# Question Paper 2015 Set-1
## Class-12 Chemistry

Time : 3 Hours, Maximum Marks : 70

**General Instructions:**

1. All questions are compulsory.
2. Q. No. 1 to 5 are very short answer questions and carry 1 mark each.
3. Q. No. 6 to 10 are short answer questions and carry 2 marks each.
4. Q. No. 11 to 22 are also short answer questions and carry 3 marks each.
5. Q. No. 23 is a value based question and carry 4 marks.
6. Q. No. 24 to 26 are long answer questions and carry 5 marks each.
7. Use log tables if necessary, use of calculator is not allowed.

**1. What is the no. of atoms per unit cell (z) in a body-centred cubic structure?**

**Ans.** 2

**2. In reference to surface chemistry, define dialysis.**

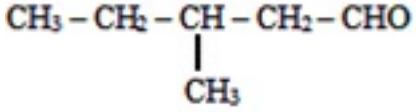
**Ans.** It is a process of removing a dissolved substance from a colloidal solution by means of diffusion through a suitable membrane.

**3. What is the IUPAC name of the complex $[Ni(NH_3)_6]Cl_2$ ?**

**Ans.** Hexaamninenickel (II) chloride

**4. Draw the structure of 3-methylpentanal.**

**Ans.**



**5. Complete the following reaction equation :**

$C_6H_5N_2Cl + H_3PO_2 + H_2O \rightarrow$

**Ans.**

$$ArN_2^+Cl^- + H_3PO_2 + H_2O \longrightarrow ArH + N_2 + H_3PO_3 + HCl$$

(where Ar is C6H5)

**6. Define osmotic pressure of a solution. How is the osmotic pressure related to the concentration of a solute in a solution ?**

**Ans.** The external pressure which is applied on solution side to stop the flow of solvent across the semi-permeable membrane. The osmotic pressure is directly proportional to concentration of the solution. $\pi$ = CRT

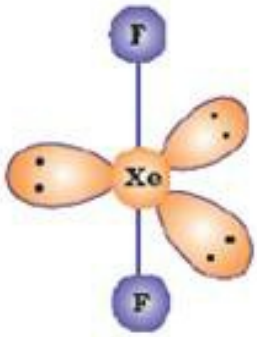
**7. Define the following terms :**
**(i) Half-life of a reaction (t½)**
**(ii) Rate constant (k)**

**Ans. (i)** The half-life of a reaction is the time in which the concentration of a reactant is reduced to one half of its initial concentration.
**(ii)** Rate constant is the rate of reaction when the concentration of the reactant is unity.

**8. Draw the structures of the following :(i)** $H_2SO_4$
**(ii)** $XeF_2$

**Ans. (i)**


**(ii)**



**9. What is meant by 'disproportionation'? Give an example of a disproportionation reaction in aqueous solution.**

**OR**

**Suggest reasons for the following features of transition metal chemistry:**
**(i) The transition metals and their compounds are usually paramagnetic.**
**(ii) The transition metals exhibit variable oxidation states.**

**Ans.** Disproportionation : The reaction in which an element undergoes self-oxidation and self reduction

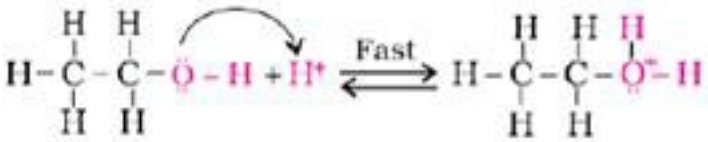
simultaneously. For example:

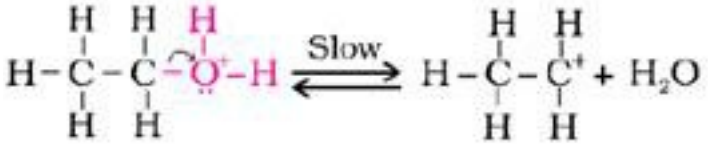
$2Cu^{+}(aq) \rightarrow Cu^{2+}(aq) + Cu(s)$

