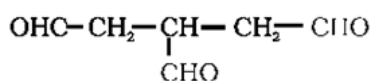


SAMPLE PAPER-04
CHEMISTRY (Theory)
Class - XII

Answers

1.



2. 3-Phenylpropanoic acid.

3.

- i. $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{Cl}$
- ii. $(\text{CH}_3)_2\text{CHCH}(\text{Cl})\text{CH}_3$
- iii. $(\text{CH}_3)_2\text{C}(\text{Cl})\text{CH}_2\text{CH}_3$
- iv. $\text{CH}_3\text{CH}(\text{CH}_2\text{Cl})\text{CH}_2\text{CH}_3$

4. It is a non-protein portion obtained by hydrolysis of conjugated proteins. The main function of the prosthetic group is to control the biological function of proteins.

5. This is due to the process of autocatalysis. In the beginning of the hydrolysis of ester gives an acid which starts as a catalyst later and so, the reaction becomes fast.

6. The iron obtained from blast furnace is pig iron. It contains about 4% of carbon and many impurities in small amount. Cast iron is obtained by melting pig iron with scrap iron and coke using hot air blast. It contains slightly lower carbon content and is extremely hard and brittle.

7.

- a) The reaction between water and aldehydes is a reversible reaction and so equilibrium lies almost towards left. On the other hand, in chloral the presence of three electron withdrawing chlorine atoms increases the positive charge on the carbonyl carbon. So, the weak nucleophiles readily add to the carbonyl group forming chloral hydrate and therefore shift the equilibrium towards right.
- b) Acetic acid can be halogenated due to the presence of α -carbon atom. However, formic acid has no α -hydrogen atom and so cannot be halogenated.

8. Scuba divers must cope with high concentrations of dissolved gases while breathing air at high pressure underwater. Increased pressure increases the solubility of atmospheric gases in blood. When the divers come towards surface, the pressure gradually decreases. This releases the dissolved gases and leads to the formation of bubbles of nitrogen in the blood. This blocks capillaries and creates a medical condition known as bends, which are painful and dangerous to life.

9. This defect is shown by ionic solids. The smaller ion (usually cation) is dislocated from its normal site to an interstitial site. It creates a vacancy defect at its original site and an interstitial defect at its new location. Frenkel defect is also called dislocation defect. It does not change the density of the solid. Frenkel defect is shown by ionic substance in which there

is a large difference in the size of ions, for example, ZnS, AgCl, AgBr and AgI due to small size of Zn^{2+} and Ag^+ ions.

Or

Since the lattice is ccp, the number of silver atoms per unit cell = $z = 4$

Molar mass of silver = $107.9 \text{ g mol}^{-1} = 107.9 \times 10^{-3} \text{ kg mol}^{-1}$

Edge length of unit cell = $a = 408.6 \text{ pm} = 408.6 \times 10^{-12} \text{ m}$

$$\begin{aligned}
 \text{Density } d &= \frac{z \cdot M}{a^3 \cdot N_A} \\
 &= \frac{4 \times (107.9 \times 10^{-3} \text{ kg mol}^{-1})}{(408.6 \times 10^{-12} \text{ m})^3 (6.022 \times 10^{23} \text{ mol}^{-1})} = 10.5 \times 10^3 \text{ kg m}^{-3} \\
 &= 10.5 \text{ g/cm}^3.
 \end{aligned}$$

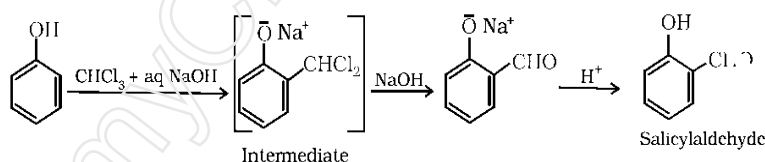
10.

- Order of a reaction is an experimental quantity. It can be zero and even a fraction but molecularity cannot be zero or a non integer.
- Order is applicable to elementary as well as complex reactions whereas molecularity is applicable only for elementary reactions. For complex reaction molecularity has no meaning.
- For complex reaction, order is given by the slowest step and molecularity of the slowest step is same as the order of the overall reaction.

11.

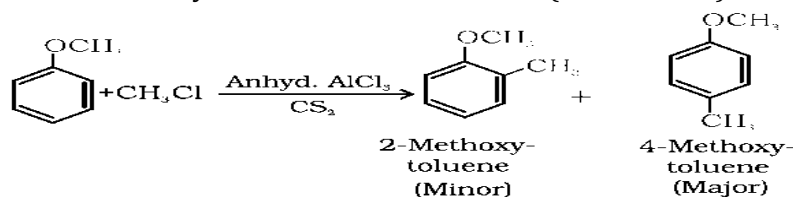
a. Reimer - Tiemann Reaction.

