Vidyamandir Classes
Gurukul for IITJEE & Medical Preparation

Sample Paper

Class XII (2017-18)

Chemistry

Time allowed: 3 hrs. **Maximum Marks: 70**

GENERAL INSTRUCTIONS:

(i) There are a total of 26 questions and five sections in the question paper. All questions are compulsory.

(ii) Section A contains question number 1 to 5, **Very Short Answer type** questions of one mark each.

(iii) Section B contains question number 6 to 10, **Short Answer type I** questions of two marks each.

(iv) Section C contains question number 11 to 22, **Short Answer type II** questions of three marks each.

(v) Section D contains question number 23, **Value Based Question** of four marks.

(vi) Section E contains question number 24 to 26, **Long Answer type** questions of five marks each.

(vii) There is no overall choice in the question paper; however, an internal choice is provided in one question of two marks, one question of three marks and all three questions of five marks. An examinee is to attempt any one of the questions out of the two given in the question paper with the same question number.

[SECTION A]

1. Calculate the no. of unit cells in 8.1g of Al if it crystallizes in a fcc structure. (At mass of Al = 27).

2. Write one similarity between physisorption and chemisorption.

3. Write the structure of white phosphorus.

4. Write the structure of 1-bromo-4-chlorobut-2-ene.

5. Arrange the following in the order of increasing boiling point H_2O, H_2S, H_2Se, H_2Te

[SECTION B]

6. For a reaction : $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$

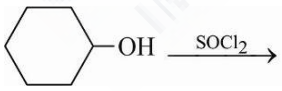
Rate = k.

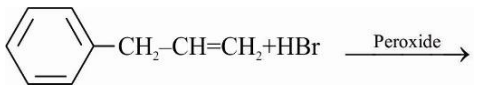
(i) Write the order and molecularity of this reaction **(ii)** Write the unit of k

OR

Write two differences between 'order of reaction' and 'molecularity of reaction?

7. Complete the following reactions:

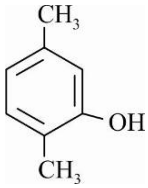
(i) 

(ii) 

8. **(i)** Why is C-Cl bond length in chlorobenzene shorter than C-Cl bond length in CH_3–Cl

(ii) Give a chemical test to distinguish C_2H_5Br and C_6H_5Br.

9. **(i)** Write the IUPAC name of following



(ii) Why is phenol a stronger acid than alcohol.

10. Calculate the limiting ionic conductivity of Al^{+3} Given:

$\lambda_m\left(Al_2(SO_4)_3\right) = 858\ Scm^2\ mol^{-1}$

$\lambda\left(SO_4^{2-}\right) = 160\ Scm^2\ mol^{-1}$

[SECTION C]

11. **(i)** Why is $\left[NiCl_4\right]^{2-}$ paramagnetic but $\left[Ni(CO)_4\right]$ is diamagnetic?

(At no. of Cr = 24, Co = 27, Ni = 28)

(ii) Write the IUPAC name of following complex: $[Co(NH_3)_6][Cr(CN)_6]$

(iii) What type of isomerism is exhibited by $[Pt(en)_2Cl_2]^{2+}$

12. $2N_2O_5(g) \rightarrow 4NO_2 + O_2(g)$

This first order reaction is allowed to proceed at 40°C and the data is collected

$[N_2O_5](M)$	Time (min)
0.400	0
0.289	20
0.209	40
0.151	60
0.109	80

(i) Calculate the rate constant

(ii) What will be concentration of N_2O_5 after 100 minutes?

13. **(a)** For the cell, $Cr(s)\left|Cr^{+3}(aq.)\right\|Fe^{+2}(aq.)\left|Fe(s)\right.$

Given $E^0_{Cr^{+3}/Cr} = -0.74V$, $E^0_{Fe^{+2}/Fe} = -0.44V$.

(i) Calculate E^0_{cell} **(ii)** Calculate E_{cell} at 25°C if $[Cr^{+3}] = 0.1$ M, $[Fe^{+2}] = 0.01$M

(b) Define Kohlrausch's is law of independent migration of ions.

14. **(a)** Differentiate between homopolymer and copolymer.

