B_2H_6 is e^- deficient species

(E) B_2H_6 is non – Planar molecule

(D) $BF_3 + LiAlH_4 \rightarrow 2B_2H_6 + 3LiF + 3AlF_3$

$NaBH_4 + I_2 \rightarrow B_2H_6 + 2NaI + H_2$

11. The most stable trihalide of nitrogen is:

(A) NF_3 (B) NCl_3

(C) NBr_3 (D) NI_3

Ans. (A)

Sol. Order of stability: -

$NF_3 > NCl_3 > NBr_3 > NI_3$

12. Which one of the following elemental forms is not present in the enamel of the teeth?

(A) Ca^{2+} (B) P^{3+}

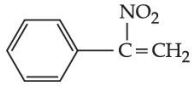
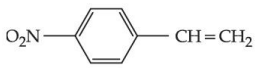
(C) F^- (D) P^{5+}

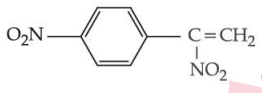
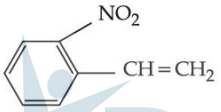
Ans. (B)

Sol. Calcium and phosphate are the major components of teeth enamel

13. In the given reactions sequence, the major product 'C' is :

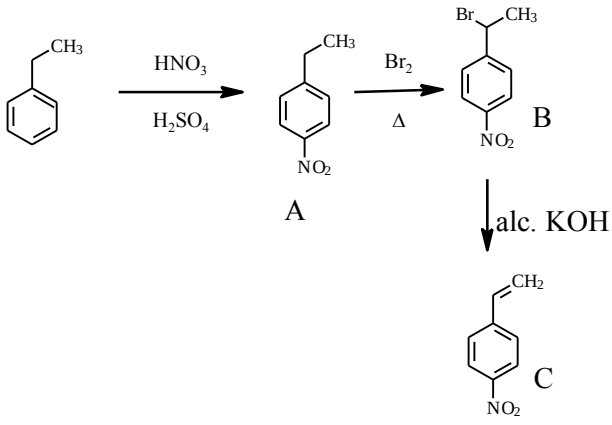
$C_8H_{10} \xrightarrow[H_2SO_4]{HNO_3} A \xrightarrow[\Delta]{Br_2} B \xrightarrow[KOH]{\text{alcoholic}} C$

(A)  (B) 

(C)  (D) 

Ans. (B)

Sol. C_8H_{10} DU = 9 –5 = 4



14. Two statements are given below :

Statement I: The melting point of monocarboxylic acid with even number of carbon atoms is higher than that of with odd number of carbon atoms acid immediately below and above it in the series.

Statement II : The solubility of monocarboxylic acids in water decreases with increase in molar mass.

Choose the most appropriate option:

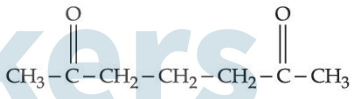
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

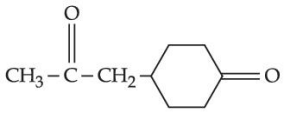
Ans. (A)

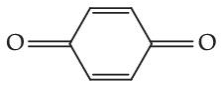
Sol. I . Better packing efficiency of monocarboxylic acids with even number of carbon atoms results in higher M.P

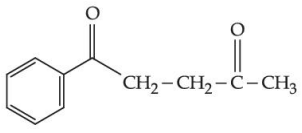
II. As molar mass increases hydrophobic part size increase hence solubility decreases.

15. Which of the following is an example of conjugated diketone?

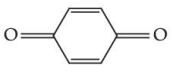
(A) 

(B) 

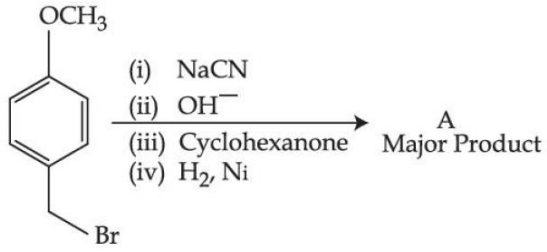
(C) 

(D) 

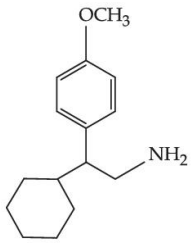
Ans. (C)

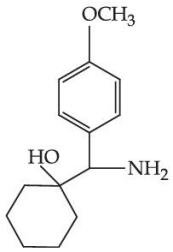
Sol.  **is a conjugated diketone**

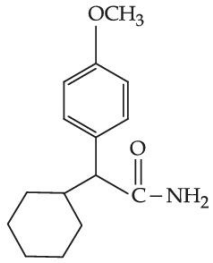
16.