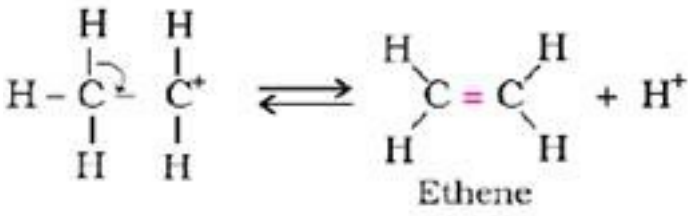
**10. Explain the mechanism of dehydration steps of ethanol :-**

$$CH_3CH_2OH \xrightarrow[443K]{H^+} CH_2=CH_2 + H_2O$$

**Ans.**




**11. Define the following :**
**(i) Schottky defect**

**(ii) Frenkel defect**

**(iii) F-centre**

**Ans. (i)**The defect in which equal number of cations and anions are missing from the lattice.

**(ii)** Due to dislocation of smaller ion from its normal site to an interstitial site.

**(iii)** Anionic vacancies are occupied by unpaired electron.

**12. 45 g of ethylene glycol ($C_2H_4O_2$) is mixed with 600 g of water. Calculate**

**(i) the freezing point depression and**

**(ii) the freezing point of the solution**

**(Given : Kf of water = 1.86 K kg mol $^{-1}$)**

**Ans. (i)** $\Delta T_f = K_f m$

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

$$\Delta T_f = \frac{1.86 K\, kgmol^{-1} x 45\, g x 1000\, g kgmol^{-1}}{60\, gmol^{-1} x 600\, g}$$

$\Delta T_f$ = 2.325K or 2.325 $^0C$

**(ii)** $\Delta T_f^0 - T_f$ =2.325 $^0C$

O $^0C$ - $T_f$ =2.325 $^0C$

$T_f$ =-2.325 $^0C$ or 270.675K

**13. The rate constants of a reaction at 500 K and 700 K are 0.02 s $^{-1}$ and 0.07 s $^{-1}$ respectively. Calculate the value of activation energy, Ea. (R = 8.314 J K $^{-1}$ mol $^{-1}$)**

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

$$\log \frac{0.07}{0.02} = \left(\frac{E_a}{2.303 \times 8.314 JK^{-1}mol^{-1}}\right)\left[\frac{700-500}{700 \times 500}\right]$$

0.544= $E_a \times 5.714 \times 10^{-4}/19.15$

$E_a$ =0.544 $\times$ 19.15/5.714 $\times 10^{-4}$ =18230.8K

**14. Define the following terms :**
**(i) Electrophoresis**
**(ii) Adsorption**
**(iii) Shape selective catalysis**

**Ans. (i)** The movement of colloidal particles under an applied electric potential towards oppositely charged electrode is called electrophoresis.

**(ii)** The accumulation of molecular species at the surface rather than in the bulk of a solid or liquid is termed adsorption.

**(iii)** The catalytic reaction that depends upon the pore structure of the catalyst and the size of the reactant and product molecules is called shape-selective catalysis.

**15. Outline the principles of refining of metals by the following methods :**
**(i) Distillation**
**(ii) Zone refining**
**(iii) Electrolysis**

**OR**

**Write down the reactions taking place in different zones in the blast furnace during the extraction of iron. How is pig iron different from cast iron?**

**Ans. (i)** The impure metal is evaporated to obtain the pure metal as distillate.
**(ii)** This method is based on the principle that the impurities are more soluble in the melt than in the solid state of the metal.
**(iii)** The impure metal is made to act as anode. A strip of the same metal in pure form is used as cathode. They are put in a suitable electrolytic bath containing soluble salt of the same metal. The more basic metal remains in the solution and the less basic ones go to the anode mud.

**OR**

**3** $Fe_2O_3$ **+CO** $\rightarrow 2Fe_3O_4 + CO_2$

**(Iron ore)**

$Fe_3O_4$ **+CO** $\rightarrow 3FeO + CO_2$

$CaCO_3 \rightarrow CaO + CO_2$

(limestone)

CaO $+SiO_2 \rightarrow CaSiO_3$ (Slag)

FeO +CO $\rightarrow$ Fe+ $CO_2$

C+ $CO_2 \rightarrow$ Fe+ $CO_2$

Coke

$C + O_2 \rightarrow CO_2$

FeO + C $\rightarrow$ Fe + CO

Cast iron has lower carbon content (about 3%) than pig iron / cast iron is hard & brittle whereas pig iron is soft.

