Solutions / CBSE XIIth Chemistry Sample Paper

1. (a) 2-cyclohexyl ethanal
(b) 4-methyl pent-3-en-2-one

2. Alkyl halides can be converted into corresponding isocyanides by treating it with AgCN.

$$CH_3Br + AgCN \xrightarrow[\Delta]{C_2H_5OH - H_2O} CH_3N \equiv C + AgI$$

3. Free electrons trapped in the site of anion vacancies are termed as F-centres.

4. Non ideal solution showing negative deviation from Raoult's law boils at a temperaure higher than the boiling point of its components A and B respectively .Such type of solutions showing negative deviation from Raoult's law form maximum boiling azeotropes.

5. The molecularity of a reaction is defined as the number of reacting species (atoms, ions or molecules) which must collide with one another simultaneously in a single step to bring about the chemical reaction .

6. There are two main phosphatic fertilizers

(i) Superphosphate of lime $\left[Ca(H_2PO_2)_2\right]$

(ii) Triple superphosphate $\left[Ca(H_2PO_4)_2.H_2O\right]$

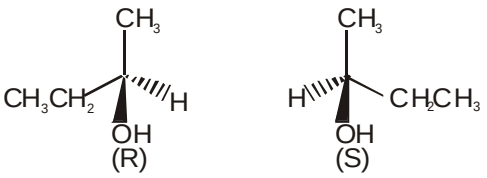
Superphosphate of lime can be produced directly from phosphate rocks by treatment with concentrated sulphuric acid.

$$Ca_3(PO_4)_2 + 2H_2SO_4 \longrightarrow Ca(H_2PO_4)_2 + 2CaSO_4$$

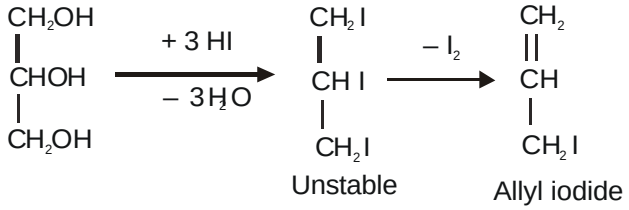
In this way insoluble phosphate rock is rendered soluble in water to improve the release of phosphorus to the soil for uptake by plants.
Treatment of phosphate rock with phosphoric acid yields triple super-phosphate, which is free from calcium phosphate and contains a greater percentage of phosphorous

$$Ca_5(PO_4)_3F + 7H_3PO_4 + 5H_2O \longrightarrow 5Ca(H_2PO_4)_2 + HF$$

7.

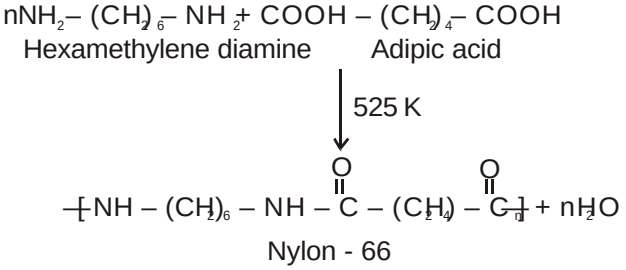


8. (i) When small amount of HI is treated with glycerol, it results in the formation of allyl iodide.



(ii) When glycerol is treated with large amount of HI, it results in the formation of isopropyl iodide.

9. Polymers in which large number of monomer molecules combine together usually with the loss of simple molecule like H_2O, alcohol, NH_3, CO_2 etc. are called as condensation polymers.
Nylon 66 which is formed from hexamethylenedi-amine and adipic acid involves loss of water.



10. **Transcription:** This process involves copying of DNA molecules into a complementary RNA molecule called messenger RNA [m-RNA]. The copying of DNA sequence into m-RNA proceeds according to the same base pairing principle as in replication, but with the difference that the base 'A' pairs with 'U' in RNA.
Translation: The mRNA directs protein synthesis in the cytoplasm of the cell with the help of rRNA (ribosonal RNA) and tRNA (transfer RNA). This process is called translation.

