XII HSC - BOARD - MARCH – 2022

CHEMISTRY (55) J-752

Date: 12.03.2022 **Marks: 70**
Time: 3 Hrs.

General Instructions:

The question paper is divided into four sections :

(1) **Section A**: Q. No. 1 contains **Ten** multiple choice type of questions carrying **One** mark each.
Q. No. 2 contains **Eight** very short answer type of questions carrying **One** mark each.

(2) **Section B**: Q. No. 3 to Q. No. 14 contain **Twelve** short answer type of questions carrying **Two** marks each. (Attempt any Eight)

(3) Section C: Q. No. 15 to Q. No. 26 contain **Twelve** short answer type of questions carrying **Three** marks each. (Attempt any Eight)

(4) Section D: Q. No. 27 to Q. No. 31 contain **Five** long answer type of questions carrying **Four** marks each. (Attemp any Three).

(5) Use of the log table is allowed. Use of calculator is not allowed.

(6) Figures to the right indicate full marks.

(7) For each multiple choice type of question, it is mandatory to write the correct answer along with its alphabet e.g. (a) ...../ (b) ..... / (c) ..... / (d) ..... etc.
No mark(s) shall be given, if ONLY the correct answer or the alphabet of the correct answer is written.
Only the first attempt will be considered for evaluation.

SECTION – A

Q.1. Select and write the correct answers for the following multiple choice type of questions: **[10]**

(i) The co-ordination number of atoms in body centred cubic structure (bcc) is _____.

(a) 4 (b) 6 (c) 8 (d) 12

Ans: (c)

(ii) In calculating osmotic pressure, the concentration of solute is expresed in _____

(a) molarity (b) molality (c) mole fraction (d) percentage mass

Ans: (a)

(iii) The enthalpy change for the chemical reactions

$H_2O_{(s)} \longrightarrow H_2O_{(l)}$ is called enthalpy of _____.

(a) vapourisation (b) fusion

(c) combustion (d) sublimation

Ans: (b)

(iv) Which of the following transition element shows maximum oxidation state?

(a) Sc (b) Fe (c) Mn (d) V

Ans: (c)

(v) The correct formula for the complex compound, sodium hexacyanoferrate (III) is _____.

(a) Na $[Fe(CN)_6]$ (b) $Na_2[Fe(CN)_6]$

(c) $Na_3[Fe(CN)_6]$ (D) $Na_4[Fe(CN)_6]$

Ans: (c)

(vi) Isoprooylbenzene on air oxidation followed by decomposition by dilute acid gives _____

(a) C_6H_5OH (b) $C_6H_5COOCH_3$

(c) C_6H_5COOH (d) C_6H_5CHO

Ans: (a)

(vii) The name of metal nanoparticle which acts as highly effective baterial disinfectant in water purification process is _____.

(a) carbon black (b) silver (c) gold (d) copper

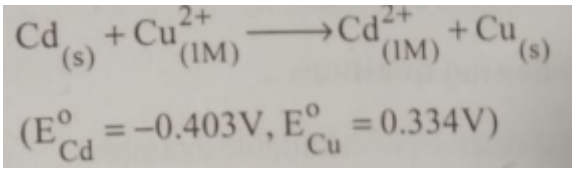
Ans: (b)

(viii) Acid anhydride on reaction with primary amine gives compound having a functional group _____.

(a) amide (b) nirtile (c) secondary amine (d) imine

Ans: (a)

(ix) The standard potential of the cell in the following reaction is _____.



(a) -0.737 V (b) 0.737 V (c) -0.069 V (d) 0.069 V

Ans: (b)

(x) The value of $[H_3O^+]$ in mol lit^{-1} of 0.001 M acetic acid solution (Ka = 1.8×10^{-5}) is ____.

(a) 1.34×10^{-1} (b) 1.34×10^{-2} (c) 1.34×10^{-3} (d) 1.34×10^{-4}

Ans: (a)

Q. 2. Answer the following questions:

(i) Write the product formed when alkyl halide reacts with silver nitrite.

Ans: Nitroethane

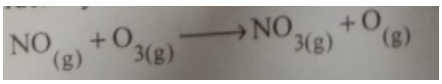
(ii) Write the name of product formed, when acetone is treated with 2,4-dinitrophenyl hydrazine.

Ans: 2,4-dinitrophenylhydrazone

(iii) Write the name of biodegradable polyamide copolymer.

