CHEMISTRY
JEE-MAIN (July-Attempt)
26 July (Shift-2) Paper Solution

SECTION - A

1. Hemoglobin contains 0.34 % of iron by mass. The number of Fe atoms in 3.3 g of hemoglobin is (Given: Atomic mass of Fe is 56 u, $N_A = 6.022 \times 10^{23}$ mol^{-1}.)

(A) 1.21×10^5 (B) 12.0×10^{16} (C) 1.21×10^{20} (D) 3.4×10^{22}

Sol. **C**

% of Iron in hemoglobin = 0.34%

Given mass of hemoglobin = 3.3g

Mass of Iron in hemoglobin $= 3.3 \times \frac{0.34}{100}$

$= 0.01122$gm

No. of Iron atoms $= \frac{mass}{GAM} \times N_A$

$= \frac{0.01122}{56} \times 6.023 \times 10^{23}$

$= 1.206 \times 10^{20}$

$\approx 1.21 \times 10^{20}$

2. Arrange the following in increasing order of their covalent character.

A. CaF_2

B. $CaCl_2$

C. $CaBr_2$

D. CaI_2

Choose the correct answer from the options given below.

(A) B < A < C < D (B) A < B < C < D

(C) A < B < D < C (D) A < C < B < D

Sol. **B**

Size of anion increase. Covalent character increase

covalent character $\rightarrow$ $CaF_2 < CaCl_2 < CaBr_2 < CaI_2$

3. Class XII students were asked to prepare one litre of buffer solution of pH 8.26 by their Chemistry teacher. The amount ammonium chloride to be dissolved by the student in 0.2 M ammonia solution to make one litre of the buffer is

(Given : pK_b (NH_3) = 4.74

Molar mass of NH_3 = 17 g mol^{-1}

Molar mass of NH_4Cl = 53.5 g mol^{-1})

(A) 53.5 g (B) 72.3 g (C) 107.0 g (D) 126.0 g

Sol. **C**

Vsolution = 1 litre

$P^H = 8.26 \quad \Rightarrow \quad P^{OH} = 14 - 8.26$

$[NH_3] = 0.2\ M = [Base] = 5.74$

$P^Kb(NH_3) = 4.74$

For basic buffer :

$P^{OH} = P^{Kb} + \log \frac{[Salt]}{[Base]}$

$5.74 = 4.74 + \log \frac{(NH_4Cl)}{0.2}$

$1 = \log [NH_4Cl] - \log (1/5)$

$\text{Log } [NH_4Cl] = 1 - \log 5$

$= \log 10 - \log 5$

$= \log \frac{10}{5} = \log 2$

$[NH_4Cl] = 2M$

$V_{solution} = 1l$

Moles of $NH_4Cl = 2 \times 1 = 2$ mol

Mass of $NH_4Cl = 2 \times GMM$

$= 2 \times 53.5$

$= 107.0$ gm

4. At 30 °C, the half life for the decomposition of AB_2 is 200 s and is independent of the initial concentration of AB_2. The time required for 80% of the AB_2 to decompose is

Given: log 2 = 0.34

log 3 = 0.48

(A) 200 s (B) 323 s (C) 467 s (D) 532 s

Sol. **C**

$AB_2 \longrightarrow t_{1/2} = 200$ sec

$T_{1/2}$ is independent of the initial concentration of AB_2, it means the order of reaction is one.

For first order reaction—

$K = \frac{0.693}{t_{1/2}} = \frac{2.303}{t} \log \frac{a}{a-x}$

$\frac{0.693}{200} = \frac{2.303}{t} \log \frac{a}{\frac{20}{100}a}$

$\frac{0.693}{200} = \frac{2.303}{t} \log \frac{100}{20}$

$\frac{0.693}{200} = \frac{2.303}{t} \log 5$

$t = \frac{2.303 \times 0.7}{0.693} \times 200 \quad \because \log 5 \approx 0.7$

$= 465.25$

≈ 465 sec

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

Assertion A : Finest gold is red in colour, as the size of the particles increases, it appears purple then blue and finally gold.

Reason R : The colour of the colloidal solution depends on the wavelength of light scattered by the dispersed particles.

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

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

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

(C) A is true but R is false.

(D) A is false but R is true.

Sol. A

∵ The colour of colloidal particles depends upon the size of particles.

Larger particles absorb the light of longer wavelength and therefore transmit light of shorter wavelength.

6. The metal that has very low melting point and its periodic position is closer to a metalloid is

(A) Al (B) Ga (C) Se (D) In

Sol. B

Ga have low M.P. and it is closer to metalloid in P.T.