11. $\Delta x \times \Delta p = \frac{h}{4\pi}$

$$\Delta x = \frac{h}{4\pi \,.\, \Delta v \,.\, m}$$

$$= \frac{6.636 \times 10^{-34}\ kgm^2s^{-1}}{4 \times 3.14 \times 5.7 \times 10^{-6} m\,s^{-1} \times 9.1 \times 10^{-31} kg}$$

$$= 10.18 m$$

OR

de Broglie wavelength $\lambda = \frac{h}{mv}$

$$\lambda = \frac{6.636 \times 10^{-34} kgm^2s^{-1}}{0.036 kg \times 35 m\,s^{-1}} = 5.27 \times 10^{-34}\ m$$

This wavelength is so short that it does not lead to any observable phenomenon.

12. $\Delta H_v = 186.5$ kJ mol^{-1};
Boiling point of water = 373 K

$$\Delta S = \frac{\Delta H}{T} = \frac{186.5}{373} = 0.5 kJ mol^{-1}K^{-1}$$

13. **(i) Dialysis:** It is a process of purification of sols containing electrolyte by keeping the sol in a bag made of parchment or animal membrane or cellophane and suspending the bag in fresh water.The electrolyte praticles pass out leaving behind the colloidal sol.

(ii) Electrophorosis: The movement of colloidal particles either towards the cathode or anode, under the influence of electric field is called electrophoresis. It is used to find out the nature of charge present on the colloidal particle.

14. (a) Linkage isomer is $[Pt(ONO)(NH_3)_3]Cl$ and its IUPAC name will be triamminenitritoplatinum (II) Chloride.

(b) The valence theory successfully explained qualitatively the geometry and magnetic properties of complex. However, it has a number of limitations.

1. The theory could not explain the spectra of complex.
2. The theory does not offer an explanation for the existence of inner-orbital and outer-orbital complexes.
3. The theory does not explain why certain complexes are labile while others are inert.
4. It failed to explain the detailed magnetic properties.
5. It does not explain the variation of magnetic moment with temperature.

15. (a) Rate of radioactive decay depends on
(i) Half life
(ii) Concentration of radioactive substance

(b) $k = \frac{0.693}{t_{1/2}} = \frac{0.693}{14}$

$$t = \frac{2.303}{k}\log\frac{N_0}{N}$$

$$= \frac{2.303}{0.693} \times 14 \log\left(\frac{2}{2\times\frac{20}{100}}\right)$$

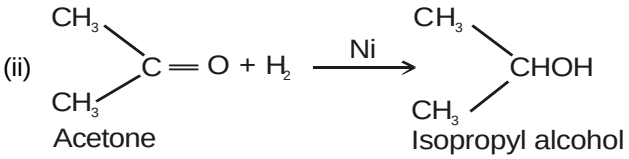
= 32.31 days

16. The reduction of aldehydes and ketones to the corresponding hydrocarbons by heating them with hydrazine and KOH or potassium tert butoxide in high boiling solvent such as ethylene glycol is called Wolf-Kishner reduction.

$$R-\overset{\overset{O}{\|}}{C}-H \xrightarrow[-H_2O]{NH_2NH_2} \underset{\text{Hydrazone}}{RCH=NNH_2} \xrightarrow[453\text{-}473\ K]{KOH\ /\ glycol} \underset{\text{Alkane}}{R-CH_3} + N_2$$

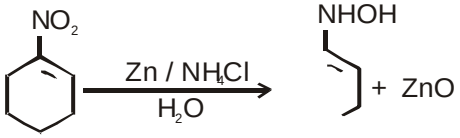
(b) (i) $CH_3CHO + 2\,[H] \xrightarrow{NaBH_4} CH_3CH_2OH$

Acetaldehyde — Ethanol

(ii) 

Acetone — Isopropyl alcohol

17. (i) Reduction of nitro compound in neutral medium is carried out in Zn dust and NH_4Cl solution and both aliphatic and aromatic nitro compounds are reduced to the corresponding hydroxylamine.