Ans: Nylon-2 nylon-6

(iv) Identify the molecularity of following elementary reaction :

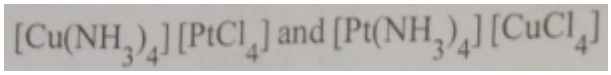


Ans: 2

(v) What is the action of selenium on magnesium metal?

Ans: Magnesium selenide

(vi) Write the name of isomerism in the following complexes:



Ans: Coordination isomerism

(vii) Write the name of the alloy used in Fischer Tropsch process in the synthesis of gasoline.

Ans: co-Th alloy

(viii) Henry's law constant for $CH_3Br_{(g)}$ is 0.159 mol cm^{-3} bar^{-1} at 25°C. What is solubility of $CH_3Br_{(g)}$ in water at same temperature and partial pressure of 0.164 bar?

Ans: 0.026

SECTION – B

Attempt any EIGHT questions of the following:

Q.3. Explain pseudo-first order reaction with suitable example.

Ans: Pseudo-first-order reaction : A reaction which has higher-order true rate law but is experimentally found to behave as first order is called pseudo first order reaction.

Explanation : Consider an acid hydrolysis reaction of an ester like methyl acetate.

$CH_3COOCH_{3(aq)} + H_2O_{(1)} \longrightarrow H+(aq)\ CH_3COOH_{(aq)} + CH_3OH_{(aq)}$

Since the reaction involves two substances, ester and water, it is a bimolecular reaction and the true rate law should be, Rate = k' $[CH_3COOCH_3]$ x $[H_2O]$

Hence the reaction is expected to follow second order kinetics. However experimentally it is found that the reaction follows first order kinetics.

This is because solvent water being in a large excess, its concentration remains constant.

Hence, $[H_2O]$ = constant = k"

Rate = k $[CH_3COOCH_3]$ x $[H_2O]$

= k $[CH_3COOCH_3]$ x k"

= k' x k" x $[CH_3COOCH_3]$

If k' x k" = k, then Rate = k $[CH_3COOCH_3]$,

This indicates that second-order true rate law is forced into first order rate law. Therefore this bimolecular reaction which appears of second order is called pseudo first order reaction.

Q. 4. Write the consequences of Schottky defect with reasons.

Ans: 1) Since the number of ions (cations and anions) decreases but volume remains unchanged, the density of a substance decreases.

2) As the number of missing cations and anions is equal, the electrical neutrality of the compound remains same.

3)This defect arises in ionic crystals like NaCl, AgBr, KCl, etc.

Q. 5. What is the action of following on ethyl bromide:

(i) Na in dry ether

(ii) Mg in dry ether

Ans: 1. $C_2H_5Br + 2\ Na + BrC_2H_5 \rightarrow C_4H_{10} + 2\ NaBr$

2. $C_2H_5Br + mg----------C_2H_5MgBr$

Q. 6. Explain formation of peptie linkage in protein with an example.

Ans: A peptide bond is a chemical bond formed between two molecules when the carboxyl group of one molecule reacts with the amino group of the other molecule, releasing a molecule of water (H_2O). This is a dehydration synthesis reaction (also known as a condensation reaction), and usually occurs between amino acids

Q. 7. Derive an expression to calculate molar mass of non volatile solute by osmotic pressure measurement.

Ans: (1) Consider V dm^3 of a solution in which n_1 moles of a solvent contains n_2 moles of a nonvolatile solute at absolute temperature T.

(2) The osmotic pressure, n of a solution is given by,
$\pi = nRT/V$
R is gas constant having value 0.08206 dm3 atm K-1 mol-1 (OR L atm K-1 mol-1).
Since concentration, C of a solution is in mol dm-3 or molarity is,
$C = n/V$ mol dm-3 or M
$\therefore \pi = CRT$
(If concentration C is expressed in mol m^{-3} and R = 8.314 J $K^{-1}mol^{-1}$, then π will be in SI units, pascals or Nm^{-2}.)

Q. 8. Expalin monodentate and ambidentate ligands with example.

Ans: Monodentate ligand-Only one donor site is present. Examples includes ammonia and chloride ions.

Ambidentate ligand-
Ligands can coordinate to a central metal through two different sites.
Examples include (1) nitro group (N as donor atom) and nitrito group (O as donor atom)
(2) Thiocyanate (S atom as donor atom) and isothiocyanate (N atom as donor atom).

