SET-3

Series BVM/2

Code No. **56/2/3**

Roll No. | | | | | | | |

Candidates must write the Code on the title page of the answer-book

CHEMISTRY (Theory) & SOLUTION

Time allowed : 3 hours **Maximum Marks : 70**

General Instructions :

(i) *All questions are compulsory.*

(ii) *Section A : Questions number 1 to 5 are very short answer questions and carry 1 mark each.*

(iii) *Section B : Questions number 6 to 12 are short answer questions and carry 2 marks each.*

(iv) *Section C : Questions number 13 to 24 are also short answer questions and carry 3 marks each.*

(v) *Section D : Questions number 25 to 27 are long answer questions and carry 5 marks each.*

(vi) *There is no overall choice. However, an internal choice has been provided in two questions of one mark, two questions of two marks, four questions of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.*

(vii) *Use of log tables, if necessary. Use of calculators is not allowed.*

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | **Email :** pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | **Toll Free :** 1800 258 5555 | **CIN :** U80302RJ2007PLC024029

SECTION A

1. Out of Chlorobenzene and Cyclohexyl chloride, which one is more reactive towards nucleophilic substitution reaction and why?

Ans. Cyclohexyl chloride is more reactive towards nucleophilic substitution reaction because C—Cl bond strength is less in cyclohexyl chloride than chlorobenzene. In cyclohexyl chloride chlorine atom is bonded to sp^3 hybrid carbon atom while in chlorobenzene chlorine is bonded to sp^2 hybrid carbon atom that's why C—Cl bond is more strong in chlorobenzene and less reactive toward Nucleophilic substitution.

2. Arrange the following in decreasing order of solubility in water:

$(C_2H_5)_2NH, C_2H_5NH_2, C_6H_5NH_2$

Ans. Decreasing order of solubility in water of following species is

$C_2H_5NH_2 > (C_2H_5)_2NH > C_6H_5NH_2$

3. What type of colloid is formed when a solid is dispersed in a gas? Give an example.

Ans. Aerosol is formed when a solid is dispersed in gas. Example: Smoke, dust.

4. Out of KCl and AgCl, which one shows Schottky defect and why ?

Ans. KCl shows schottky defect because cation & anions are of similar size.

OR

Why does ZnO appear yellow on heating?

Ans. ZnO on heating loses oxygen leaving behind their electrons at that position due to electrons it appears yellow in colour.

5. What is the difference between amylose and amylopectin?

Ans.

Amylose	**Amylopectin**
1. It is water soluble component.	1. It is water insoluble
2. It constitutes about 15-20% of starch	2. It constitutes about 80-85% of starch.

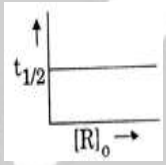
OR

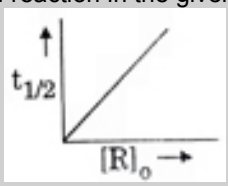
Write the products obtained after hydrolysis of lactose.

Ans. Hydrolysis product of lactose are β-D-galactose & β-D-glucose.

SECTION B

6. Define order of reaction. Predict the order of reaction in the given graphs :

(a) 

(b) 

Where $[R]_0$ is the initial concentration of reactant and $t_{1/2}$ is half – life.

Ans. The sum of powers of the concentration of the reactants in rate law expression is called order of that chemical reaction.

Rate = $K[A]^x[B]^y$ (x + y = order of reaction)

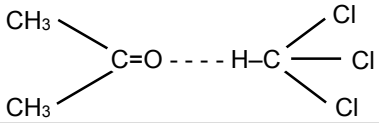
(a) 1st order $\left[t_{1/2} = \frac{0.693}{K}\right]$

(b) O order $\left[t_{1/2} = \frac{[R_0]}{2K}\right]$

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029

7. Give reasons :
(a) An increase in temperature is observed on mixing chloroform and acetone.
(b) Aquatic animals are more comfortable in cold water than in warm water.

Ans. (a) A mixture of chloroform and acetone forms a solution with negative deviation from Raoult's law. This is because chloroform molecule is able to form hydrogen bond with acetone molecule as shown.



This decreases the escaping tendancy of molecules for each component and consequently the vapour pressure decreases resulting in negative deviation from Raoult's law. There for $\Delta H = -ve$
(b) Solubility of O_2 in water increases with decrease of temperature. It is due to this reason that aquatic species are more comfortable in cold waters rather than in warm waters.

