CBSE
Class XII Chemistry
Sample Paper 5 - Solution

Time: 3 Hrs **Total Marks: 70**

Section A

1.

(i) (d)2 NO and 1 O_2 molecules are taking part in an elementary reaction.
So, molecularity = 2 + 1 = 3

(ii) (b)Molecularity of the slowest step: 1 + 1 = 2

(iii) (a)Order of reaction = 2
2 + x = 2
x = 0

(iv) (c) In the zero-order reaction, rate of reaction = k
So, there will be no change in the rate of reaction.

2.

(i) (a) $Fe(OH)_3$ is positively charged colloid so it can be coagulated by negatively charged ions.

(ii) (d) According to Hardy-schulze rule, Greater the valence of the active ion or flocculating ion, greater will be its coagulating power.

(iii) (b) Arsenious sulphide is positively charged and Aluminium hydroxide is negatively charged.

(iv) (b) Colloidal sulphur and colloidal sulphate particles are negatively charged.

3. (b) The molal elevation constant depends upon nature of the solvent.

4. (d) The atmospheric pollution is generally measured in the units of ppm.

5. (c) Tyndall effect confirms the heterogeneous nature of sols.

6. (a) Degeneracy of the d-orbital is removed with the approach of the ligand due to ligand electron-metal electron repulsion.

7. (c) Nitrogen atom of amino group is sp^2 hybridised.

8. (c) 2,4,6-trinitrophenol

9. (b) Catenation property is maximum in carbon.

10. (b) Fused NaCl on electrolysis gives sodium on cathode.

11. (a) The oxidation of toluene to benzaldehyde by chromyl chloride is called Etard reaction.

12. (c) Assertion is correct, but reason is wrong.

13. (a) Both assertion and reason are correct, and the reason is the correct explanation of the assertion.

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15. (a) Both assertion and reason are correct, and the reason is the correct explanation of the assertion.

16. (d) Assertion is wrong, but reason is correct.

Section B

17. The molecular mass of ascorbic acid ($C_6H_8O_6$) = 12 × 12 + 22 × 1 + 11 × 16 = 342 g mol^{-1}.

$$\Delta T_f = K_f \frac{1000 \times W_B}{M_B \times W_A}$$

$$W_B = \frac{\Delta T_f \times M_B \times W_A}{K_f \times 1000}$$

$$W_B = \frac{1.5\,K \times 176\,g\,mol^{-1} \times 75\,g}{3.9\,K\,kg\,mol^{-1} \times 1000} = 5.08\,g$$

18.

$$E^0_{cell} = E^0_{1/2}\,Cl_2 / Cl^- - E^0 Cu^{2+} / Cu$$

$$= +1.36\,V - 0.34\,V = 1.02\,V$$

$$\log k = \frac{nE^0}{0.0591} = \frac{2 \times 1.02}{0.0591}$$

$$= \frac{2.04}{0.0591} = 34.5177$$

$$k = antilog\,34.5177$$

$$k = 3.294 \times 10^{34}$$

19.

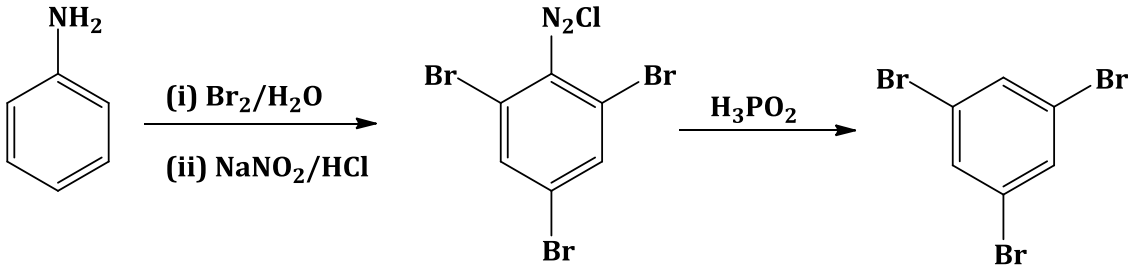
(a) Nitrogen being smaller in size forms $p\pi - p\pi$ multiple bonding with carbon, so CN^- ion is known, but phosphorus in CP^- ion does not form $p\pi - p\pi$ bond due to its larger size.

(b) NO_2 dimerises to form N_2O_5 because NO_2 is an odd electron molecule and therefore gets dimerised to the stable N_2O_4.

20.