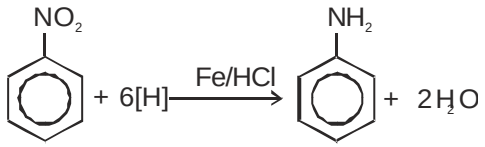
Hydroxylamine

(ii) Reduction of aromatic nitro compounds in basic medium gives different products depending upon the nature of reducing agent.

$$2\,C_6H_5NO_2 + 4Zn + 8\,NaOH \xrightarrow{CH_3OH} C_6H_5 - N = N - C_6H_5 + 4Na_2ZnO_2 + 4H_2O$$

Azobenzene

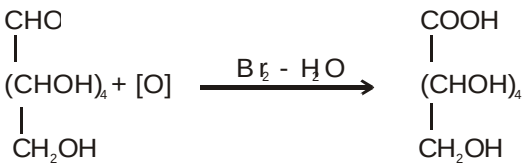
(iii) Both aliphatic and aromatic nitro compounds can be reduced to the corresponding primary amines by a combination of some active metal like Zn, Fe or Sn and hydrochloric acid.



18. (a) Glucose on reduction with HI and red P at 373 K gives 2-iodohexane and prolonged heating produces n-hexane.

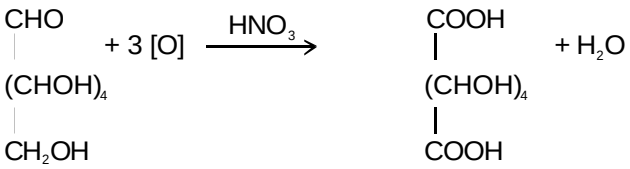
$$C_6H_{12}O_6 \xrightarrow[373\ k]{HI/Red\ P} \underset{2\text{ - Iodohexane}}{CH_3CHICH_2CH_2CH_2CH_3} \xrightarrow{\Delta} \underset{n\text{ hexane}}{CH_3(CH_2)_4CH_3}$$

(b) With mild oxidising agent, glucose is oxidized to gluconic acid



Glucose Gluconic acid

(c) With strong oxidising agent, like nitric acid, a dicarboxylic acid is obtained.



Glucose Glucaric acid
(Saccharic acid)

19. Detergent contain two characteristic group:
(i) Hydrophilic group [water soluble]
(ii) Lyophilic[oil soluble]
When dirty surface is treated with detergent solution, the non – polar hydrocarbon chain of the detergent dissolves in oil or grease, (non polar). the sulphonate group of detergent is held by surrounding water. This lowers the surface tension between water and grease. As a result, a stable emulsion of oil in water is formed. When the surface of the cloth is mechanically scrubbed, the loosened dirt particles are absorbed by colloidal soap particles and ultimately washed away by water.

Detergents having branched chain hydrocarbon chain cause pollution in rivers and other waterways. It is because side chain stop bacteria from attacking and breaking the chains which results in slow degradation of detergent molecule leading to their accumulation. Nowadays, in most of detergents branching is kept minimum so that they can be easily attacked by bacteria and become biodegradable, which help in prevention of pollution.

20. $N_2(14): -\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \pi 2p_x^2 = \pi 2p_y^2, \sigma 2p_z^2$

$$\text{BondOrder} = \frac{N_b - N_a}{2} = \frac{10-4}{2} = 3$$

$N_2^+(13): -\left(\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \pi 2p_x^2 = \pi 2p_y^2, \sigma 2p_z^1\right)$

$$\text{BondOrder} = \frac{N_b - N_a}{2} = \frac{9-4}{2} = 2\frac{1}{2};$$

$N_2^-(15): -\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \pi 2p_x^2 = \pi 2p_y^2, \sigma 2p_z^2, \sigma^* 2p_x^1$

$$\therefore \text{BondOrder} = \frac{N_b - N_a}{2} = \frac{10-5}{2} = 2\frac{1}{2}$$

21. As A^+B^- has NaCl structure, A^+ ions will be present in the octahedral voids. Ideal radius of the cation will be equal to the radius of the octahedral void. So in that case it will touch the anions and the arrangement will be close packed.