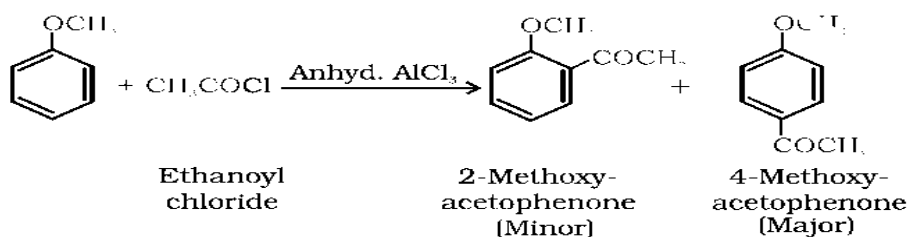
On treating phenol with chloroform in the presence of sodium hydroxide, a $-\text{CHO}$ group is introduced at orthoposition of benzene ring. This reaction is known as Reimer - Tiemann reaction. The intermediate substituted benzal chloride is hydrolysed in the presence of alkali to produce salicylaldehyde.



b. Friedel - Crafts Reaction:

Anisole undergoes Friedel-Crafts reaction, i.e., the alkyl and acyl groups are introduced at ortho and para positions by reaction with alkyl halide and acyl halide in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst.





12. When reaction is completed 99.9% $[R]_t = [R]_0 - 0.999[R]_0$

$$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

$$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]_0 - 0.999[R]_0} = \frac{2.303}{t} \log 10^3$$

$$t = 6.909/k$$

For half-life of the reaction

$$t_{1/2} = 0.6963/k$$

$$\frac{t}{t_{1/2}} = \frac{6.909}{k} \times \frac{k}{0.693} = 10$$

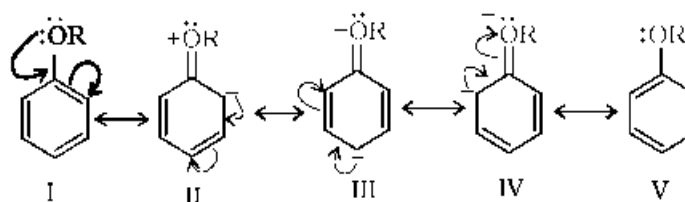
13.

- $\text{KNO}_2 + \text{O}_3 \rightarrow \text{KNO}_3 + \text{O}_2$
- $2\text{KI} + \text{O}_3 + \text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{I}_2 + \text{O}_2$
- $2\text{HCl} + \text{O}_3 \rightarrow \text{H}_2\text{O} + \text{Cl}_2 + \text{O}_2$

14.

Rate of reaction	Reaction rate constant
It is the speed with which reactants are converted into products.	It is the proportionality constant in the rate law which is defined as the rate of reaction when the concentration of the reactants is unity.
It depends on the initial concentration of the reactants.	It does not depend on the initial concentration of the reactants.
Its units are mol/L/time.	Its unit depend on the order of the reaction.

15. The alkoxy group increases the electron density on the benzene ring and so activates the aromatic ring towards electrophilic substitution reaction as given below:



The structures, III – V show high electron density at o-and p-positions and so direct the incoming substituents to o- and p- positions in the benzene ring.

16.

- i. Bithional acts as an antiseptic agent and reduces the odours produced by bacterial decomposition of organic matter on the skin.
- ii. Sulpha drugs act against micro-organism like antibiotics. But these are not obtained from micro-organism like antibiotics.
- iii. It is antipyretic.

17.

- i. When a di- or polydentate ligand uses its two or more donor atoms to bind the same central metal atom or ion, it is called chelation.
- ii. The resulting complex structure having ring structure and the ligand coordinating through two or more donor groups are called chelating ligand.
- iii. The number of ligating groups indicates the denticity of the ligand.

Or

- i. A complex ion or coordination entity which has a net positive charge is called cationic complex. Example – $[\text{Co}(\text{NH}_3)_6]^{3+}$
- ii. A complex ion or coordination entity which has a net negative charge is called anionic complex. Example – $[\text{Ag}(\text{CN})_2]^-$
- iii. A complex or coordination entity which has no net charge is called neutral complex. Example – $[\text{Ni}(\text{CO})_4]$

18.

- a) Lead compounds can be obtained from natural sources such as plants, trees, bushes, venoms and metabolites of micro-organisms. These compounds have also been isolated from fish, coral sponges and marine micro-organisms.
- b) The branch of chemistry which deals with the treatment of diseases using chemicals is called chemotherapy.
- c) It includes carbohydrates, proteins, lipids and nucleic acids.