(a) Primary amines (RNH_2) have two hydrogen atoms attached to the nitrogen atom and therefore show hydrogen bonding. Tertiary amines (R_3N) do not have hydrogen atoms attached to the nitrogen atom and therefore do not show hydrogen bonding. Thus, primary amines have a higher boiling point than tertiary amines as a result of their hydrogen bonding.

(b)



(A) **(B)**

21.

(a) Butanone < Propanone < Propanal < Ethanal

(b) Acetophenone < p-Tolualdehyde < Benzaldehyde < p-nitrobenzaldehyde

22. $\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[\text{Oxidation}]{K_2Cr_2O_7/H_2SO_4} \underset{\text{Ethanoic acid}}{CH_3COOH} \xrightarrow{CaCO_3} \underset{\text{Ca.Ethanoate}}{(CH_3COO)_2Ca} \longrightarrow \underset{\text{Acetone}}{CH_3COCH_3}$

23. Diameter = 245 pm

$$\therefore \text{Radius} = \frac{245}{2}\text{pm} = 122.5\text{ pm}$$

$$\text{In a bcc structure, } r = \frac{\sqrt{3}}{4}a$$

$$\therefore \quad 122.5 = \frac{\sqrt{3}}{4}a$$

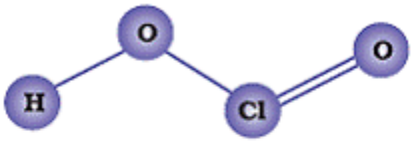
$$\therefore \ a = \frac{122.5 \times 4}{\sqrt{3}} = \frac{490}{1.732} = 282.91\text{ pm}$$

$$d = \frac{z \times M}{a^3 \times N_A} = \frac{2 \times 52}{(282.91 \times 10^{-10})^3 \times 6.02 \times 10^{23}}$$

$$= \frac{104}{2.264 \times 10^{-23} \times 6.02 \times 10^{23}} = \frac{104}{2.264 \times 6.02} = 7.63\text{ g cm}^{-3}$$

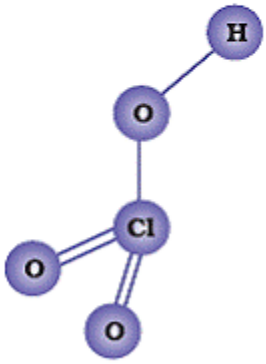
24.

(i)



Chlorous acid

(ii)



Chloric acid

25.

(a) In the presence of nitrating mixture $(HNO_3 + H_2SO_4)$, aniline gets protonated to form anilinium ion, which is a meta-directing group, thus giving a substantial amount of m-nitroaniline.

(b) In aniline, a lone pair of electrons on the N atom is delocalised over the benzene ring, resulting in lowering its basic strength. Hence, its K_b value will be lower and its pK_b value will be higher. On the other hand, the +I effect of the $-CH_3$ group increases the electron density on the N atom in CH_3NH_2 making it a stronger base. Hence, its K_b value will be higher and its pK_b value will be lower.

Section C

26.

(a) Alcosol: A colloidal sol in which the dispersion medium is alcohol. Example: Collodion

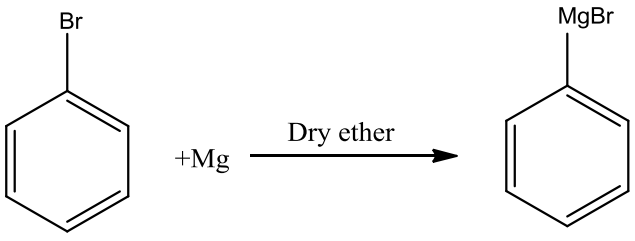
(b) Aerosol: When the dispersion medium is a gas and the dispersed phase is either solid or liquid, the colloidal system is called an aerosol. Examples: Fog, cloud, smoke

(c) Hydrosol: Colloids in water are called hydrosols. Examples: Milk, protein

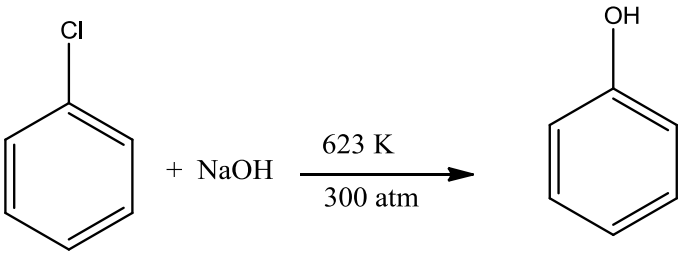
27.

