Code Number: **A**

Medical|IIT-JEE|Foundations

Corp. Office: Aakash Educational Services Limited, 3rd Floor, Incuspaze Campus- 2, Plot No. 13, Sector- 18, Udyog Vihar, Gurugram, Haryana - 122015

Mock Test Paper for Class-XII

CHEMISTRY

Time: 3 hrs.

Max. Marks: 70

Answers & Solutions

SECTION-A

A1. Answer (c) **[1]**

S_N2 reaction (alkoxide ion reacts with primary alkyl halide reacts in a single step to form ether)

A2. Answer (c)

1,4-dicholorbenzene (para isomers are more symmetric than ortho and meta isomer) **[1]**

A3. Answer (d) **[1]**

pH does not affect the primary structure of protein (pH affects the secondary, tertiary structure etc.)

A4. Answer (c) **[1]**

Reimer-Tiemann reaction (Kolbe's reaction is used to prepare salicylic acid, Etard reaction for benzaldehyde, Reimer-Tiemann reaction for salicylaldehyde and Stephen's reduction for aldehyde)

A5. Answer (b)

Exothermic and reversible process (according to Le-Chatelier principle Solubility of gases in liquids decreases with rise in temperature) **[1]**

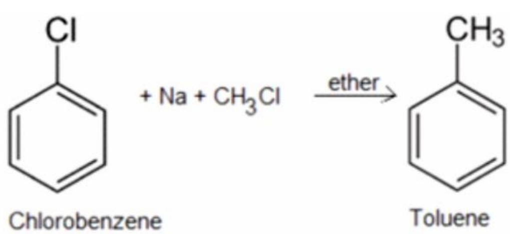
A6. Answer (b) **[1]**

A7. Answer (b) **[1]**

Raoult's law

A8. Answer (b)

CH_3Cl, Na, Dry ether **[1]**



A9. Answer (b)

1-Phenyl-3-bromopropane **[1]**

($(C_6H_5)CH_2CH=CH_2$ + HBr (organic peroxide) $\rightarrow$ $(C_6H_5)CH_2CH_2CH_2Br$ anti-Markovnikov addition)

A10. Answer (b) **[1]**

A11. Answer (a) **[1]**

When placed in water containing more than 0.9% (mass/volume) NaCl solution [because fluid inside blood cells is isotonic with 0.9% NaCl solution]

A12. Answer (c) **[1]**

A13. Answer (a) **[1]**

A14. Answer (b) **[1]**

A15. Answer (b) **[1]**

A16. Answer (c) **[1]**

Assertion: Molarity of a solution changes with temperature. (correct)

Reason: Molarity is a colligative property. (incorrect)

Molarity is a means to express concentration. It is not a physical property.

SECTION-B

A17. (a) As seen from the graph, electrolyte A is a strong electrolyte which is completely ionised in solution. With dilution, the ions are far apart from each other and hence the molar conductivity increases. **[1]**

(b) To determine the value of limiting molar conductivity for electrolyte B, indirect method based upon Kohlrausch law of independent migration of ions can be used. **[1]**

A18. (a) 1-Methylcyclohexene **[1]**

(b) $C_6H_6 \xrightarrow{\text{conc.}H_2SO_4,\,\Delta} C_6H_5SO_3H \xrightarrow{\text{NaOH, fuse, 575 K}} C_6H_5ONa \xrightarrow{\text{dil.HCl}} C_6H_5OH$ **[1]**

A19. (i) Reaction is a complex reaction.

Order of reaction is 1.5.