(b) Write the name and structure of monomers of following polymers

(i) Buna-S **(ii)** Nylon-6, 6

15. Mention the type of linkage responsible for the formation of the following:

(i) Cross-linkage of polypeptide chains **(ii)** α-helix formation

(iii) β-sheet structure

16. **(a)** Write the chemical reactions involved in the extraction of silver from silver ore

(b) Out of C and CO, which is better reducing agent at the lower temperature range in the blast furnace to extract iron from oxide ore?

(c) The reaction, $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$; $\Delta G = -421kJ$, is thermodynamically feasible, why does it not take place at room temperature?

17. What are the following substances? Give one example of each.

(i) Analgesic **(ii)** Antibiotic **(iii)** Tranquilzers

18. Predict the products of the following reactions:

(i) $CH_3-CH=CH_2 \xrightarrow[2.\ 3H_2O_2/OH^-]{1.\ B_2H_6}$ **(ii)** $C_6H_5OH \xrightarrow{Br_2(aq)}$

(iii) $CH_3CH_2OH \xrightarrow{Cu/573k}$

OR

Give the chemical test to distinguish between the following pairs of compounds

(i) Ethanol and phenol **(ii)** 2-Propanol and 2-methylpropan-2-ol.

19. **(a)** Complete the following reaction:

(i) $XeF_4 + O_2F_2 \rightarrow$ **(ii)** $XeF_4 + SbF_5 \rightarrow$

(b) Write the structure of BrO_3^-.

20. **(a)** Account for oxidising power of oxoacids of chlorine: $HClO_4 < HClO_3 < HClO_2 < HClO$

(b) $6NaCl + 3Cl_2 \rightarrow ?$

(c) Calculate the oxidation states of both sulphur atom in $H_2S_2O_3$.

21. **(a)** What is the basic difference between adsorption and absorption?

(b) Why does physisorption decrease with increase in temperature?

(c) In chemisorption why x/m initially increases and then decreases with rise in temperature?

22. In a fcc lattice of X and Y, X atoms are present at the corners while Y atoms are at face centres.

(a) What is the formula of compound.

(b) What would be the formula of the compound if

(i) One of X atom is missing from the corner in each unit cell.

(ii) two atoms of X are missing from the corner.

(iii) One X atom from corner replaced by z atom.

[SECTION D]

23. **(a)** Write the structures of main products when benzenediazonium chloride $\left(C_6H_5N_2^+Cl^-\right)$ reacts with following:

(i) HBF_4/Δ **(ii)** Cu/HBr

(b) Write the structure of A, B and C:

(i) $C_6H_5NO_2 \xrightarrow{Sn+HCl} A \xrightarrow[HCl]{NaNO_2} B \xrightarrow[\Delta]{H_2O} C$

(ii) $CH_3Cl \xrightarrow[(ii)H_2O/H^+]{(i)KCN} A \xrightarrow{NH_3} B \xrightarrow{Br_2/KOH} C$

[SECTION E]

24. **(a)** The depression in freezing point of water observed for same molar concentration of acetic acid, trichloroacetic acid and trifluoroacetic acid increases in the order as stated below. Explain $H_3C–COOH < Cl_3CCOOH < F_3C – COOH$

(b) The freezing point of a solution containing 0.2g of acetic acid in 20g of benzene is lowered by 0.45 °C. Calculate

(i) the molar mass of acetic acid

(ii) Van't Hoff factor (k_f for benzene = 5.12 K kg/mol)

What conclusion can you draw from the value of Van't Hoff factor obtained.

OR

(a) Write two differences between ideal solutions and non-ideal solutions.

(b) 30 gm of urea (M = 60g/mol) is dissolved in 846g of water. Calculate the vapour pressure of solution if water vapour of pure water at 298 k is 23.8 min Hg.

25. **(a)** Write down the electronic configuration of

(i) Cr^{+3} **(ii)** Cu^{+} **(iii)** Co^{+2} **(iv)** Mn^{+2}

(b) Zn^{+2} salts are white while Cu^{+2} salts are coloured. Why?

(c) Write the formula of oxo-anion of Cr having same oxidation state as its group no.

(d) Cu(I) is not known to exist in aqueous solutions why?

(e) $MnO_4^- + S_2O_3^{2-} + H_2O \rightarrow$

Balance the above reaction in basic medium.

OR

(a) What is 'lanthanide contraction'?

(b) **(i)** How is the variability of oxidation states of transition metals different from that of p-block elements?