Q. 9. Explain the trends in the following atomic properties of group 16 elements :

(i) Atomic radii

(ii) Ionisation enthalpy

(iii) Electronetativity

(iv) Electron gain enthalpy

Ans: Atomic and ionic radii :In groups 16, the atomic and ionic radii increase down the group, due to increase in the number of quantum shells. Across a period atomic or ionic radii decrease due to increase in effective nuclear charge.

Ionisation enthalpy :
In groups 16, the ionisation enthalpy decreases down the group, due to increase in atomic size.
Electronegativity : In groups 16,the elec-tronegativity decreases down the group.
Electron gain enthalpy :
In groups 16 the electron gain enthalpy becomes less negative down the group.

Q. 10. Write preparation of phenol from aniline.

Ans: Aniline is diazotized by treatment with nitrous acid (NaNO2 and HCl) under ice-cold conditions to form benzene diazonium chloride.

The step is followed by hydrolysis with dilute sulphuric acid to form phenol.
$C_6H_5 - NH_2 + HNO_2 + HCl \rightarrow C_6H_5 - N_2 + Cl^- + 2H_2O$

C6H5−N2+Cl− + H2O → C6H5−OH + N2↑ + HCl

REFER PHENOL PREPARATION

Q. 11. Write chemical reactions to prepare ethanamine from:

(i) acetonitrile

(ii) nitroethane

Ans: Ethanamine from acetonitrile :

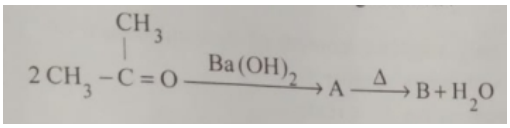
$$\underset{\text{Acetonitrile}}{CH_3 - C \equiv N} + 4\,[H] \xrightarrow{Na/C_2H_5OH} \underset{\text{Ethanamine}}{CH_3 - CH_2 - NH_2}$$

b. Ethanamine from nitroethane :

$$\underset{\text{Nitroethane}}{CH_3 - CH_2 - NO_2} + 6[H]$$

$$\xrightarrow[\Delta]{Sn/\text{conc. } HCl} \underset{\text{Ethanamine}}{CH_3 - CH_2 - NH_2} + 2H_2O$$

Q. 12. Identify A and B from the following reaction :



Ans: Refer aldol condensation reaction page no 273

Q. 13. One mole of an ideal gas is expanded isothermally and reversible from 10L to 15L at 300K. Calculate the work done in the process.

Ans:

Q. 14. How many moles of electrons are required for reduction of 2 moles of Zn^{2+} to Zn? How many Faradays of electricity will be required ?

Ans: The balanced equation for the reduction of Zn2+ to Zn is

$Zn^{2+} + 2e^{-}$ ----------> Zn

The equation shows that 1 mole of Zn^{2+} is reduced to Zn by 2 moles of electrons for reduction of 2 mole of Zn^{2+}, 4 mole of electron will be required.

SECTION – C

Attempt any EIGHT questions of the following:

Q. 15. Write chemical composition of haematite. Write the names and electronic configuration of first two elements of group 17

Ans: Fe_2O_3

group 17 elements

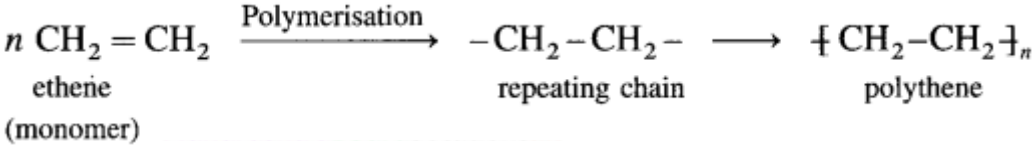
$_9F$ – $1s^2\ 2s^2\ 2p^5$

$_{17}Cl$ – $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

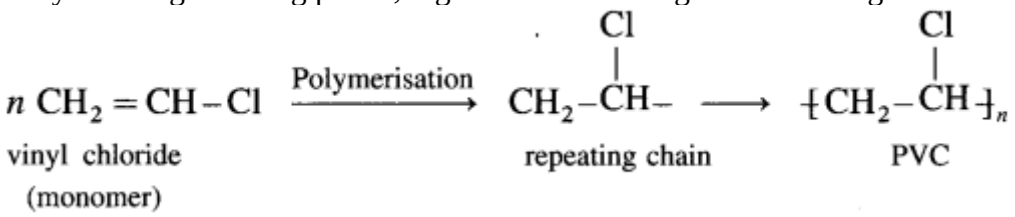
Q. 16. Write classification of polymers on the basis of structure.