Molecularity cannot be 1.5. It has no meaning for this reaction. The reaction occurs in multiple steps, so it is a complex reaction. **[1]**

(ii) Unit of k are $mol^{-1/2}L^{1/2}s^{-1}$ **[1]**

OR

Let the rate law expression be Rate = $k[P]^x[Q]^y$

From the table we know that

Rate 1 = $3.0 \times 10^{-4} = k\,(0.10)^x\,(0.10)^y$

Rate 2 = $9.0 \times 10^{-4} = k\,(0.30)^x\,(0.30)^y$

Rate 3 = $3.0 \times 10^{-4} = k\,(0.10)^x\,(0.30)^y$

Rate 1/ Rate 3 = $(1/3)^y$ or $1 = (1/3)^y$ **[½]**

So y = 0 **[½]**

Rate 2/ Rate 3 = $(3)^x$ or $3 = (3)^x$

So x = 1 **[½]**

Rate = k [P] **[½]**

A20. (a) Scandium (Sc) **[½]**

(b) $KMnO_4$ **[½]**

(c) Cerium (Ce) **[½]**

(d) Chromite ore **[½]**

A21. Racemic mixture will be given by 2 chlorobutane as it is an optically active compound. **[1]**

When 2 chlorobutane undergoes S_N1 reaction, both front and rear attack are possible, resulting in a racemic mixture. **[1]**

SECTION-C

A22. (a) Manganese is having lower melting point as compared to chromium, as it has highest number of unpaired, electrons, strong interatomic metal bonding hence no delocalisation of electrons. **[1]**

(b) There is much more frequent metal-metal bonding in compounds of the heavy transition metals i.e. 4*d* and 5*d* series, which accounts for lower melting point of 3*d* series. **[1]**

(c) Tungsten **[1]**

A23. $Al(s) \mid Al^{3+}(aq) \parallel Cd^{2+}(aq) \mid Cd(s)$ **[1]**

(0.01M) (0.1M)

$2Al(s) + 3Cd^{2+}\ (0.1M) \rightarrow 3Cd\ (s) + 2Al^{3+}\ (0.01M)$

$$E_{cell} = E^{\circ}_{cell} - \frac{0.059}{n}\log\frac{[Al^{3+}]^2}{[Cd^{2+}]^3}$$

$$E_{cell} = 1.26 - \frac{0.059}{6}\log\frac{(0.01)^2}{(0.1)^3}$$ **[1]**

$$= 1.26 - \frac{0.059}{6}(-1)$$

= 1.26 + 0.009

= 1.269 V **[1]**

A24. (a) The colour of coordination compound depends upon the type of ligand and *d-d* transition taking place. H_2O is weak field ligand, which causes, small splitting, leading to the *d-d* transition, corresponding to green colour, however due to the presence of (en) which is strong field ligand, the splitting is increased. Due to the change in t_{2g}–e_g splitting the colouration of the compound changes from green to blue. **[1]**

(b) Formula of the compound is $[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3$ **[1]**

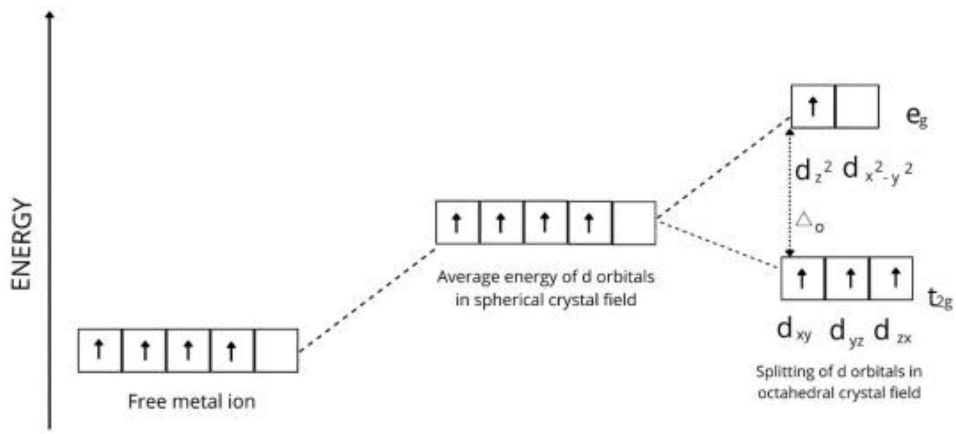
The hybridisation of cobalt atom in compound is: d^2sp^3 **[1]**

OR

(a) The fourth electron enters in one of the e_g orbitals giving the configuration t^3_{2g}, e^1_g, this indicates **[1]**

$\Delta_0 < P$, hence the co-ordination compound is high spin complex.