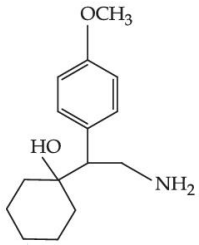


The major product of the above reaction is

(A) 

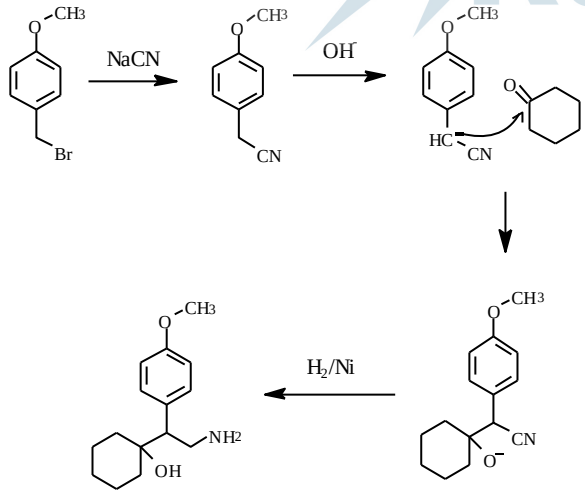
(B) 

(C) 

(D) 

Ans. (D)

Sol.



17. Which of the following is an example of polyester?

(A) Butadiene-styrene copolymer

(B) Melamine polymer

(C) Neoprene

(D) Poly-β-hydroxybutyrate-co-β-hydroxy valerate

Ans. (D)

Sol. Factual

18. A polysaccharide 'X' on boiling with dil H_2SO_4 at 393 K under 2-3 atm pressure yields 'Y'.

'Y' on treatment with bromine water gives gluconic acid. 'X' contains β-glycosidic linkages only. Compound 'X' is :

(A) starch (B) cellulose

(C) amylose (D) amylopectin

Ans. (B)

Sol. Cellulose contains β – glycosidic linkages only

19. Which of the following is not a broad spectrum antibiotic?

(A) Vancomycin (B) Ampicillin

(C) Ofloxacin (D) Penicillin G

Ans. (D)

Sol. Penicillin G following is a narrow spectrum antibiotic

20. During the qualitative analysis of salt with cation y^{2+}, addition of a reagent (X) to alkaline solution of the salt gives a bright red precipitate. The reagent (X) and the cation (y^{2+}) present respectively are:

(A) Dimethylglyoxime and Ni^{2+}

(B) Dimethylglyoxime and Co^{2+}

(C) Nessler's reagent and Hg^{2+}

(D) Nessler's reagent and Ni^{2+}

Ans. (A)

Sol. $Ni^{2+} + DMG^{-} \rightarrow [Ni(DMG)_2] \downarrow$

(Bright red precipitate)

SECTION-B

1. Atoms of element X form hcp lattice and those of element Y occupy $\frac{2}{3}$ of its tetrahedral voids. The percentage of element X in the lattice is_____

(Nearest integer)

Ans. (43)

Sol. $X \to 6 \qquad Y \to \frac{2}{3} \times 2 \times 6 = 8$

$$\% X = \frac{6}{14} \times 100 = 42.8 \simeq 43\%$$

2. $2O_3(g) \rightleftharpoons 3O_2(g)$

At 300 K, ozone is fifty percent dissociated. The standard free energy change at this temperature and 1 atm pressure is (–) __J mol $^{-1}$ (Nearest integer)

[Given: ln 1.35 = 0.3 and R = 8.3 J K^{-1} mol^{-1}]

Ans. (747)

Sol. $2O_3 \rightleftharpoons 3O_2(g)$

$\frac{2}{5} \qquad \frac{3}{5}$

$$k_p = \frac{P_{O_2}^3}{P_{O_3}^2}$$

$k_p = 1.35$

$\Delta G° = -RT \ln k_p$

$= -8.3 \times 300 \times \ln 1.35$

$= -747$ J/mol

3. The osmotic pressure of blood is 7.47 bar at 300 K. To inject glucose to a patient intravenously, it has to be isotonic with blood. The concentration of glucose solution in gL^{-1} is _____(Molar mass of glucose = 180 g mol^{-1}

R = 0.083 L bar K^{-1} mol^{-1}) (Nearest integer)