Ans: Based on structure polymers are classified as linear chain polymers, branched chain polymers and network or cross linked polymers.

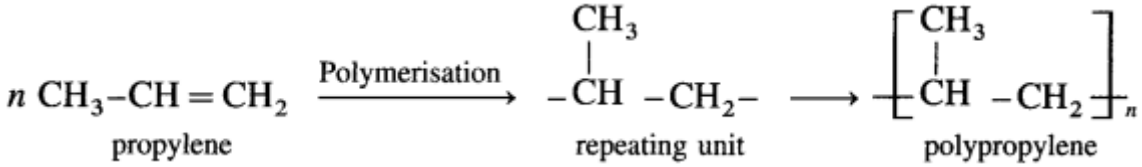
(1) Linear chain polymers : When the monomer molecules are joined together in a linear arrangement, the resulting polymer is straight-chain or long-chain polymer, e.g., polythene, PVC.



They have high melting points; high densities and high tensile strength.



(2) Branched-chain polymers : These polymers consist of long and straight chain with smaller side chains give rise to branched-chain polymers. They have low density. They have lower melting points and tensile strength. Polypropylene having methyl groups as branches.



(3) Network or cross-linked polymers : These polymers consist of cross-linking of chains by strong covalent bonds leading to a network-like structure. Cross-linking results from polyfunctional monomers, e.g., melamine, bakelite, vulcanization of rubber. These polymers are hard rigid and brittle.

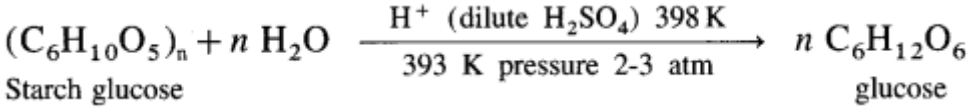
Q. 17. Define green chemistry. Write two disadvantages of nanotechnology.

Ans: (i) Green chemistry : Green chemistry is the use of chemistry for pollution prevention and it designs the use of chemical products and processes that reduce or eliminate the use or generation of hazardous substances.

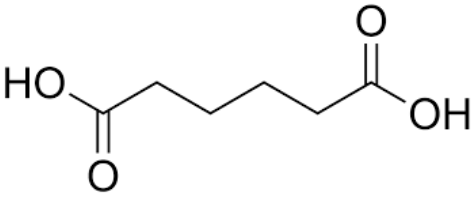
Disadvantages of nanotechnology
1. Nanoparticle can cause lung damage
2. Nano pollution is very danger for living organism.

Q. 18. Write commericial method of preparation of glucose. Write structure of adipic acid.

Ans: Commercially, on a large scale, glucose is prepared by hydrolysis of starch with dilute sulphuric acid. Starchy material is mixed with water and dilute sulphuric acid and heated at 393 K under 2 to 3-atm pressure. Starch is hydrolysed to give glucose.



Structure of adipic acid



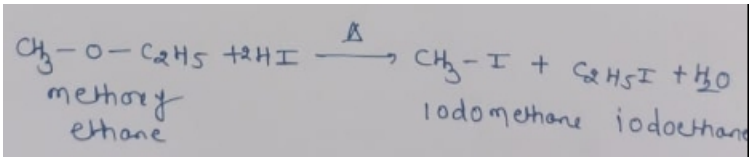
Q. 19. Write chemical reactions of following reagents on methoxyethane:

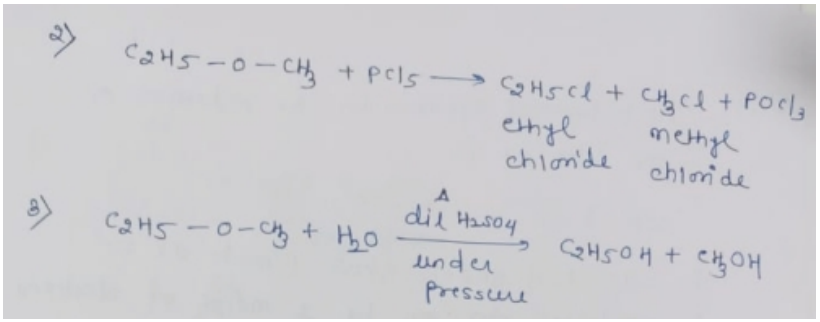
(i) hot HI

(ii) PCl_5

(iii) dilute H_2SO_4

Ans:





Q. 20. Explain cationic, anionic and neutral sphere complexes with example.

Ans: (1) Cationic sphere complexes : A positively charged coordination sphere or a coordination compound having a positively charged coordination sphere is called cationic sphere complex. For example : $[Zn(NH_3)_4]^{2+}$ and $[Co(NH_3)_5Cl]\ SO_4$ are cationic complexes. The latter has coordination sphere $[Co(NH_3)_5Cl]^{2+}$, the anion SO_4^{2+} makes it electrically neutral.