(ii) Orange colour of $Cr_2O_7^{2-}$ ion changes to yellow when treated with an alkali why?

(c) Write one similarity and one difference between the chemistry of lauthanide and actinoid elements.

26. **(a)** An organic compound A, having the formula C_3H_8O, on treatment with copper at 573K gives B. B does not reduce fehling's solution but gives yellow precipitate of compound C with I_2/NaOH. Deduce A, B, C structure.

(b) Write the structure of main products

(i)  $+C_6H_5COCl \xrightarrow[CS_2]{\text{anhyd.}AlCl_3}$

(ii) $CH_3 - C \equiv C - H \xrightarrow[H_2SO_4]{Hg^{+2}}$

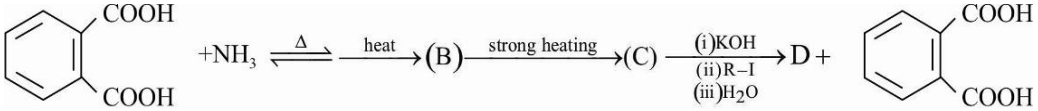
(iii)  $\xrightarrow[(ii)H_2O]{(i)CrO_2Cl_2}$

OR

(a) Write the reactions involved in following:

(i) Hell-volhard-Zelinsky reaction **(ii)** De-carboxylation reaction.

(b) Identify B, C, D:



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Answers to Sample Paper

Class XII (2017-18)

Chemistry

[SECTION A]

1. Number of atoms in 8.1 g of $Al = \left(\frac{N_A}{27} \times 8.1\right)$ atoms

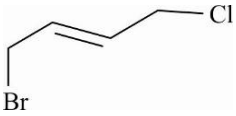
In fcc, 4 atoms per unit cell

$\therefore$ Number of unit cells in 81.g of $Al = \frac{N_A}{27} \times \frac{8.1}{4} = 4.517 \times 10^{22}$

2. Both increases with increase in surface area of the adsorbent

3.

4.



5. $H_2S < H_2Se < H_2Te < H_2O$

[SECTION B]

6. **(i)** Order = 0
Molecularity = 2

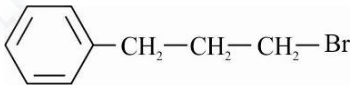
(ii) Unit of the = mol L^{-1} sec^{-1}

OR

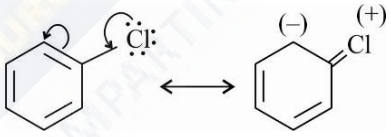
Order of reaction	Molecularity of reaction
(i) It is the sum of powers of the concentration of reactants in rate law expression.	**(i)** Number of reacting species taking part in elementary reaction.
(ii) Need not be whole number.	**(ii)** Always a whole no.

7. **(i)**

(ii)



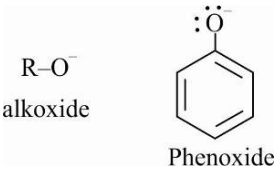
8. **(i)** In halobenzene C-X bond has partial double bond character due to resonance while CH_3X bond is single bond



(ii) C_2H_5Br reacts with $AgNO_3$ to give yellow precipitate while $C_6H_5B_r$ does not.

9. **(i)** 2, 5- Dimethylphenl.

(ii) The great acidity of phenol is due to the stability of phenoxide ion which is resonance stabilized.



10. $\lambda_m^0\left(Al_2(SO_4)_3\right) = 2\lambda_m^0\left(Al^{+3}\right) + 3\lambda_m^0\left(SO_4^{2-}\right)$

$858 = 2\lambda_m^0\left(Al^{+3}\right) + 3\times160 \quad \Rightarrow \quad \lambda_m^0\left(Al^{+3}\right) = 189 cm^2\ mol^{-1}$

[SECTION C]

11. **(i)** $[NiCl_4]^{2-}$ Oxidation state of Ni = +2 ($3d^8$ configuration)
Cl^- weak field ligand.
Hence, sp^3 hybridisation with 2 unpaired electron.
$\therefore$ It is paramagnetic

$[Ni(CO)_4]$ Oxidation state of Ni = 0 ($3d^{10}$ configuration)
Co strong field ligand.
$\therefore$ sp^3 hybridisation and no unpaired electrons.
$\therefore$ Diamagnetic