(b) **[2]**



A25. (i) (a) Cr^{3+}/Cr^{2+} has a negative reduction potential. Hence Cr^{3+} cannot be reduced to Cr^{2+}. Cr^{3+} is most stable. Mn^{3+}/Mn^{2+} have large positive E° values. Hence Mn^{3+} can be easily reduced to Mn^{2+}. Thus Mn^{3+} is least stable. Fe^{3+}/Fe^{2+} couple has a positive E° value but less than that of Mn^{3+}/Mn^{2+} couple. Thus the stability of Fe^{3+} is more than Mn^{3+} but less stable than Cr^{3+}. **[1]**

(b) If we compare the reduction potential values, Mn^{2+}/Mn has the most negative value i.e. its oxidation potential value is most positive. Thus its most easily oxidised. Thus the decreasing order for their ease of oxidation is Mn > Cr > Fe. **[1]**

(ii) $K_4[Mn(CN)_6]$

Mn is in +2 oxidation state. Magnetic moment 2.2 indicates that it has one unpaired electron and hence forms inner orbital or low spin complex. In presence of CN^- is a strong ligand, hybridisation involved is d^2sp^3 (octahedral complex) **[1]**

A26. Compound A is an alkene. On ozonolysis it will give carbonyl compounds. As both B and C have >C = O group,

B gives positive Fehling's test so it is an aldehyde and it gives iodoform test,

so it has $CH_3C = O$ group. This means the aldehyde is acetaldehyde

C does not give Fehling's test, so it is a ketone. It gives positive iodoform test so it is a methyl ketone means it has $CH_3C = O$ group

Compound A (C_5H_{10}) on ozonolysis gives B(CH_3CHO) + C (CH_3COR) **[1]**

So "C" is CH_3COCH_3

$$CH_3CH = C(CH_3)_2 \xrightarrow{\text{(i) } O_3 \text{ (ii)} Zn/H_3O^+} CH_3CHO + CH_3COCH_3$$

$$CH_3CHO + 2Cu^{2+} + 5OH^- \longrightarrow CH_3COO^- + Cu_2O \text{ (red ppt)} + 3H_2O$$

$$CH_3COCH_3 + 2Cu^{2+} + 5OH^- \longrightarrow \text{No reaction}$$

$$CH_3CHO + 3I_2 + 3NaOH \longrightarrow CHI_3 \text{ (yellow ppt)} + 3HI + HCOONa$$

$$CH_3COCH_3 + 3I_2 + 3NaOH \longrightarrow CHI_3 \text{ (yellow ppt)} + 3HI + CH_3COONa$$ **[1]**

$A \Rightarrow CH_3CH = C(CH_3)_2$

$B \Rightarrow CH_3CHO$

$C \Rightarrow CH_3COCH_3$ **[1]**

A27. (a) A - Sucrose ($C_{12}H_{22}O_{11}$) **[½]**

The mixture of D-(+)-glucose and D-(-)-Fructose is known as invert sugar. **[½]**

The linkage which holds the two monosaccharide units through oxygen atom is called glycosidic linkage. **[1]**

(b) The amino acids exist as dipolar zwitter ion. Due to this dipolar salt like character they have strong dipole-dipole attractions. Thus their melting points are higher than the corresponding haloacids which do not exist as zwitter ions **[1]**

A28. (a) A - $C_6H_5NH_2$ B - $C_6H_5N_2^+Cl^-$ C - $C_6H_5–N_2–C_6H_4–OH$ **[½ + ½ + ½]**

(b) A - C_6H_5CN B - C_6H_5COOH C - $C_6H_5CONH_2$ **[½ + ½ + ½]**

SECTION-D

A29. (i) Carbon dioxide is a gas which provide fizz and tangy flavour. He can dissolve carbon dioxide gas in the drink. **[1]**