8. When $FeCr_2O_4$ is fused with Na_2CO_3 in the presence of air it gives a yellow solution of compound (A). Compound (A) on acidification gives compound (B). Compound (B) on reaction with KCl forms an orange coloured compound (C). An acidified solution of compound (C) oxidises Na_2SO_3 to (D). Identify (A), (B), (C) and (D).

Ans. $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow \underset{(A)}{8Na_2CrO_4} + 2Fe_2O_3 + 8CO_2$

$2Na_2CrO_4 + 2H^+ \longrightarrow \underset{(B)}{Na_2Cr_2O_7} + 2Na^+ + H_2O$

$Na_2Cr_2O_7 + 2KCl \longrightarrow \underset{(C)}{K_2Cr_2O_7} + 2NaCl$

$K_2Cr_2O_7 + 3Na_2SO_3 + 4H_2SO_4 \longrightarrow \underset{(D)}{3Na_2SO_4} + K_2SO_4 + Cr_2(SO_4)_3 + 4H_2O$

9. Write balanced chemical equations for the following processes :
(a) Cl_2 is passed through slaked lime.
(b) SO_2 gas is passed through an aqueous solution of Fe(III) salt.

Ans. (a) $2Ca(OH)_2 + Cl_2 \longrightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O$
(b) $2Fe^{+3} + SO_2 + 2H_2O \longrightarrow 2Fe^{+2} + SO_4^{-2} + 4H^+$

OR

(a) Write two poisonous gases prepared from chlorine gas.
(b) Why does Cu^{2+} solution give blue colour on reaction with ammonia?

Ans. (a) (i) $COCl_2$ Phosgene
(ii) CCl_3NO_2 tear gas
(b) The presence of a lone pair of electrons on the nitrogen atom of the ammonia molecule makes it a Lewis base. It donates the electron pair and forms linkage with metal ions and the formation of such complex compound

$$\underset{(blue)}{Cu^{2+}(aq)} + 4NH_3(aq) \rightleftharpoons \underset{(deep\ blue)}{[Cu(NH_3)_4]^{2+}(aq)}$$

10. Define the following terms with a suitable example of each :

(a) Polydentate ligand

(b) Homoleptic complex

Ans. (a) When several donar atoms are present in a single ligand, the ligand is said to be polydentate.

e.g. $\rightarrow (EDTA^{-4})$

(b) Complexes in which a metal is bound to only one kind of donar groups are known as homoleptic complexes

e.g. $\rightarrow [CO(NH_3)_6]$

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029

OR

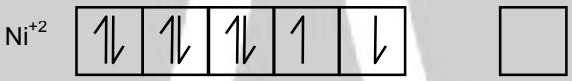
Using IUPAC norms, write the formulae for the following complexes :
(a) Potassium tri(oxalato) chromate (III)
(b) Hexaaquamanganese (II) sulphate

Ans. (a) $K_3\left[Cr(C_2O_4)_3\right]$

(b) $\left[Mn(H_2O)_6\right]SO_4$

11. (a) Although both $[NiCl_4]^{2-}$ and $[Ni(CO)_4]$ have sp^3 hybridisation yet $[NiCl_4]^{2-}$ is paramagnetic and $[Ni(CO)_4]$ is diamagnetic. Give reason. (Atomic no. of Ni = 28)
(b) Write the electronic configuration of d^5 on the basis of crystal field theory when
(i) $\Delta_0 < P$ and
(ii) $\Delta_0 > P$

Ans. (a) Although both $\left[NiCl_4\right]^{-2}$ and $[Ni(CO)_4]$ are tetrahedral, their magnetic characters are different. This is due to difference in the nature of ligands. Cl^- is weak field ligand and it does not cause the pairing of unpaired 3d electron. Hence $[NiCl_4]^{-2}$ is paramagnetic.



In $[Ni(CO)_4]$ Ni is in zero oxidation state i.e. it has a configuration of $3d^8 4s^2$.

But CO is strong field ligand. Therefore, it causes the pairing of unpaired 3d electron. Also it causes the 4s electrons to shift to the 3d orbital, thereby giving rise to sp^3 hybridization.

Since no unpaired electrons are present in this Case, $[Ni(CO)_4]$ is diamagnetic.