**16. What is lanthanoid contraction? What are the consequences of lanthanoid contraction?**

**Ans.** The steady decrease in atomic radii from La to Lu due to imperfect shielding of 4f – orbital.

**Consequences –**

**(i)** Members of third transition series have almost identical radii as coresponding members of second transition series.

**(ii)** Difficulty in separation.

**17. Indicate the types of isomerism exhibited by the following complexes:**

**(i) [Co(NH$_3$)$_5$ (NO2)]$^{2+}$**

**(ii) [Co(en)$_3$]Cl$_3$ (en = ethylene diamine)**

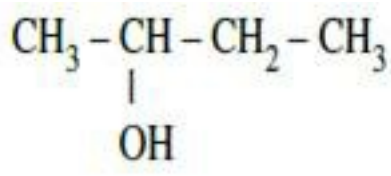
**(iii) [Pt(NH$_3$)2Cl$_2$]**

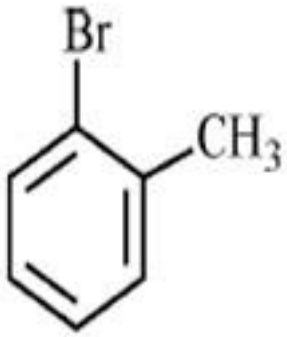
**Ans. (a)** Linkage isomerism

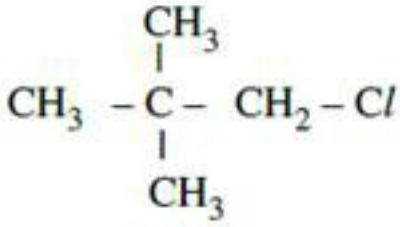
**(b)** Optical isomerism

**(c)** Cis - trans / Geometrical isomerism

**18. Name the following according to IUPAC system:**

**(i)** 

**(ii)** 

**(iii)** 

**Ans. (a)** Butan – 2 – ol

**(b)** 2 – bromotoluene

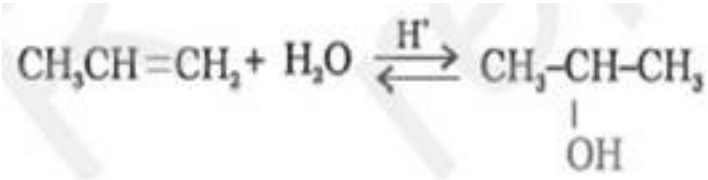
**(c)** 2, 2-dimethylchlorpropane

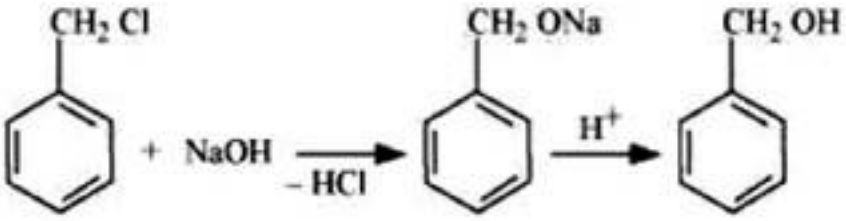
**19. How are the following conversions carried out ?**

**(i) Propene to propane-2-ol**

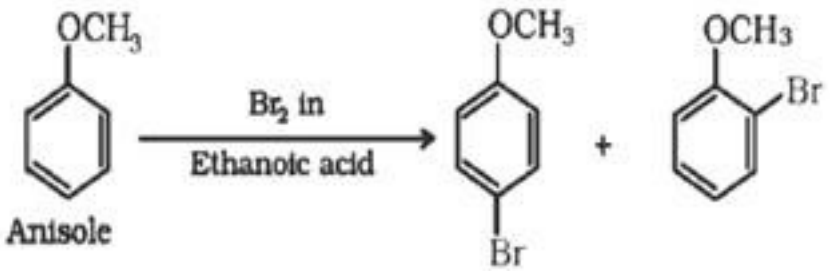
**(ii) Benzyl chloride to Benzyl alcohol**