Ans. (54)

Sol. π=C.R.T

$7.47 = C \times 0.083 \times 300$

$C = 0.3$ M

$= 0.3 \times 180$ gL^{-1}

$= 54$ gL^{-1}

4. The cell potential for the following cell

$Pt\,|\,H_2(g)\,|\,H^+(aq)\,||\,Cu^{2+}(0.01M)\,|\,Cu(s)$

is 0.576 V at 298 K. The pH of the solution is ___. (Nearest integer)

Ans. (5)

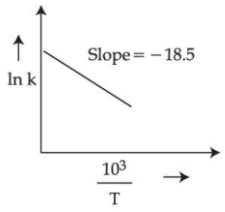
Sol.
$$\text{Anode} : H_2 \to 2H^+ + 2e^-$$
$$\text{Cathode} : Cu^{2+} + 2e^- \to Cu$$
$$Cu^{2+} + H_2 \to 2H^+ + Cu$$

$$E_{cell} = E^0_{cell} - \frac{0.06}{2} \log \frac{[H^+]^2}{[Cu^{2+}]}$$

$$0.576 = 0.34 - \frac{0.06}{2} \log \left\{ \frac{[H^+]^2}{(0.01)} \right\}$$

$+ 3.93 \; -\log(H^+) + \log 0.1 \Rightarrow pH = 4.93 \simeq 5$

5. The rate constants for decomposition of acetaldehyde have been measured over the temperature range 700 –1000 K. The data has been analysed by plotting In k vs $\frac{10^3}{T}$ graph.The value of activation energy for the reaction is___ kJ mol^{-1}. (Nearest integer) (Given : R = 8.31 J K^{-1} mol^{-1})



Ans. (154)

Sol. $\ln k = \ln A - \frac{Ea}{10^3 RT} \times 10^3 = \ell nA + \frac{10^3}{T}\left[-\frac{Ea}{10^3 RT}\right]$

From the graph

$$\frac{-Ea}{10^3 \times R} = -18.5$$

Ea = 153.735 kJ/mol

~154

6. The difference in oxidation state of chromium in chromate and dichromate salts is _____

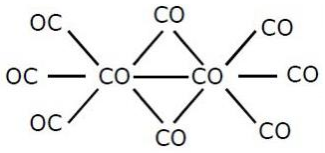
Ans. (0)

Sol. $\overset{+6}{Cr}O_4^{2-}, \overset{+6}{Cr}_2O_7^{2-}$ difference is zero

7. In the cobalt-carbonyl complex: $[Co_2(CO)_8]$, number of Co-Co bonds is "X" and terminal CO ligands is "Y". X + Y =____

Ans. (7)

Sol.



X = 1

Y = 6

8. A 0.166 g sample of an organic compound was digested with cone. H_2SO_4 and then distilled with NaOH. The ammonia gas evolved was passed through 50.0 mL of 0.5 N H_2SO_4. The used acid required 30.0 mL of 0.25 N NaOH for complete neutralization. The mass percentage of nitrogen in the organic compound is____.

Ans. (Bonus)

Sol. m_{eq} of NaOH used = 30 ×0.25

m_{eq} of H_2SO_4 taken = 50 × 0.5

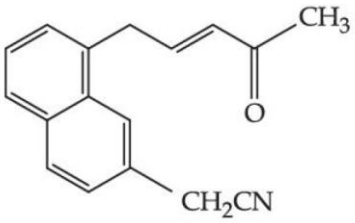
$\therefore$ m_{eq} of H_2SO_4 used

= 50 × 0.25 ×30 ×0.25 = 17.5 m mol of NH_3

$$\therefore \% N = \frac{17.5 \times 10^{-3} \times 14}{0.166} \times 100 = 147.59\%$$

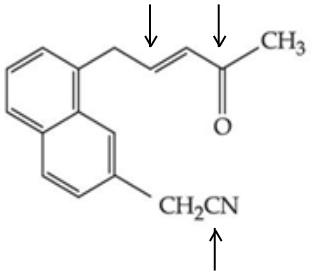
(Not possible)

9. Number of electrophilic centre in the given compound is ____



Ans. (3)

Sol.



10. The major product 'A' of the following given reaction has _____ sp^2 hybridized carbon atoms.

2,7 – Dimethyl1 – 2, 6 – octadiene

$\xrightarrow{H^+}$ A (Mojor Pr oduct)

Ans. (2)

Sol. Answer (2)