7. The metal that is not extracted from its sulfide ore is

(A) Aluminium (B) Iron (C) Lead (D) Zinc

Sol. A

Al is not obtained from sulphide ore

8. The products obtained from a reaction of hydrogen peroxide and acidified potassium permanganate are

(A) Mn^{4+}, H_2O only

(B) Mn^{2+}, H_2O only

(C) Mn^{4+}, H_2O, O_2 only

(D) Mn_2+, H_2O, O_2 only

Sol. D

$$2KMnO_4 + 3H_2SO_4 + 5H_2O_2 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$$

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

Assertion A : LiF is sparingly soluble in water.

Reason R : The ionic radius of Li^+ ion is smallest among its group members, hence has least hydration enthalpy.

In the light of the above statements, choose the most appropriate answer from the option given below.

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

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

(C) A is true but R is false.

(D) A is false but R is true.

Sol. **C**

Due to high lattice energy LiF is less soluble.

$\rightarrow Li^+$ has small size so it's has very high hydroation energy

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

Assertion A : Boric acid is a weak acid.

Reason R : Boric acid is not able to release H^+ ion on its own. It receives OH^- ion from water and release H^+ ion.

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

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

(B) Both A and R are correct but R is NOT the correct explanation of A.

(C) A is correct but R is not correct.

(D) A is not correct but R is correct.

Sol. **A**

It is a weak mono basic acid soluble in water and in aqueous solution the boron atom completes it's octect by accepting OH^- ion from water molecules.

$B(OH)_{3(aq)} + 2H_2O \rightleftharpoons [B(OH)_4]^- + H_3O^+$

11. The metal complex that is diamagnetic is (Atomic number: Fe, 26; Cu, 29)

(A) $K_3[Cu(CN)_4]$ (B) $K_2[Cu(CN)_4]$ (C) $K_3[Fe(CN)_4]$ (D) $K_4[FeCl_6]$

Sol. **A**

Coordination Compound	**O.S.**	**Magnetic Behaviour**
(A) $K_3[Cu(CN)_4]$	Cu^{+1}	dia
(B) $K_2[Cu(CN)_4]$	Cu^{+2}	Para
(C) $K_3[Fe(CN)_4]$	Fe^{+1}	Para
(D) $K_4[FeCl_6]$	Fe^{+2}	Para

12. Match List – I with List – II

List – I **Pollutant**	**List – II** **Source**
A. Microorganisms	I. Strip mining
B. Plant nutrients	II. Domestic sewage
C. Toxic heavy metals	III. Chemical fertilizer
D. Sediment	IV. Chemical factory

Choose the correct answer from the options given below:

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

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

Sol. **A**

A. Microorganisms → Domestic sewage
B. Plant nutrients → Chemical fertilizer
C. Toxic heavy metals → Chemical factory
D. Sediment → Strip mining

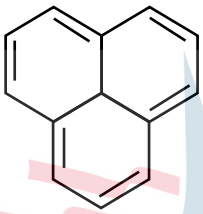
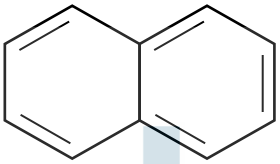
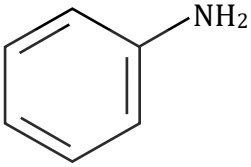
13. The correct decreasing order of priority of functional groups in naming an organic compound as per IUPAC system of nomenclature is

(A) — COOH > — $CONH_2$ > — COCl > — CHO
(B) — SO_3H > — COCl > — $CONH_2$ > — CN
(C) — COOR > — COCl > — NH_2 > $\diagdown$ C = 0
(D) — COOH > — COOR > — $CONH_2$ > — COCl

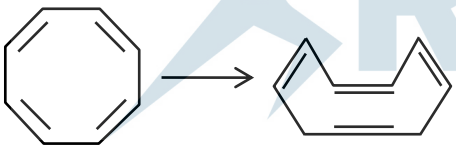
Sol. **B**

$-So_3H > -\overset{\overset{O}{\|}}{C}-Cl > -\overset{\overset{O}{\|}}{C}-NH_2 > -C \equiv N$

14. Which of the following is not an example of benzenoid compound?

(A) 
(B) 
(C) 
(D) 