**(iii) Anisole to p-Bromoanisole**

**Ans. (i)** 

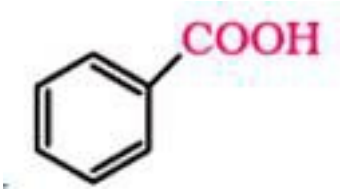
**(ii)** 

**(iii)**

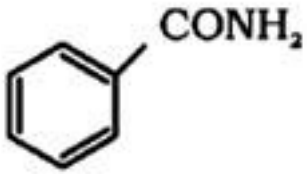



**20. An aromatic compound 'A' on treatment with aqueous ammonia and heating forms compound 'B' which on heating with $Br^2$ and KOH forms a compound 'C' of molecular formula $C_6H_7N$. Write the structures and IUPAC names of compounds A, B and C.**

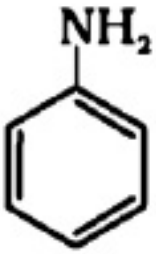
**Ans. A- Benzoic Acid**




**B- Benzamide**




**C-Aniline**




**21. How are vitamins classified ? Name the vitamin responsible for the coagulation of blood.**

**Ans.** Fat soluble vitamin- Vitamin A, D
Water soluble vitamin-Vitamin B,C
Vitamin K

**22. Write the names and structures of the monomers of the following polymers :**

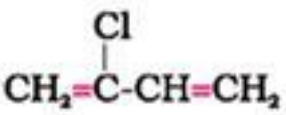
**(i) Buna-S**
**(ii) Neoprene**
**(iii) Teflon**

**Ans. (i)** $CH_2$ =CH=CH= $CH_2$ and

$C_6H_5CH = CH_2$

1,3-Butadiene  Stydrene

**(ii)**



**Chloroprene/2-Chloro-1,3-Butadine**

**(iii)** $CF_2 = CF_2$

**Tetrafluroethene**

**23. Ramesh went to a departmental store to purchase groceries. On one of shelves he noticed sugar-free tablets. He decided to buy them for his grandfather who was a diabetic. There were three types of sugar-free tablets. Ramesh decided to buy sucrolose which was good for his grandfather's health.**

**(i) Name another sugar free tablet which Ramesh did not buy.**
**(ii) Was it right to purchase such medicines without doctor's prescription ?**
**(iii) What quality of Ramesh is reflected above ?**

**Ans. (i)** Aspartame, Saccharin (any one)

**(ii)** No

**(iii)** Social concern, empathy, concern, social awareness.

**24. a) Define the following terms :**

**(i) Molar conductivity (^m)**
**(ii) Secondary batteries**
**(iii) Fuel cell**

**(b) State the following laws :**
**(i) Faraday first law of electrolysis**
**(ii) Kohlrausch's law of independent migration of ions**

**OR**

**(a) Define the term degree of dissociation. Write an expression that relates the molar conductivity of a weak electrolyte to its degree of dissociation.**

**(b) For the cell reaction**

**Ni(s) | $Ni^{2+}$ (aq) || $Ag^{+}$ (aq) | Ag(s)**

**Calculate the equilibrium constant at 25 °C. How much maximum work would be obtained by operation of this cell?**

**E° $Ni^{2+}$ /Ni= 0.25 V and E°**

**Ag+/Ag = 0.80 V.**

**Ans. (a) (i)**Molar conductivity of a solution at a given concentration is the conductance of the volume *V* of solution containing one mole of electrolyte kept between two electrodes with area of cross section *A* and distance of unit length.
**(ii)** Secondary battery- can be recharged by passing current through it in opposite direction so that it can be used again.
**(iii)** Galvanic cells that are designed to convert the energy of combustion of fuels like hydrogen, methane, methanol, etc. directly into electrical energy are called fuel cells.

**(b) (i)** The amount of chemical reaction which occurs at any electrode during electrolysis by a current is proportional to the quantity of electricity passed through the electrolyte (solution or melt).
**(ii)** Limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte.