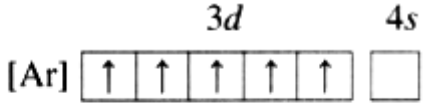
(2) Anionic sphere complexes : A negatively charged coordination sphere or a coordination compound having negatively charged coordination sphere is called anionic sphere complex. For example, $[Ni(CN)_4]^{2+}$ and $K_3\ [Fe(CN)_6]$ have anionic coordination sphere; $[Fe(CN)_6]^{3-}$ and three K^+ ions make the latter electrically neutral.

(3) Neutral sphere complexes : A neutral coordination complex does not possess cationic or anionic sphere. $[Pt(NH_3)_2Cl_2]$ or $[Ni(CO)_4]$ are neither cation nor anion but are neutral sphere complexes.

Q. 21. Calculate spin only magnetic moment of divalent cation of transition metal with atomic number 25.

Salts of Ti^{4+} are colourless. Give reason.

Ans: For element with atomic number 25. electronic configuration of its divalent cation will be : [Ar] 3d5.



There are 5 unpaired electrons.

$\therefore\ n = 5.$

$\therefore\ \mu = \sqrt{5\ (5+2)} = 5.92$ B.M.

The electronic configuration of Ti is [Ar]3d
2
4s
2
The electronic configuration of Ti 4^+ is $[Ar]^3d_0\ 4s_0$.

Since no unpaired electron is present in Ti^{4+}
So , it is colourless

Q. 22. What is lanthanoid contraction?

Write preparation of acetic acid from

(i) dry ice

(ii) acetyl chloride.

Ans: Lanthanide contraction is the gradual decrease in the atomic and ionic size of lanthanoids with an increase in atomic number.

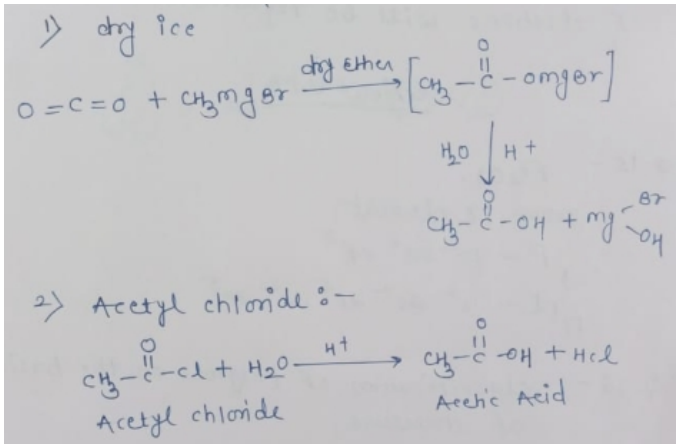
Causes of lanthanide contraction:

With an increase in the atomic number, the positive charge on nucleus increases by one unit and one more electron enters same 4f subshell.

The electrons in 4f subshell imperfectly shield each other. Shielding in a 4f subshell is lesser than in d subshell.

With the increase in nuclear charge, the valence shell is pulled slightly towards the nucleus.

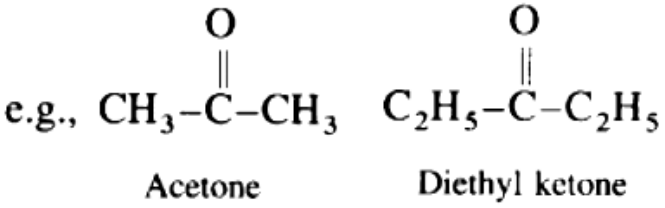
This causes lanthanide contraction.



Q. 23. Write the classification of alihatic ketones with example. What is the action of sodium hypoiodite on acetone?

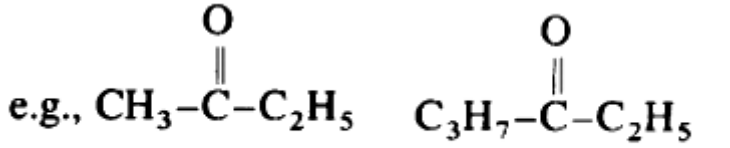
Ans: Aliphatic ketones : The compounds in which group is attached to two alkyl groups are called aliphatic ketones.