Sol. **B**

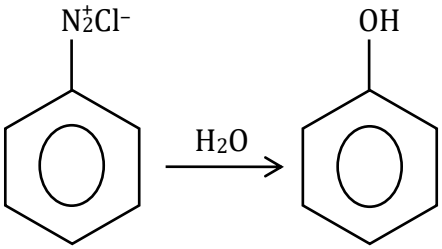


Tub shape

15. Hydrolysis of which compound will give carbolic acid?

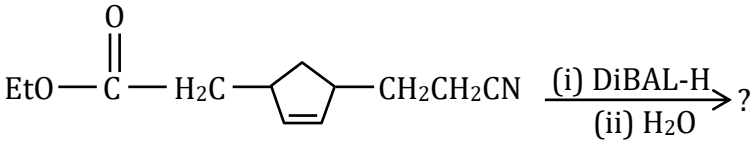
(A) Cumene
(B) Benzenediazonium chloride
(C) Benzal chloride
(D) Ethylene glycol ketal

Sol. **B**



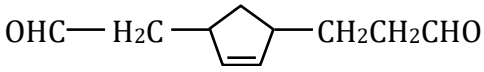
Carbolic acid
Or phenol

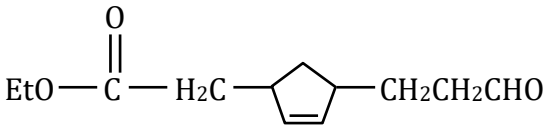
16.

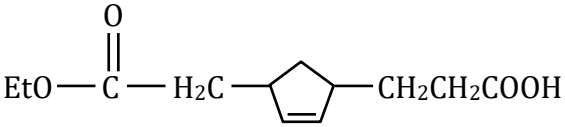


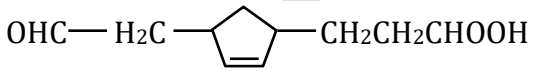
[Et is $-C_2H_5$]

Consider the above reaction and predict the major product.

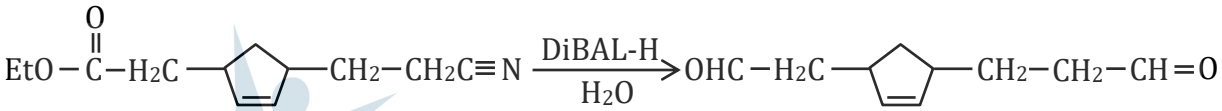
(A) 

(B) 

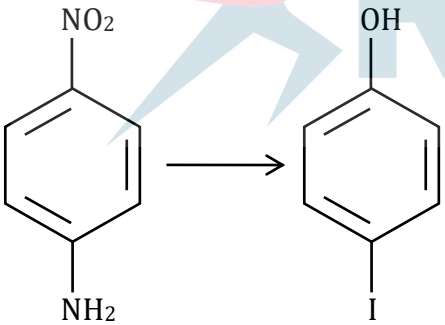
(C) 

(D) 

Sol. **A**



17. The correct sequential order of the reagents for the given reaction is



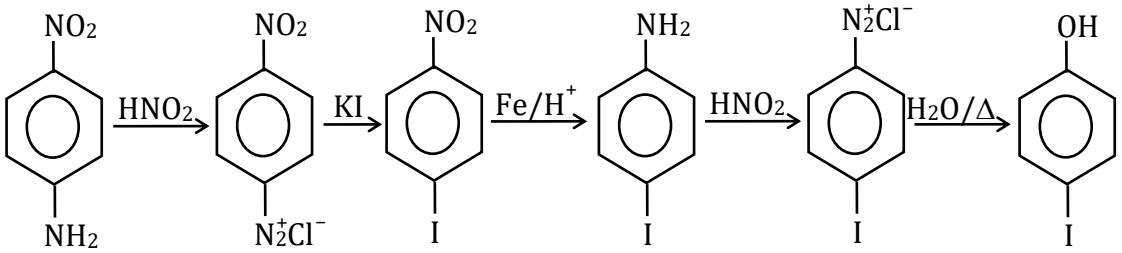
(A) HNO_2, Fe/H^+, HNO_2, KI, H_2O/H^+

(B) HNO_2, KI, Fe/H^+, HNO_2, H_2O/warm

(C) HNO_2, KI, HNO_2, Fe/H^+, H_2O/H^+

(D) HNO_2, Fe/H^+, KI, HNO_2, H_2O/warm

Sol. **B**



18. Vulcanization of rubber is carried out by heating a mixture of

(A) Isoprene and styrene (B) Neoprene and Sulphur

(C) Isoprene and Sulphur (D) Neoprene and styrene

Sol. **C**

Isoprene and sulphur

19. Animal starch is the other name of

(A) Amylose (B) Maltose

(C) Glycogen (D) Amylopectin

Sol. **C**

Glycogen

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

Assertion A : Phenolphthalein is a pH dependent indicator, remains colourless in acidic solution and gives pink colour in basic medium.