(b) (i) $t_{2g}^3 eg^2$

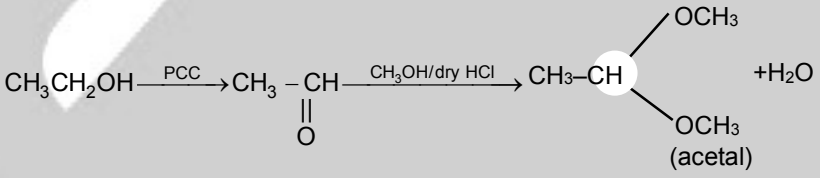
(ii) $t_{2g}^5 eg^0$

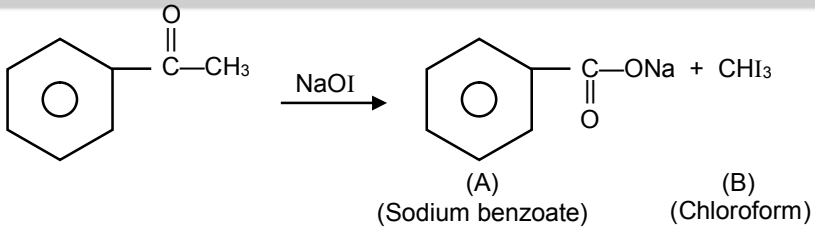
12. Write structures of main compound A and B in each of the following reactions :

(a) $CH_3CH_2OH \xrightarrow{PCC} A \xrightarrow{CH_3OH/dryHCl(g)} B$

(b) $C_6H_5COCH_3 \xrightarrow{NaOI} A + B$

Ans.





Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029

SECTION C

13. The following data were obtained for the reaction.

$A + 2B \longrightarrow C$

Experiment	[A]/M	[B]/M	Initial rate of formation of C/M min^{-1}
1	0.2	0.3	4.2×10^{-2}
2	0.1	0.1	6.0×10^{-3}
3	0.4	0.3	1.68×10^{-1}
4	0.1	0.4	2.40×10^{-2}

(a) Find the order of reaction with respect to A and B.

(b) Write the rate law and overall order of reaction.

(c) Calculate the rate constant (k).

Ans. (a) Rate expression for 1st experiment

$4.2 \times 10^{-2} = K [A]^{\alpha}[B]^{\beta}$

$4.2 \times 10^{-2} = K[0.2]^{\alpha}[0.3]^{\beta}$ ..... (1)

Rate expression for 3rd experiment

$1.68 \times 10^{-1} = K[0.4]^{\alpha} [0.3]^{\beta}$ ..... (2)

Dividing eq. (2) by eq. (1)

$$\frac{1.68\times10^{-1}}{4.2\times10^{-2}} = \frac{K\left[0.4\right]^{\alpha}[0.3]^{\beta}}{K[0.2]^{\alpha}\left[0.3\right]^{\beta}}$$

$4 = [2]^{\alpha}$

$2^2 = 2^{\alpha}$

$\alpha = 2$

Rate expression for 2nd experiment

$6.0 \times 10^{-3} = K[0.1]^2 [0.1]^{\beta}$ ..... (3)

Rate expression for 4th experiment

$2.40 \times 10^{-2} = K[0.1]^2 [0.4]^{\beta}$ ..... (4)

Dividing equation 4 by equation 3

$$\frac{2.40\times10^{-2}}{6.0\times10^{-3}} = \frac{K\left[0.1\right]^2\left[0.4\right]^{\beta}}{K\left[0.1\right]^2\left[0.1\right]^{\beta}}$$

$$4 = \left[\frac{0.4}{0.1}\right]^{\beta}$$

$4 = 4^{\beta}$

$\beta = 1$

Order of reaction in respect of A is 2

Order of reaction in respect of B is 1

(b) Rate law for the given reaction is

$rate = K[A]^2\left[B\right]^1$

Thus Order of reaction n = 2 + 1 = 3

(c) Rate constant K is calculated by the equation (1)

$4.2 \times 10^{-2} = K [0.2]^2 [0.3]^1$

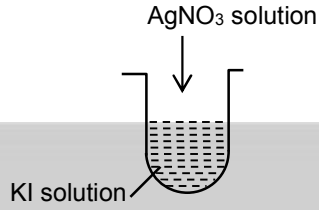
$$K = \frac{4.2\times10^{-2}}{\left[0.2\right]^2\left[0.3\right]^1}$$

$$K = \frac{4.2\times10^{-2}}{.04\times.3}$$

$K = 3.5\ M^{-3}\ min^{-1}$

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029

14. (a) Write the dispersed phase and dispersion medium of butter.
(b) Why does physisorption decrease with increase in temperature?
(c) A colloidal sol is prepared by the method given in the figure. What is the charge on AgI colloidal particles formed in the test tube ? How is this sol represented?