(ii) Hexaamminecobalt (III) hexacyanochromate (III)

(iii) Geometrical and optical isomerism

12. **(i)** $[C]_0 = 0.4$ mol/L

$$k = \frac{2.303}{t}\log\frac{[C]}{[C_t]}$$

at t = 20 min, $k = 1.626 \times 10^{-2}\ min^{-1}$

(ii) at t = 100 min,

$[C]_t = [C]_0\, e^{-kt} = 0.079M$

13. **(a)** **(i)** $E_{cell}^0 = E_{cathode}^0 - E_{anode}^0 = -0.44 - (-0.74) = 0.30V$

(ii) $$E_{cell} = E_{cell}^0 - \frac{0.059}{n}\log\frac{\left[Cr^{+3}\right]^2}{\left[fe^{+2}\right]^3} = 0.30 - \frac{0.059}{6}\log\frac{(0.1)^2}{(0.01)^3} = 0.26V.$$

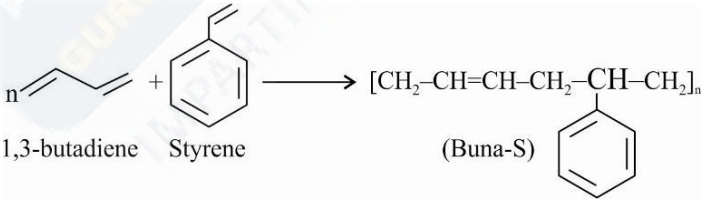
(b) It states that limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of anions and cations of the electrolyte.

14. **(a)** Homo polymer – A polymer made by a single monomer.

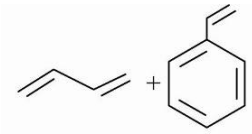
eg- $n\ CH_2 = CH_2 \longrightarrow (CH_2 - CH_2)_n$

ethene polyethene

Copolymer- A polymer made by two or more different monomers.



1,3-butadiene Styrene (Buna-S)



1,3-butadiene Styrene

(b) **(i)** Buna-S

(ii) Nylon-6,6

$HOOC(CH_2)_4COOH$ & $H_2N(CH_2)_6NH_2$

Adipic acid Hexamethylene diamine

15. **(i)** Cross-linkage - Hydrogen bond, disulphide linkage, electrostatic force of attraction

(ii) α -helix formation – H- bonding

(iii) β -sheet structure – intramolecular H-bonding.

16. **(a)** $Ag_2S + 4NaCN \rightleftharpoons 2Na\left[Ag(CN)_2\right] + Na_2S$

$2Na\left[Ag(CN)_2\right] + Zn \rightarrow Na_2\left[Zn(CN)_4\right] + 2Ag$

(b) Ellingham diagram shows that at 673k, $\Delta G_f^0 d(CO_2) < \Delta G_f^0(CO)$. hence formation of CO_2 is mole favorable than CO gas. Hence, CO is a better reducing agent.

(c) In solid state chance of contact between reactants is negligible. Since thermodynamically feasible reactions require some activation energy for initiation. Hence, it does not take place at room temperature.

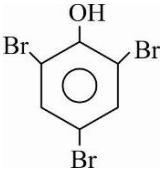
17. **(i)** Analgesics are drugs that reduce pain without causing impairment of consciousness, mental confusion, incordination or paralysis Eg- Aspirin, Paracetamol.

(ii) Antibiotics are chemical substances which in low concentration either kill or inhibit the growth of micro-organism by intervening in their metabolic process, eg-Dysidazinine

(iii) Tranquilizers – medicines which act on central nervous system and help in reducing anxiety and relieve tension on the nerves. Eg-valium.

18. **(i)** $CH_3CH_2CH_2OH$

(ii)



(iii) CH_3CHO

OR

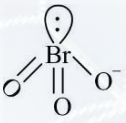
(i) Ethanol and phenol

$FeCl_3$ test- Phenol gives violet colouration with $FeCl_3$ solution. While ethanol does not.

(ii) 2-Propanaol gives yellow solid iodoform with NaOH + I_2. While 2-methyl Propan-2-ol does not.