(a) $CH_3CH_2CH_2CH_2Cl + KOH_{(alc)} \longrightarrow CH_3CH_2 - CH = CH_2 + KCl + H_2O$

(b)



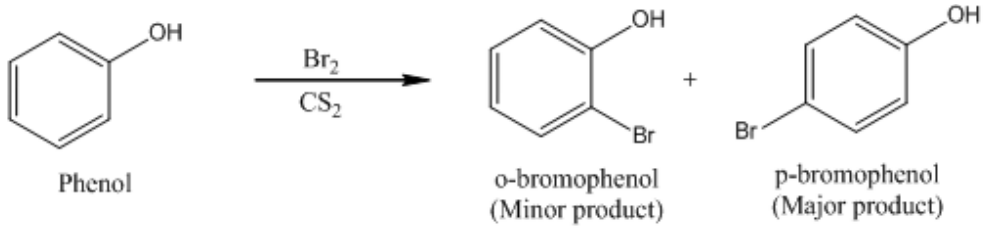
(c)



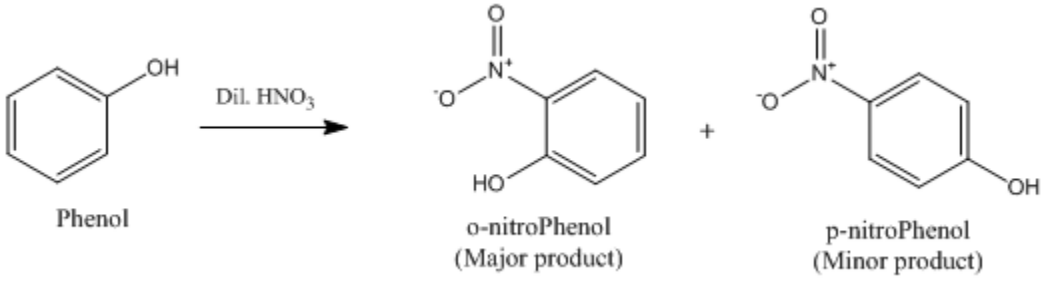
28.

(a) $\underset{\text{Propan-1-ol}}{CH_3CH_2CH_2OH} + 2[O] \xrightarrow[\text{Oxidation}]{\text{Alkaline } KMnO_4} \underset{\text{Propanoic acid}}{CH_3CH_2COOH} + H_2O$

(b)



(c)



29.

(a) $4NaCl + MnO_2 + 4H_2SO_4 \rightarrow MnCl_2 + 4NaHSO_4 + 2H_2O + Cl_2$

(b) $4Al + 3O_2 \rightarrow 2Al_2O_3$

(c) $2Pb(NO_3)_2 \xrightarrow{673\ K} 4NO_2 + 2PbO + O_2$

30.

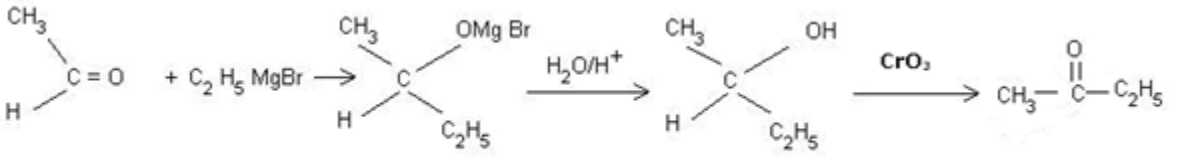
(a) In the increasing order of basic strength: $C_6H_5NH_2 < C_6H_5N(CH_3)_2 < CH_3NH_2 < (C_2H_5)_2NH$

(b) In the decreasing order of basic strength: p-toluidine > Aniline > p-nitroaniline

(c) In the increasing order of pK_b value: $(C_2H_5)_2NH < C_2H_5NH_2 < C_6H_5NHCH_3 < C_6H_5NH_2$

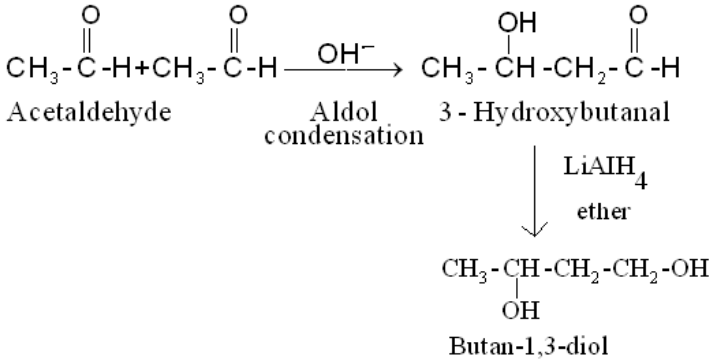
Section-D

31. (a) (i)



Acetaldehyde Butan – 2- one

(ii)



(b)

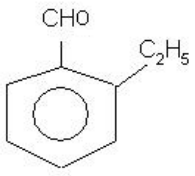
(i) The C:H ratio in the molecular formula suggests that the given compound is an aromatic compound.