Ans. (a) Dispersion medium of butter is fat and dispersed phase is water.
(b) Physisorption is due to weak vander waal's forces of attraction. These attractions decreases with increase temperature that's why physisorptions also decreases.
(c) When in solution of KI, $AgNO_3$ solution is added, –ve charged AgI colloid is formed. –ve charged AgI colloid is represented as $\underset{(-)\text{ Colloid}}{AgI/I^-}$

$$KI + AgNO_3 \longrightarrow \underset{(-)\text{ Colloid}}{AgI/I^-}$$

15. A solution containing 1.9 g per 100 mL of KCl (M = 74.5 g mol^{-1}) is isotonic with a solution containing 3 g per 100 mL of urea (M = 60 g mol^{-1}). Calculate the degree of dissociation of KCl solution. Assume that both the solutions have same temperature.

Ans. Isotonic solutions have same osmotic pressure if osmotic pressure of KCl solution is $i_1\pi_1$ and osmotic pressure of urea solution is $i_2\pi_2$.

Then $i_1\pi_1 = i_2\pi_2$ $\quad \pi_1 = C_1RT$ at same temperature

$\pi_2 = C_2RT$

$i_1 = ?$

$i_2 = 1$ because urea neither associate nor dissociate.

According the question

$i_1C_1RT = i_2C_2RT$

$i_1C_1 = C_2$ $\qquad C_1 = \frac{n_1}{v}, C_2 = \frac{n_2}{v}$

$i_1 = \frac{C_2}{C_1}$ or $\frac{n_2}{V} \times \frac{V}{n_1}$ $\qquad n_1 = \frac{1.9}{74.5}, n_2 = \frac{3}{60}$

$$i_1 = \frac{n_2}{n_1}$$

$$i_1 = \frac{3}{60} \times \frac{74.5}{1.9} = 1.96$$

KCl dissociates as

$$KCl \longrightarrow K^+ + Cl^-$$

Degree of Dissociation of KCl $\quad \alpha = \frac{i-1}{n-1}, \qquad n = 2$

$$\alpha = \frac{1.96-1}{2-1} = 0.96$$

$\alpha = 0.96$ **Ans.**

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | **Email :** pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | **Toll Free :** 1800 258 5555 | **CIN :** U80302RJ2007PLC024029

16. An element X with an atomic mass of 81 u has density 10.2 cm^{-3}. If the volume of unit cell is 2.7×10^{-23} cm^3, identify the type of cubic unit cell.
(Given : $N_A = 6.022 \times 10^{23}$ mol^{-1})

Ans. Density of cubic unit cell is given as :

$$d = \frac{Zm}{a^3}$$

$d = 10.2$ gcm^{-3}

$a^3 = 2.7 \times 10^{-23}$ cm^3

$$m = \frac{81}{6.022 \times 10^{23}} g$$

$Z = ?$

$$10.2 = \frac{Z \times 81}{6.022 \times 10^{23} \times 2.7 \times 10^{-23}}$$

$$Z = \frac{10.2 \times 6.022 \times 10^{23} \times 2.7 \times 10^{-23}}{81}$$

$Z = 2.05$

$Z = 2$

Two atoms per unit cell

Hence cubic unit cell must be body centered cubic unit cell.

17. Write the principle of the following

(a) Hydraulic washing

(b) Chromatography

(c) Froth – floatation process

Ans. (a) Principle of hydraulic washing – This separation is based on the difference in the specific gravities of the gangue particles and the ore particles. The powdered ore is agitated with water or washed with a running water. The heavy ore particles settle down while the lighter particles of sand, clay etc. are washed away.

(b) Chromatography : - It is based on selective distribution of the various constituents of a mixture between two phases. A stationary phase and a moving phase. The stationary phase can be either solid (such as alumina, silicagel) or tightly bound liquid on a solid support. The moving phase may be liquid or a gas.

(c) Froth – floatation process. This process is based on the fact that metallic sulphide ore particles are preferentially wetted by oil where as silicate gangue particles are preferentially wetted by water. So sulphide ore particles rise to the surface in the form of froth while gangue particles sink to the bottom.

18. Give reasons for the following :

(a) Transition metals have high enthalpies of atomization.

(b) Manganese has lower melting point even though it has a higher number of unpaired electrons for bonding.

(c) Ce^{4+} is a strong oxidizing agent.