19. The possible sequences are:

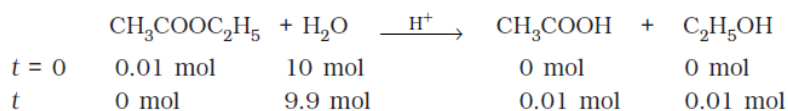
- a. Gly – Ala – Phe
- b. Gly – Phe – Ala
- c. Ala – Gly – Phe
- d. Ala – Phe – Gly
- e. Phe – Gly – Ala
- f. Phe – Ala – Gly

20.

- a. By drugs which kill the organism in the body – bactericidal.
- b. By drugs which inhibit the growth of the organism – bacteriostatic.
- c. By increasing immunity and resistance to infection of the body – immunity.

21. The order of a reaction is sometimes altered by conditions. Consider a chemical reaction between two substances when one reactant is present in large excess. During the hydrolysis

of 0.01 mol of ethyl acetate with 10 mol of water, amounts of the various constituents at the beginning ($t = 0$) and completion (t) of the reaction are given as



The concentration of water does not get altered much during the course of the reaction. So, in the rate equation,

Rate = $k'[\text{CH}_3\text{COOC}_2\text{H}_5][\text{H}_2\text{O}]$ the term $[\text{H}_2\text{O}]$ can be taken as constant.

The equation, thus, becomes

Rate = $k[\text{CH}_3\text{COOC}_2\text{H}_5]$ where $k = k'[\text{H}_2\text{O}]$

This reaction behaves as first order reaction. Such reactions are called pseudo first order reactions.

22.

- When electrophoresis, i.e., movement of particles is prevented by some suitable means, it is observed that the dispersion medium begins to move in an electric field. This phenomenon is termed electro-osmosis.
- The stability of the lyophobic sols is due to the presence of charge on colloidal particles. If, somehow, the charge is removed, the particles will come nearer to each other to form aggregates (or coagulate) and settle down under the force of gravity. The process of settling of colloidal particles is called coagulation or precipitation of the sol.

23.

- Thermal power plant causes air pollution. They use coal, which is non-renewable source of energy.
- Promoted values – Reducing environmental pollution. Reducing dependency of fossil fuels,
- Organizing mass campaigns for spreading awareness. Increase in the use of renewable sources energy such as solar energy etc.,

24. In the lanthanoid series, as we move from one element to another, the nuclear charge increases by one unit and one electron is added. The new electrons are added to the same inner 4f-subshells. However, the 4f-electrons shield each other from the nuclear charge quite poorly because of the very diffused shapes of f-orbitals. The nuclear charge increases by one step. Hence, with increasing atomic number and nuclear charge, the effective nuclear charge experienced by each 4f-electron also increases. As a result, there is a gradual decrease in size of lanthanoids with increase in atomic number.

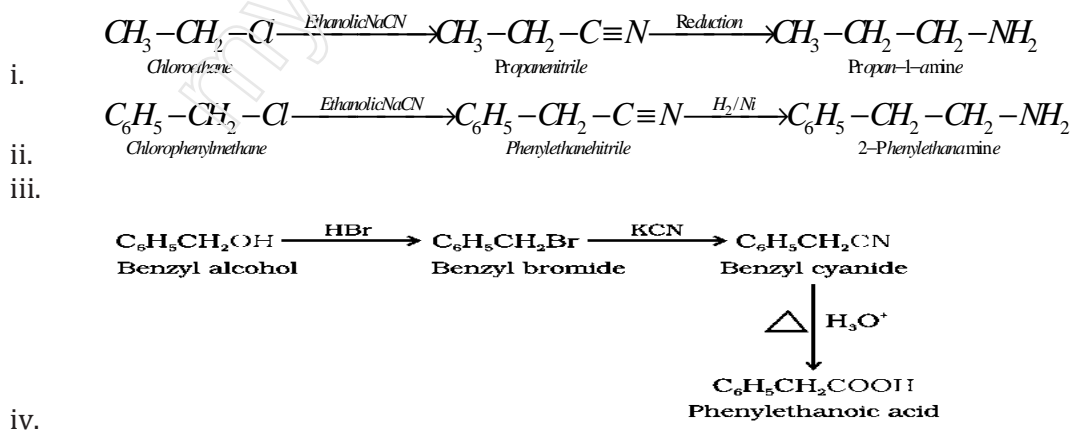
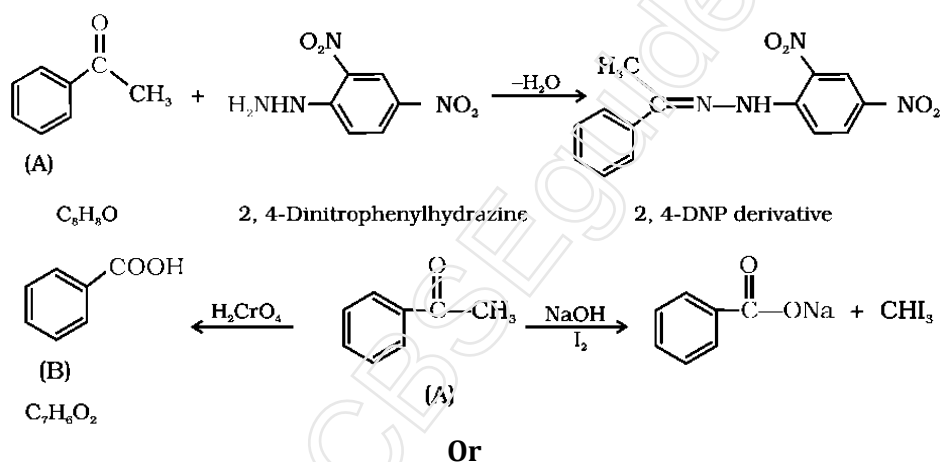
Or