19. **(a)** **(i)** $XeF_6 + O_2$ **(ii)** $2Xe + 4HF + O_2$

(b)



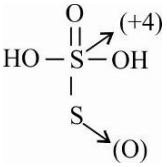
(Pyramidal)

20. **(a)** As the stability of oxoanion increases , its tendency to decompose to give O_2 decreases and hence its oxidising power decreases. Stability order of oxoanions is:

$ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$

(b) $6NaOH + 3Cl_2 \rightarrow 5NaCl + NaClO_3 + H_2O$

(c)



21. **(i)**

Adsorption	Absorption
-Surface phenomenon -Adsorbate concentrated at surface of adsorbent. -Concentration high on surface.	-bulk phenomenon -Substance present in the material. -Uniform concentration through out.

(ii) Since adsorption is exothermic and according to Le-chateliess principle, low temperature is favourable for physical adsorption.

$$\text{Solid} + \text{Gas} \rightleftharpoons \text{Gas adsorbed on solid} + \text{heat}$$

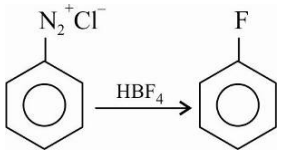
(iii) Rate of adsorption decreases with rise in temperature. In chemisorption, due to high activation energy, with increases in temperature rate of adsorption increases.

22. **(a)** XY_3

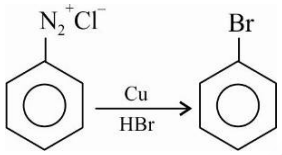
(b) **(i)** X_7Y_{24} **(ii)** XY_4 **(iii)** $X_7Y_{24}Z$

[SECTION D]

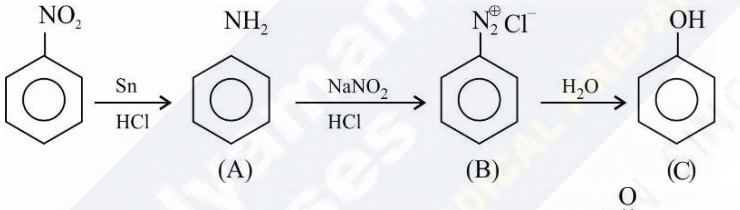
23. **(a)** **(i)**



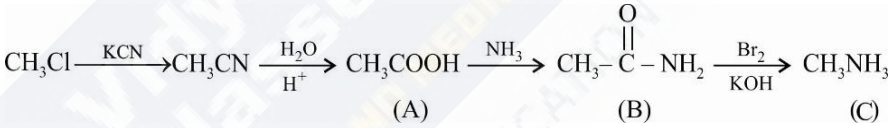
(ii)



(b) **(i)**



(ii)



[SECTION E]

24. **(a)** $H_3C–COOH < Cl_3CCOOH < F_3C – COOH$

Trifluoroacetic acid ionizes to greater extent due to high electron withdrawing inductive effect of fluorine while acetic acid ionizes to minimum extent due to +I effect of CH_3. Greater the no. of ions produced, greater ΔT_f .

(b) **(i)** $\Delta T_f = K_f m \Rightarrow M_{(\text{acetic acid})} = \dfrac{K_f \times W_1 \times 100}{\Delta T_f \times W_2} = \dfrac{5.12 \times 0.2 \times 1000}{0.45 \times 20} = 113.77 \text{g/mol}$

(ii) $i = \dfrac{M_{\text{calculated}}}{M_{\text{observed}}} = \dfrac{60}{113.77} = 0.52$

$\because$ $i < 1$, the solute undergoes association in benzene.

OR

(a)

Ideal solution		Non-ideal solutions	
(i)	$\Delta V_{mix} = 0,\ \Delta H_{mix} = 0$	**(i)**	$\Delta V_{mix} \neq 0,\ \Delta H_{mix} \neq 0$
(ii)	Obeys Raoult's law at all temperature and concentration.	**(ii)**	Do not obey Raoult's law

(b) $P_A = P_A^0 \times X_A = 23.8 \times \left[\dfrac{\left(\frac{846}{18}\right)}{\left(\frac{30}{60}\right)+\left(\frac{846}{18}\right)}\right] = 23.8 \times 0.99 = 23.5 \text{mmHg}.$

25. **(a)** **(i)** $`Cr^{+3}$ - $[Ar]_{18}\ 3d^3$

(ii) Cu^{+} - $[Ar]_{18}\ 3d^{10}$

(iii) Co^{+2} - $[Ar]_{18}\ 3d^7$

(iv) Mn^{+2}- $[Ar]_{18}\ 3d^5$

(b) Zn^{+2} has completely filled d orbital, thus no d-d transition possible. Hence, colourless.