(ii) Formation of 2, 4-DNP derivative indicates that the compound is an aldehyde or a ketone.

(iii) Since the compound reduces Tollens' reagent, it must be an aldehyde and not a ketone.

(iv) Only aldehydes which do not contain an α-hydrogen atom give the Cannizzaro reaction. Thus, the aldehyde group should be directly attached to the benzene ring. This implies that the ethyl group should be attached to benzaldehyde.

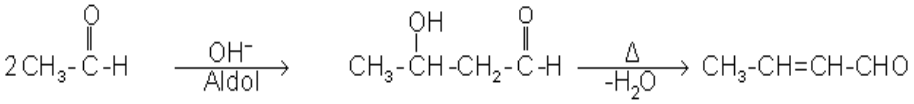
(v) As vigorous oxidation of the aromatic aldehyde yields 1, 2-dicarboxylic acid, the ethyl group must be present at the ortho position. Therefore, the compound is 2-ethyl benzaldehyde.



OR

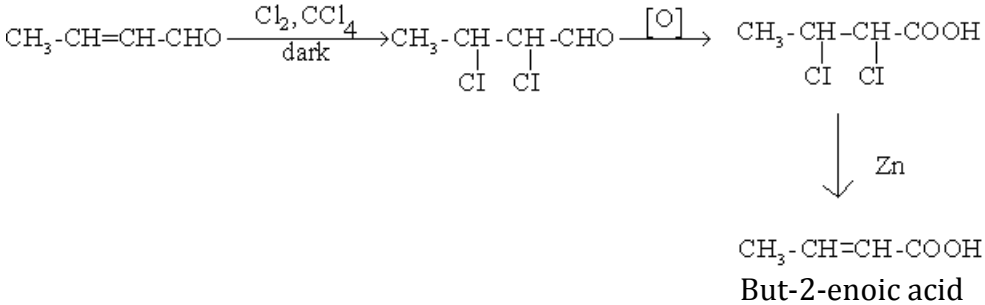
(a)

(i)



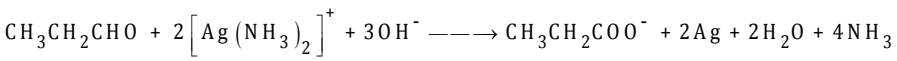
Acetaldehyde condensation 3-hydroxybutanal (dehydration) But -2 enal

(ii) But 2-enal obtained in the above steps is treated with chlorine in CCl_4 in the dark and the product obtained is oxidised to dihaloacid which is further dehalogenated to get but-2-enoic acid.



But-2-enoic acid

(b) Propanal reduces Tollens' reagent into silver mirror, while propanone does not give this test.



Propanal Tollen's reagent

32.

(a) Au and Hg can show +1 oxidation state.

(b) Scandium

(c) Transition elements exhibit variable oxidation state and can form complexes.

(d) Due to low charge density, Cu^+ has low enthalpy of hydration. Cu^+ in aqueous solution undergoes disproportionation.

$$2Cu^+_{(aq)} \rightarrow Cu^{2+}_{(aq)} + Cu_{(s)}$$

The E^θ value for this is positive and the reaction is favourable

33.

(a) $HClO_4$ is a stronger acid than H_2SO_4 due to the higher electronegativity of Cl than S making the O–H bond in $HClO_4$ more polar.

(b) Noble gases contain a fully filled p-subshell. This leads to interelectronic repulsions leading to an increase in size. Therefore, noble gases are larger in size than the corresponding halogens.

(c) In the solid state, PCl_5 exists as $[PCl_4]^+$ $[PCl_6]^-$, thus exhibiting ionic character.

(d) Due to very small size of O, addition of an electron leads to interelectronic repulsions, hence lowering the value of electron gain enthalpy.

(e) Due to the $N \equiv N$ triple bond, N2 is chemically inert. Flushing packaged foods with high purity nitrogen retards oxidative deterioration by typically reducing the oxygen level in packaged foods. Hence, it is used in food packaging.