(ii) Henry's law which states that solubility of a gas in liquid is directly proportional to partial pressure of the gas. **[1]**

(iii) Bottles should be sealed under high pressure of CO_2 and capping should be done perfectly to avoid leakage of CO_2 as any loss of partial pressure will result into decrease in solubility. **[2]**

OR

$p_{He} = K_{He} \times X_{He}$ **[1]**

$= (144.97 \times 10^3 \text{ bar}) (1.2 \times 10^{-6})$

$= 0.174$ bar **[1]**

A30. When a metal is in a high oxidation state, its oxide is acidic and when a metal is in a low oxidation state its oxide is basic.

(i) A plant cell shrinks when it is kept in a hypertonic solution. **[1]**

(ii) 1.2% sodium chloride solution is hypertonic with respect to 0.9% sodium chloride solution or blood cells. When blood cells are placed in this solution, water flows out of the cells and they shrink due to loss of water by osmosis. **[1]**

(iii) When the external pressure applied becomes more than the osmotic pressure of the solution, then the solvent molecules from the solution pass through the semipermeable membrane to the solvent side. This process is called reverse osmosis. **[2]**

OR

In an upward direction, osmosis helps in the transportation of water in a plant. **[2]**

SECTION-E

A31. (a) For a first order reaction

$$k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$$ where $[R]_0$ = initial concentration, [R] = conc. after time t **[½]**

When half of the reaction is completed, $[R] = [R]_0/2$. Representing, the time taken for half of the reaction to be completed, by $t_{1/2}$, equation becomes:

$$k = \frac{2.303}{t_{1/2}}\log\frac{[R]_0}{[R]_0/2}$$

$t_{1/2} = \frac{2.303}{k}\log 2$ **[1]**

$t_{1/2} = \frac{2.303}{k} \times 0.3010$

$t_{1/2} = \frac{0.693}{k}$

The above equation shows that half-life of first order reaction is independent of the initial concentration of the reactant. **[1]**

(b) For a first order reaction

$t = \frac{2.303}{k}\log\frac{a}{a-x}$ **[1]**

$t_{99\%} = \frac{2.303}{k}\log\frac{a}{a-0.99a}$

$t_{90\%} = \frac{2.303}{k}\log\frac{a}{a-0.90a}$ **[½]**

$\frac{t_{99\%}}{t_{90\%}} = \left(\frac{2\times 2.303}{k}\right)/\frac{2.303}{k} = 2$

$t_{99\%} = 2 \times t_{90\%}$ **[1]**

OR

(a) $r = k[R]^n$ **[½]**

When concentration is increased three times, [R] = 3a

$27r = k(3a)^n$

$\frac{27r}{r} = \frac{k(3a)^n}{ka^n}$ or $27 = 3^n$ or $3^3 = 3^n$ **[½]**

n = 3 **[1]**

(b) According to Arrhenius equation,

$\log k = \log A - \frac{E_a}{2.303RT}$

For uncatalysed reaction

(i) $\log k_1 = \log A - \frac{E_a(1)}{2.303RT}$ **[½]**

For catalysed reaction

(ii) $\log k_2 = \log A - \frac{E_a(2)}{2.303RT}$ **[½]**

A is equal for both the reactions.

Subtracting equation (i) from equation (ii)

$\log\frac{k_2}{k_1} = \frac{E_a(1) - E_a(2)}{2.303RT}$

$\log\frac{k_2}{k_1} = \frac{(75.2 - 50.14)\ \text{kJmol}^{-1}}{2.303 \times 8.314\ \text{JK}^{-1}\text{mol}^{-1} \times 298\ \text{K}}$ **[1]**

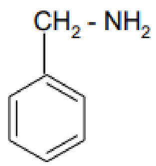
$\log\frac{k_2}{k_1} = 4.39$

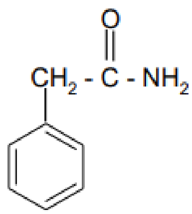
$\frac{k_2}{k_1} = \text{anti}\log(4.39)$ **[1]**

$= 2.45 \times 10^4$

Rate of reaction increases by 2.45×10^4 times

A32. (a) A = $AgNO_2$ **[½]**

B =  **[½]**

C =  **[½]**

D = $CHCl_3$ + KOH, Heat. **[½]**

(b)

(i) **[1]**

Experiment	Aniline	Benzylamine
Azo dye test: Dissolve the amine in HCl, cool it and then add cold aqueous solution of $NaNO_2$ and then solution of β-naphthol	A brilliant orange red dye is observed.	No dye is formed.