$Cu^{+2} \rightarrow [Ar]3d^9$, due to partly filled d-subshell, its compounds are coloured.

(c) $Cr_2O_7^{2-}$

(d) In aq. Solution, $2Cu^{+}(aq) \rightarrow Cu(s) + Cu^{+2}(aq)$ (Disproportion reaction)

Cu^{+2} is more stable than Cu^{+} in aq. Medium due to high hydration enthalpy.

(e) $8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$

OR

(a) The steady decrease in atomic and ionic radii of lanthanide elements with increase in atomic number.

(b) **(i)** Variability of oxidation states of transition metals arises due to incomplete filing of d-orbitals and it differes from each other by unity. Eg- Fe^{+2}, Fe^{+3} While, P-block elements oxidation states differs generally by two PCl_3, PCl_5.

(ii) On addition of alkali, concentration of H^+ ions decreases, hence the reaction proceeds in forward direction.

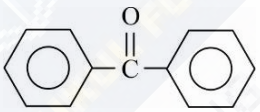
$$Cr_2O_7^{2-} + 2OH^- \longrightarrow 2CrO_4^{2-} + H_2O$$
$$(\text{orange}) \qquad (\text{yellow})$$

(c) Similarity: Elements of both series are electropositive in nature. Act as strong reducing agents
Difference: hanthanoids except promethium are non-radioacitve while all actinoids are radioactive.

26. **(a)** A is $CH_3CH(OH)CH_3$

B is 

C is CHI_3

(b) **(i)**  **(ii)**  **(iii)** 

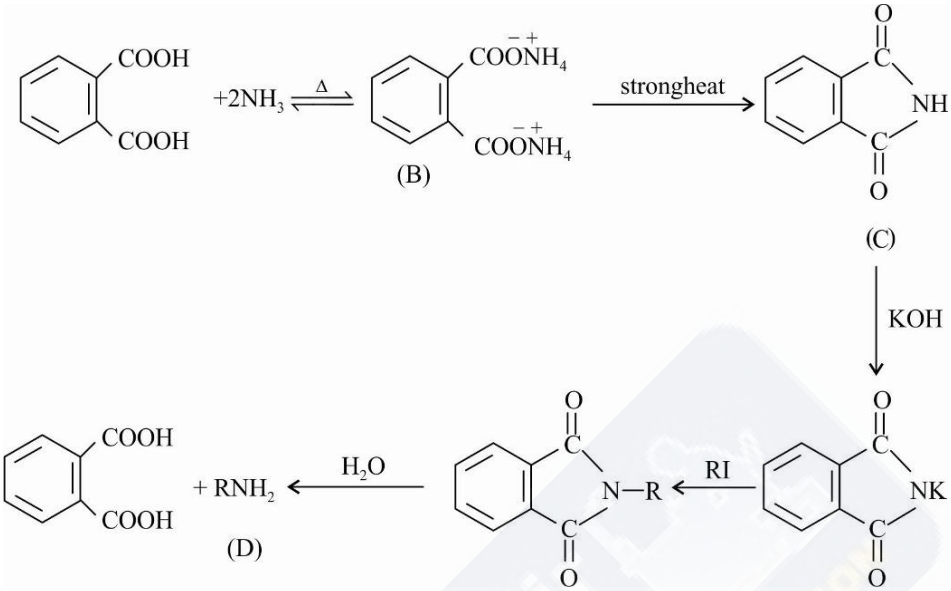
OR

(a) **(i)** $R - CH_2 - COOH \xrightarrow[(ii)\ H_2O]{(i)\ Cl_2 + Red\ P} R - \underset{\displaystyle Cl}{\underset{|}{CH}} - COOH$

(α -halogeration of carboxylic acid).

(ii) $R - \overset{\displaystyle O}{\overset{||}{C}} - ONa \xrightarrow[\Delta]{CaO} R - H + Na_2CO_3$

(b)


COOH
COOH
+2NH3
Δ
COONH4
COONH4
(B)
strongheat
O
C
NH
C
O
(C)
KOH
O
C
NK
C
O
RI
O
C
N—R
C
O
H2O
+ RNH2
COOH
COOH
(D)