So, radius of octahedral void = $r_{A^+} = 0.414 \times r_{B^-} = 0.414 \times 250$ pm = 103.4 pm.

Radius of the tetrahedral site = $0.225 \times r_{B^-}$ = 56.25 pm. As the radius of the cation C^+ (180 pm) is larger than the size of the tetrahedral site, it cannot be slipped into it.

OR

Now as element exists in bcc structure Z = 2
$a = 288 \times 10^{-10}$ cm
density of the element = d = 7.2 g cm^{-3}
Avogadro's number = $N_0 = 6.023 \times 10^{23}$
Atomic mass of the element = M = ?

$$d = \frac{Z \times M}{a^3 \times N_A}$$

$$M = \frac{d \times a^3 \times N_A}{Z}$$

$$= \frac{7.2 \times (288)^3 \times 10^{-30} \times 6.023 \times 10^{23}}{2}$$

$$= \frac{7.2 \times 23.9 \times 10^{-24} \times 6.023 \times 10^{23}}{2} = 52 \text{ g mol}^{-1}$$

$M = 52$ g mol^{-1}
So, atomic mass of the element = 52 g mol^{-1}

22. $w_A = 3.8$ g T = 46.66 °C
T° = 46.30 °C

$w_B = 100$ g
K_b of CS_2 = 2.40 K Kg mol^{-1}

$\Delta T_b = T - T^\circ$

$\Delta T_b = 46.66^\circ C - 46.30^\circ C$

$= 0.36^\circ C$

As we know, $M_B = \frac{w_B \times 1000 \times K_b}{\Delta T_B \times w_1} = \frac{3.8 \times 1000 \times 2.40}{0.36 \times 100}$

$M_B = 253$ g mol^{-1}

$$\text{Atomicity} = \frac{M_B}{\text{gramatomicweight}} = \frac{253}{32} = 8$$

$\therefore$ Sulphur exists as S_8 molecule.

23. $\Delta G° = \Delta H° - T\Delta S$
$= 77.5 - 400 \times 135 \times 10^{-3}$
$= 23.5 \text{ kJ mol}^{-1}$
$\Delta G° = -2.303 RT \log K$
$-23.5 \times 10^3 = 2.303 \times 8.314 \times 400 \log K$

$$-\log K = \frac{23.5\times10^3}{2.303\times8.314\times400} = 3.0686 \text{ or } K = 8.551 \times 10^{-4}$$

24. $k_1 = 5.6 \times 10^{-5} \text{ L mol}^{-1}\text{s}^{-1}$
$T_1 = 273 \text{ K}$
$k_2 = 100 \times 10^{-5} \text{ L mol}^{-1}\text{s}^{-1}$
$T_2 = 300\text{K}$
Subtituting these values in equation

$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1T_2}\right]$$

$$E_a = \frac{2.303RT_1T_2}{T_2 - T_1}\log\frac{k_2}{k_1}$$

$$E_a = \frac{2.303\times8.314\times300\times273}{27}\log\frac{100\times10^{-5}}{5.6\times10^{-5}} = 72.70 \text{ kJ mol}^{-1}$$

25. (a) CO_2 is a monomeric linear molecule in which C forms pp- pp (multiple) bonds and molecules have weak van der waals forces so it is a gas at room temperature, while in SiO_2, Si is unable to form pp- pp bonds due to its large size and forms a three dimensional network structure that is why it is solid at room temperature.