Reason R : Phenolphthalein is a weak acid. It doesn't dissociate in basic medium.

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

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

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

(C) A is true but R is false.

(D) A is false but R is true.

Sol. **C**

A is true but R is false

$\because$ Phenolphthalein is weak acidic in nature.

It dissociates in basic medium and gives pink colour.

$HIn + OH^- \rightleftharpoons In^- + H_2O$

Colourless Pink

SECTION - B

21. A 10 g mixture of hydrogen and helium is contained in a vessel of capacity 0.0125 m^3 at 6 bar and 27 °C. The mass of helium in the mixture is _____ g. (nearest integer)

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

(Atomic masses of H and He are 1 u and 4 u, respectively)

Sol. **8**

Mass of mixture = 10 g = H_2 + He

Volume of container = $0.0125 m^3$

= 12.5 l

P = 6 bar = 5.922 atm

T = 27ºC = 300K

PV = nRT

Total mole (n) $= \frac{PV}{RT} = \frac{5.922 \times 12.5 \times 101.33}{8.314 \times 300}$ $\because$ 1 l-atm = 101.33 J

= 3.01 ≈ 3 mole

Let mass of H_2 in mixture = x gm

Mass of He = (10 – x) gm

Mole of H_2 $= \frac{x}{2}$

Mole of He $= \frac{10-x}{4}$

Total mole $= \frac{x}{2} + \frac{10-x}{4} = 3$

2x + 10 – x = 12

X = 2 gm

Mass of H_2 = 2g

Mass of He = 10 – x

= 8 gm

22. Consider an imaginary ion $^{48}_{22}X^{3-}$. The nucleus contains 'a'% more neutrons than the number of electrons in the ion. The value of 'a' is _____. [nearest integer]

Sol. 4

$^{48}_{22}x^{3-} \Rightarrow \begin{matrix} no.\,of\ e^- = 22 + 3 = 25 \\ no.\,of\ n^0 = 48 - 22 = 26 \end{matrix}$

No. of neutron = 9% of no of e^- + no. of e^-

$26 = \left(\frac{a}{100} \times 25\right) + 25$

$1 = \frac{a}{4}$

$\boxed{a = 4}$

23. For the reaction

$H_2F_2(g) \rightarrow H_2(g) + F_2(g)$

$\Delta U = -59.6$ kJ mol^{-1} at 27 °C.

The enthalpy change for the above reaction is (–) _____ kJ mol^{-1} [nearest integer]

Given : R = 8.314 J K^{-1} mol^{-1}.

Sol. **57**

$H_2F_2(g) \longrightarrow H_2(g) + F_2(g)$

$\Delta U = -59.6$ kJ/mol, $\Delta n_g = 2 - 1 = 1$

$T = 27^oC = 300K$

$\Delta H = \Delta U + \Delta ngRT$

$= -59.6 + 1 \times 8.314 \times 300 \times 10^{-3}$

$= -59.6 + (8.314 \times 0.3)$

$= -57.10$ kJ/mol

≈ -57 KJ/mol

24. The elevation in boiling point for 1 molal solution of non-volatile solute A is 3 K. The depression in freezing point for 2 molal solution of A in the same solvent is 6 K. The ratio of K_b and K_f i.e., K_b/K_f is 1 : X. The value of X is [nearest integer]

Sol. **1**

Molality = 1m molality = 2m

$\Delta T_b = 3k$ $\Delta T_f = 6K$

∵ Solvent is same

$\Delta T_b = K_b m_1$ $\Delta T_f = K_f m_2$

$$\frac{\Delta T_b}{\Delta T_f} = \frac{K_b}{K_f} \times \frac{m_1}{m_2}$$

$$\frac{3}{6} = \frac{K_b}{K_f} \times \frac{1}{2}$$

$$\frac{K_b}{K_f} = \frac{1}{1}$$

$K_b : K_f = 1 : 1$

$= 1 : X$

So, $\boxed{X = 1}$

25. 20 mL of 0.02 M hypo solution is used for the titration of 10 mL of copper sulphate solution, in the presence of excess of KI using starch as an indicator. The molarity of Cu^{2+} is found to be _____ $\times 10^{-2}$ M. [nearest integer]

Given : $2\ Cu^{2+} + 4\ I^- \rightarrow Cu_2I_2 + I_2$

$I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$

Sol. **4**

Hypo solution = 20 ml & 0.02 M

$CuSO_4$ Sol^n = 10 ml

$2Cu^{2+} + 4I^- \longrightarrow Cu_2I_2 + I_2$

$I_2 + 2S_2O_3^{2-} \longrightarrow 2I^- + S_4O_6^{2-}$

Meq of hypo solution = $(M \times V) \times n_f$

$= 20 \times 0.02 \times 1$

$= 0.4$

Meq of hypo = meq of $I_2 = 0.4$

Meq of $CuSO_4 = 0.4$

Moles of $CuSO_4$ = Meq $\times n_f$

$= 0.4 \times 1$

$= 0.4$ mol.