Ketones are classified into two types :
1. Simple or symmetrical ketones and
2. mixed or unsymmetrical ketones.
1. Simple or symmetrical ketone : The ketone in which the carbonyl carbon is attached to two identical alkyl groups is called a simple or symmetrical ketone.



Acetone Diethyl ketone

2. Mixed or unsymmetrical ketone : The ketone in which the carbonyl carbon is attached to two different alkyl groups is called a mixed or unsymmetrical ketone.



Ethyl methyl ketone **Ethyl *n*-propyl ketone**

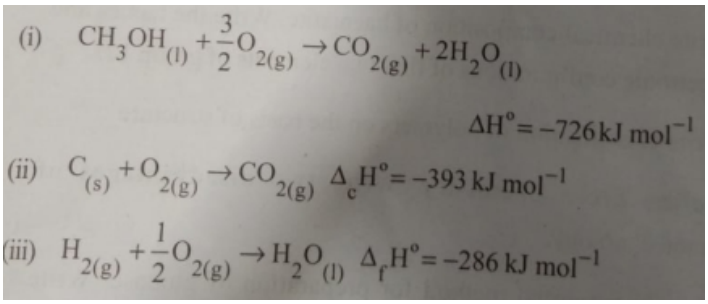
$CH_3COCH_3 + 3I_2 + 4NaOH \rightarrow CHI_3 + 3NaI + CH_3COONa + 3H_2O$

Acetone Iodoform

Q. 24. Define half life of first order reaction. Obtain the expression for half life and rate constant of the first order reaction.

Ans: Refer page no-126 -----6.5.1& 6.5.3

Q. 25. Calculate the standard enthalpy of formation of $CH_3OH_{(l)}$ from the following data



Q. 26. Calculate the pH of buffer solution composed of 0.01 M weak base BOH and 0.02 M of its salt BA.

[$K_b = 1.8 \times 10^{-5}$ for weak base]

SECTION – D

Attempt any THREE questions of the following:

Q. 27. Define the following terms :

(i) Isotonic solutions

(ii) Osmosis

Gold crystallises into face-centred cubic cells. The edge length of unit cell is 4.08×10^{-8} cm. Calculate the density of gold.

[Molar mass of gold = 197 g mol^{-1}]

Ans: 1. isotonic solution-page no-40……..2.10.3

2. osmosis-page no-39…….2.10.1

Q. 28. Write the mathematical equation for the first law of thermodynamics for

(i) isothermal processes

(ii) adiabatic process

Derive the relationship between pH and pOH.

Ans: 1. isothermal process-page no65…….4.2.7

2. adiabatic process-page no-65
Relation between PH & POH---Page no-52…….3.6.2

Q. 29. Define reference electrode. Write functions of salt bridge.

Draw neat, labelled diagram of standard hydrogen electrode (SHE).

Ans: Reference electrode-

Function of salt bridge-page no-103……5.6.1
Standard hydrogen electrode-page no-109 ……..5.6

Q. 30. Explain metal deficiency defect with example. Write chemical equation for preparation of sulphur dioxide from sulphur. Write uses of sulphur.

Ans: Metal deficiency defect-page no-19……..

Page no-145

Q. 31. Write chemical reactions for the following conversions:

(i) Ethyl bromide to ethyl methyl ehter.

(ii) Ethyl bromide to ethene.

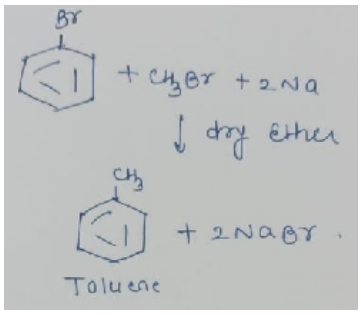
(iii) Bromobenzene to toluene.

(iv) Chlorobenzene to biphenyl.

Ans: 1.page no-248

2.ethyl bromide to ethene by elimination reaction

3.



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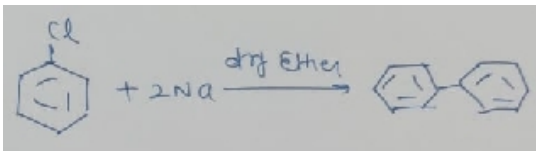

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