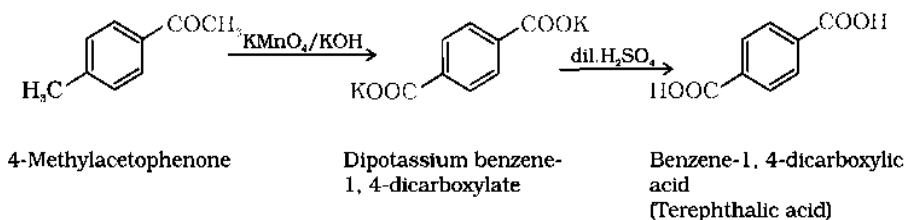
- The hardness of lanthanoids increases with increasing atomic number.

- b) In their chemical behaviour, the earlier members of the series are quite reactive but with increase in atomic number they behave like aluminium.
- c) They combine with nitrogen to form nitrides.
- d) They liberate hydrogen from dilute acids.
- e) When the metals are heated with carbon, they form carbides of the formula Ln_3C , Ln_2C_3 and LnC_2 .

25. (A) forms 2,4-DNP derivative. Therefore, it is an aldehyde or a ketone. Since it does not reduce Tollens' or Fehling reagent, (A) must be a ketone. (A) responds to iodoform test. Therefore, it should be a methyl ketone. The molecular formula of (A) indicates high degree of unsaturation, yet it does not decolourise bromine water or Baeyer's reagent. This indicates the presence of unsaturation due to an aromatic ring. Compound (B), being an oxidation product of a ketone should be a carboxylic acid. The molecular formula of (B) indicates that it should be benzoic acid and compound (A) should, therefore, be a monosubstituted aromatic methyl ketone. The molecular formula of (A) indicates that it should be phenyl methyl ketone (acetophenone).

Reactions:





26.

$$A = \pi r^2 = 3.14 \times 0.5^2 \text{ cm}^2 = 0.785 \text{ cm}^2 = 0.785 \times 10^{-4} \text{ m}^2$$

$$l = 50 \text{ cm} = 0.5 \text{ m}$$

$$R = \frac{\rho l}{A} \text{ or } \rho = \frac{RA}{l} = \frac{5.55 \times 10^3 \Omega \times 0.785 \text{ cm}^2}{50 \text{ cm}} = 87.135 \Omega \text{ cm}$$

$$\text{Conductivity} = k = \frac{1}{\rho} = \left(\frac{1}{87.135} \right) \text{ S cm}^{-1} = 0.01148 \text{ S cm}^{-1}$$

$$\text{Molar conductivity } \wedge_m = \frac{k \times 1000}{c} \text{ cm}^3 \text{ L}^{-1}$$

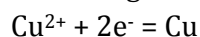
$$= \frac{0.01148 \text{ S cm}^{-1} \times 1000 \text{ cm}^3 \text{ L}^{-1}}{0.05 \text{ mol L}^{-1}}$$

$$= 229.6 \text{ S cm}^2 \text{ mol}^{-1}$$

Or

a) $T = 600 \text{ sec}$, charge = current \times time = $1.5 \times 600 = 900 \text{ C}$

According to the reaction,



We need, $2F = 2 \times 96487 \text{ C}$ to deposit 1 mol or 63 g of Cu.

For 900 C, the mass of Cu deposited = $63 \times 900 / 2 \times 96487 = 0.2938 \text{ g}$.

b) It is observed that the electric current flows through external circuit as indicated by the ammeter. The following observations are made:

- Zn rod gradually loses its weight.
- The concentration of Zn ions in the zinc sulphate solution increases.
- Cu gets deposited on the electrode.
- The concentration of Cu ions in copper sulphate solution decreases.
- There is flow of electrons from Zn rod to Cu rod and so current flows from Cu to Zn rod.