(b) $PbO_2 + 2HNO_3 \longrightarrow Pb(NO_3)_2 + H_2O + \frac{1}{2}O_2$

$2NaBH_4 + I_2 \longrightarrow 2NaI + B_2H_6 + H_2$
$Ca_3P_2 + 6H_2O \longrightarrow 3Ca(OH)_2 + 2PH_3$

26. The molten pig-iron is fed into a converter A blast of oxygen and either steam or CO_2 is blown through the converter. Oxygen reacts with impurities and raises the temperature of the system. C is oxidised to CO which burns with blue flame at the mouth of converter. Oxides of Si and Mn form slag. In 10 minutes, the flame dies down indicating that all carbon has been removed. The flame is stopped, slag is tapped off and then other metals (Cr, Mn etc) may be added to form specific type of steel.

(a) Quenching: If the steel is heated to 1123K and then cooled suddenly by plunging it into cold water or oil, it makes steel hard and brittle. The process is known as quenching.

(b) Tempering: If the quenched steel is reheated to 503-573K and cooled slowly, the process is called tempering. The steel thus obtained is hard but not brittle.

(c) Annealing: If the steel is heated above red heat and is then cooled slowly the process is called annealing. It makes steel soft.

OR

(a) Preparation of potassium dichromate: The various steps involved are:

(i) **Preparation of sodium chromate from chromite ore**

$$\underset{\text{Chromiteore}}{4FeO.Cr_2O_3} + 8Na_2CO_3 + O_2 \rightarrow \underset{\text{Sodiumchromate}}{8Na_2CrO_4} + 2Fe_2O_3 + 8CO_2$$

(ii) **Conversion of sodium chromate into sodium dichromate:**

$$\underset{\text{SodiumChromate}}{2Na_2CrO_4} + H_2SO_4 \rightarrow \underset{\text{Sodiumdichromate}}{Na_2Cr_2O_7} + Na_2SO_4 + H_2O \triangleright$$

(iii) **Conversion of sodium dichromate into potassium dichromate:**

$$\underset{\text{Sodiumdichromate}}{Na_2Cr_2O_7} + 2KCl \rightarrow \underset{\text{Potassiumdichromate}}{K_2Cr_2O_7} + 2NaCl$$

(b) (i) $\underset{\substack{\text{Dichromateion}\\ \text{(Orange)}}}{Cr_2O_7^{2-}} + 14H^+ + 3Sn^{2+} \rightarrow \underset{\text{(Green)}}{2Cr^{3+}} + 3Sn^{4+} + 7H_2O$

(ii) $2MnO_4^- + 16H^+ + 10Fe^{2+} \rightarrow 2Mn^{2+} + 10Fe^{3+} + 8H_2O$

27. (a) $H_2 - O_2$ cell is an example of fuel cell.

Atcathode	$H_2(g)$ +	$2OH^-(aq)$	$\longrightarrow$	$2H_2O(l)$	$+2e^-$
Atanode	$O_2(g)$ +	$2H_2O(l)$	$+4e^-$ $\longrightarrow$	$4OH^-(aq)$	
over all reaction	$2H_2O(g)$	$+O_2(g)$	$\longrightarrow$	$2H_2O(l)$	

(b) $Mg \longrightarrow Mg^{2+} + 2e^-$

$Sn^{2+} + 2e^- \longrightarrow Sn$

$Mg + Sn^{2+} \longrightarrow Mg^{2+} + Sn$

$$E_{cell} = E^\circ_{cell} - \frac{0.0591}{n}\log\frac{\left[Mg^{2+}\right]}{\left[Sn^{2+}\right]}$$

$$or\ E_{cell}\left[E^\circ_{Sn^{2+}/Sn} - E^\circ_{Mg^{2+}/Mg}\right] - \frac{0.0591}{2}\log\frac{0.01}{0.1}$$

$$= -0.14 - (-2.37) - \frac{0.0591}{2}\log\frac{1}{10} = +2.23 + \frac{0.0591}{2} = 2.23 + 0.0295 = 2.2595\ V$$