**OR**

**(a)** Degree of dissociation is the extent to which electrolyte gets dissociated into its constituent ions.

$$\alpha = \frac{\Lambda_m}{\Lambda^o_m}$$

**(b)** $E^0$ cell = $E^0$ Ag+ / Ag - $E^0$ Ni2+ / Ni

= 0.80V – 0.25V

= 0.55V

log Kc = $\left(\frac{nE^0 cell}{0.059}\right)$

= $\frac{2x0.55v}{0.059}$

log Kc = 18.644

$\Delta G^0$ = - nF $E^0$ cell

= -2 × 96500 C $mol^{-1}$ × 0.55V

= -106,150 J $mol^{-1}$

Max.work =+106150 J $mol^{-1}$

or 106.150kJ $mol^{-1}$

**25. (a) Complete the following chemical reaction equations :**

**(i) Cu + $HNO_3$ (dilute) →**

**(ii) $P_4$ + NaOH+ H2O →**

**(b) (i) Why does $R_3P = O$ exist but $R_3N = O$ does not ? (R = alkyl group)**

**(ii) Why is dioxygen a gas but sulphur a solid ?**

**(iii) Why are halogens coloured ?**

**OR**

**(a) Write balanced equations for the following reactions :**

**(i) Chlorine reacts with dry slaked lime.**

**(ii) Carbon reacts with concentrated $H_2SO_4$.**

**(b) Describe the contact process for the manufacture of sulphuric acid with special reference to the reaction conditions, catalysts used and the yield in the process.**

**Ans. (a)(i)** $2ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O$

**(ii) C +** $2H_2SO_4$ **(conc.)** $\rightarrow CO_2 + 2SO_2 + 2H_2O$

**(b) i)** Due to absence of d-orbital, nitrogen cannot expand its valency beyond four.

**(ii)** Because of pπ – pπ multiple bonding in dioxygen which is absent in sulphur.

**(iii)** Due to excitation of electron by absorption of radiation from visible region.

OR

**(a) (i)** $2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O$

**(ii)** C + $2H_2SO_4$ (conc.) $\rightarrow CO_2 + 2SO_2 + 2H_2O$

**b)** It is manufactured by Contact Process which involves following steps:

**(i)** burning of sulphur or sulphide ores in air to generate $SO_2$ .

**(ii)** conversion of $SO_2$ to $SO_3$ by the reaction with oxygen in the presence of a catalyst ( $V_2O_5$ )

**(iii)** absorption of $SO_3$ in $H_2SO_4$ to give *Oleum* ($H_2S_2O_7$ ). The oleum obtained is diluted to give sulphuric acid

$$2SO_2(g) + O_2(g) \overset{V_2O_5}{\rightarrow} 2SO_3(g)$$

Reaction condition – pressure of 2 bar and temperature of 720 K

Catalyst used is $V_2O_5$

Yield – 96 – 98% pure

**26. (a) Describe the following giving chemical equations :**
**(i) De-carboxylation reaction**

**(ii) Friedel-Crafts reaction**

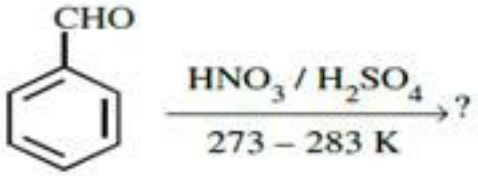
**(b) How will you bring about the following conversions ?**
**(i) Benzoic acid to Benzaldehyde**
**(ii) Benzene to m-Nitroacetophenone**
**(iii) Ethanol to 3-Hydroxybutanal**

**OR**

**(a) Describe the following actions :**
**(i) Acetylation (ii) Aldol condensation**

**(b) Write the main product in the following equations :**

**(i)** $CH_3-\underset{\underset{O}{\|}}{C}-CH_3 \xrightarrow{LiA/H_4} ?$

**(ii)** 


**(iii)** $CH_3-COOH \xrightarrow{PCl_5} ?$

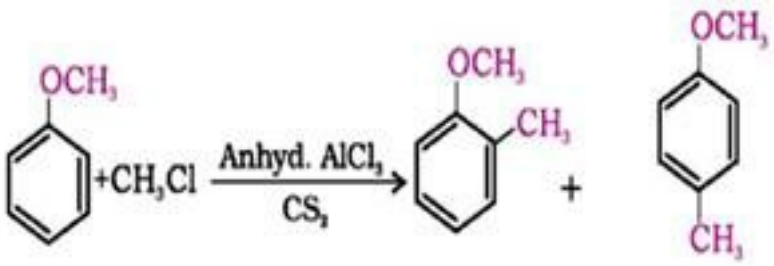
**Ans. (a) (i)** Carboxylic acids lose carbon dioxide to form hydrocarbons when their sodium salts are

heated with sodalime (NaOH and CaO).