Molarity = $\frac{mol}{volume} = \frac{0.4}{10}$

$= 0.04M$

$= 4 \times 10^{-2}$ M

26. The number of non-ionisable protons present in the product B obtained from the following reactions is _____.

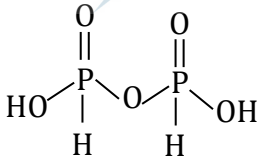
$C_2H_5OH + PCl_3 \rightarrow C_2H_5Cl + A$

$A + PCl_3 \rightarrow B$

Sol. **2**

$C_2H_5OH + PCl_3 \rightarrow C_2H_5Cl + H_3PO_3$

$H_3PO_3 + PCl_3 \rightarrow H_4P_2O_5 + HCl$



27. The spin only magnetic moment value of the compound with strongest oxidizing ability among MnF_4, MnF_3 and MnF_2 is _____ B. M. [nearest integer]

Sol. **5**

The change from Mn2+ to Mn3+ results in the half-Filled (d5) configuration which has extra stability.

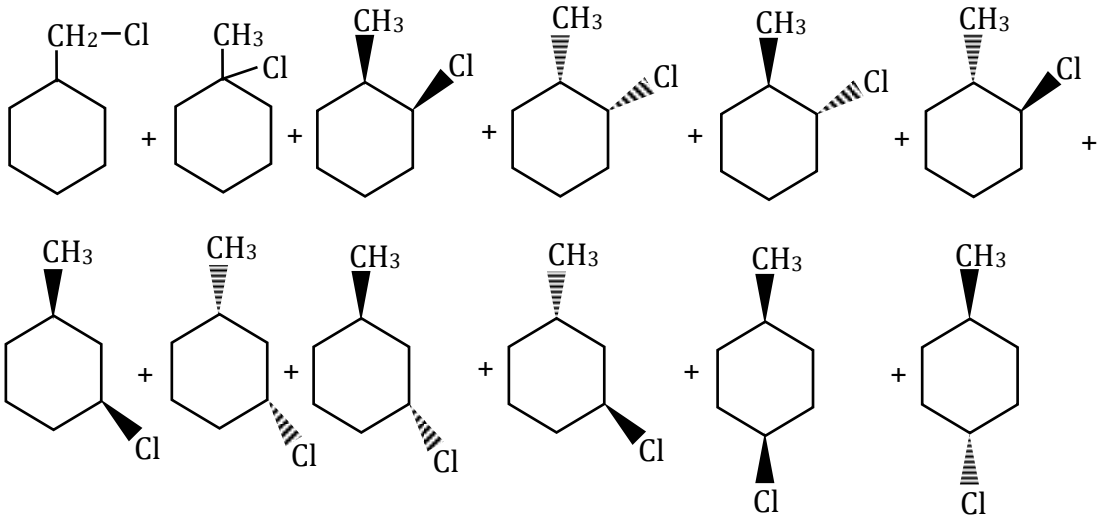
$MnF_3 \rightarrow$ most oxising agent

$Mn^{+3} \rightarrow 3d^4$

$\mu = \sqrt{n(n+2)} = \sqrt{4 \times 6} = \sqrt{24} = 5$

28. Total number of isomers (including stereoisomers) obtained on monochlorination of methyl cyclohexane is _____.

Sol. **12s**



29. A 100 mL solution of CH_3CH_2MgBr on treatment with methanol produces 2.24 mL of a gas at STP. The weight of gas produced is _____ mg. [nearest integer]

Sol. **3**

$CH_3CH_2MgBr + CH_3OH \longrightarrow CH_3 - CH_3(g)$

2.24 ml

Mole of ethane = $\frac{2.24}{22400}$

= 10^{-4} mole

Mass of ethane = 10–4 × 30

= 3×10^{-3} gm

= 3 mg

30. How many of the following drug is/are example(s) of broad spectrum antibiotics?
Ofloxacin, Penicillin G, Terpinerol, Salvarsan.

Sol. **1**

Ofloxacin