(ii) **[1]**

Experiment	Methylamine	Dimethylamine
Carbylamine test: To the organic compound add chloroform and ethanolic potassium hydroxide and heat	A foul smelling substance (isocyanide)	No reaction

(c) A = $CH_3CH_2CH_2NH_2$ **[½]**

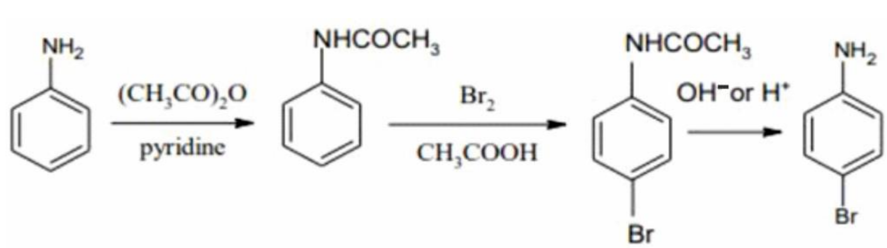
B = $CH_3CH_2CH_2OH$ **[½]**

OR

(a) (i) In strongly acidic medium, aniline is protonated to form the aniline ion which is meta directing. **[1]**

(ii) Aryl halides do not undergo nucleophile substitution with the anion formed by phthalimide. **[1]**

(b) (i) $CH_3\text{-}COOH \xrightarrow{NH_3,\ \Delta} CH_3\text{-}CO\text{-}NH_2 \xrightarrow{NaOH + Br_2} CH_3NH_2$ **[1]**

(ii) 

[1]

(c) p-Nitroaniline < Aniline < p-Toludine **[1]**

A33. (a) A = $FeCr_2O_4$ B = Na_2CrO_4 **[½ + ½ + ½ + ½]**

C = $Na_2Cr_2O_7$ D = $K_2Cr_2O_7$

(b) (i) 5*f*, 6*d* and 7*s* levels in actinoids are of comparable energies. **[1]**

(ii) This is due to poorer shielding by 5*f* electrons in actinoids as compared to shielding by 4*f* electrons in lanthanoids. **[1]**

(iii) In actinoids, 5*f* electrons are more effectively shielded from the nuclear charge than the 4*f* electrons of the corresponding lanthanoids. Since the outer electrons are less firmly held, they are available for bonding in the actinoids. **[1]**

OR

(a) (i) MnO_4^{2-} ions disproportionate in acidic medium to give Permanganate ions and Manganese (IV) oxide. **[½]**

$3MnO_4^{2-} + 4H^+ \longrightarrow 2MnO_4^- + MnO_2 + 2H_2O$ **[½]**

(ii) Lanthanum sulphide is formed. **[½]**

$2La + 3S \xrightarrow{heat} La_2S_3$ **[½]**

(b) (i) Copper has high enthalpy of atomisation and low enthalpy of hydration. Since the high energy to transform Cu(s) to Cu^{2+}(aq) is not balanced by hydration enthalpy, therefore E° (M^{2+}/M) value for copper is positive (+0.34 V). **[1]**

(ii) Cr^{2+} is reducing as its configuration changes from d^4 to d^3, the latter having more stable half filled t_{2g} level. On the other hand, the change from Mn^{3+} to Mn^{2+} results in extra stable d^5 configuration. **[1]**

(iii) This is due to the increasing stability of the species of lower oxidation state to which they are reduced. **[1]**

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