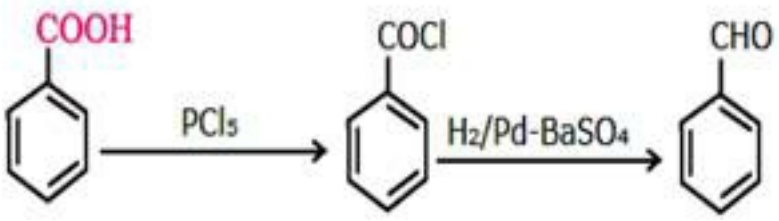
$$R\text{-}COONa \xrightarrow[Heat]{NaOH \,\&\, CaO} R\text{-}H + Na_2CO_3$$

**(ii)** When the alkyl / acyl group is introduced at ortho and para positions by reaction

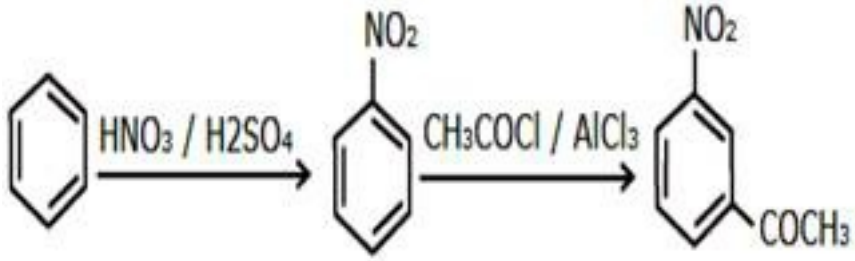
with alkyl halide / acyl halide in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst.



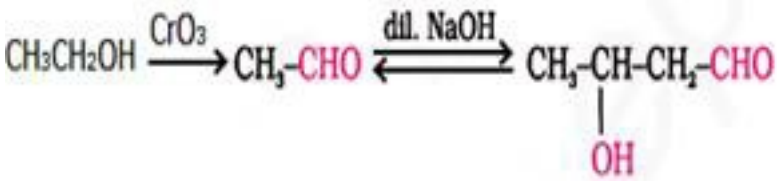

**(b) (i)**




**(ii)**

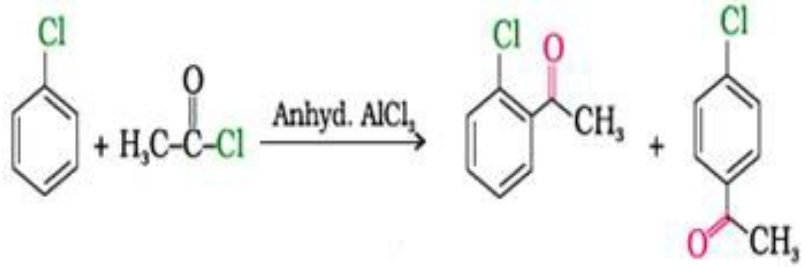



**(iii)**



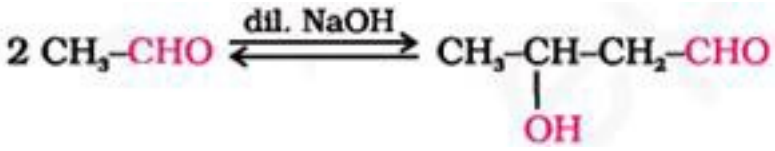

**OR**

**(a) (i)** When the acyl groups are introduced at ortho and para positions by reaction with acyl halide in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst.

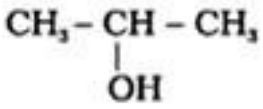



**(ii)** Aldehydes and ketones having at least one -hydrogen undergo a reaction in the presence

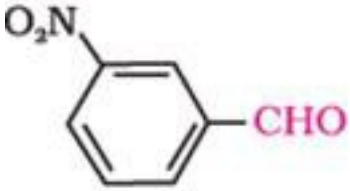
of dilute alkali as catalyst to form $\alpha$ -hydroxy aldehydes (aldol) or $\alpha$-hydroxy ketones (ketol), respectively.




**(b) (i)**




**(ii)**




**(iii)** $CH_3COCl$