Ans. (a) Transition elements have a large number of valence electrons and high effective nuclear charge. Due to this they form very strong metallic bonds. As a result of this the enthalpy of atomization of transition metals is high.

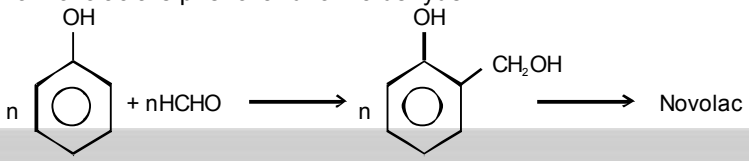
(b) Complex structure of metal crystal is responsible for this abnormal behaviour of manganese.

(c) $Ce^{4+}(4f^0)$ in + 4 oxidation state tend to revert to the more stable oxidation state of + 3 by gain of an electron so it behaves as strong oxidising agent.

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029

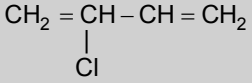
19. Write the structures of monomers used for getting the following polymers :
(a) Novolac
(b) Neoprene
(c) Buna -S

Ans. (a) Momnomer of novolac are phenol and formaldehyde

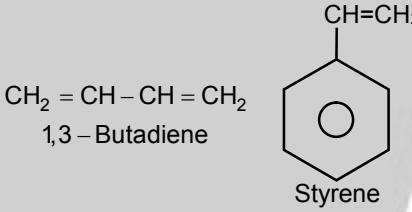


Monomer of Novolac

(b) Monomer of Neoprene is 2-Chlorobuta-1,3-diene



(C) Buna-S :- Monomers are styrene & 1, 3 - Butadiene

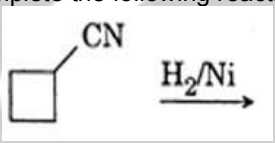


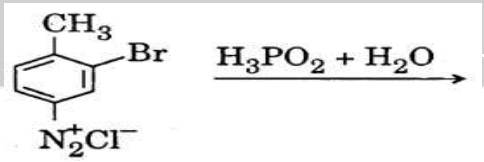
OR

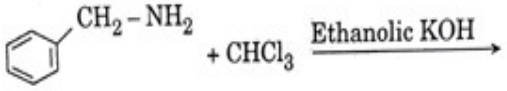
(a) Write one example each of
(i) Cross – linked polymer
(ii) Natural polymer
(b) Arrange the following in the increasing order of their intermolecular forces :
Terylene, Buna – N, Polystyrene
(c) Define biodegradable polymers with an example.

Ans. (a) (i) Example of cross-linked polymer is Bakelite
(ii) Example of natural polymer is starch.
(b) Increasing order of their intermolecular forces.
Buna-N < Polystyrene < Terylene
(c) Biodegradable polymers – Natural or synthetic polymers which can be degraded to small molecules by bacteria. Example is PHBV, Nylon-2

20. Complete the following reaction :

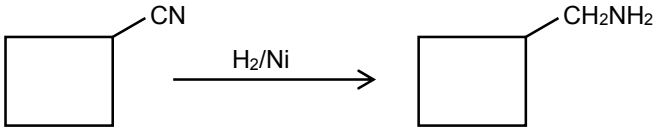
(a) 

(b) 

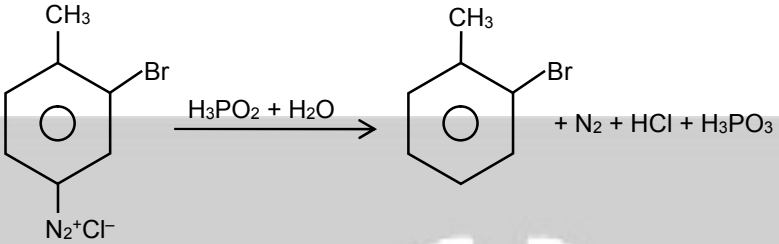
(c) 

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029

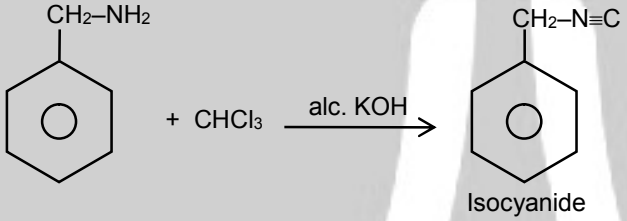
Ans. (a)



(b)



(c)



Isocyanide

OR

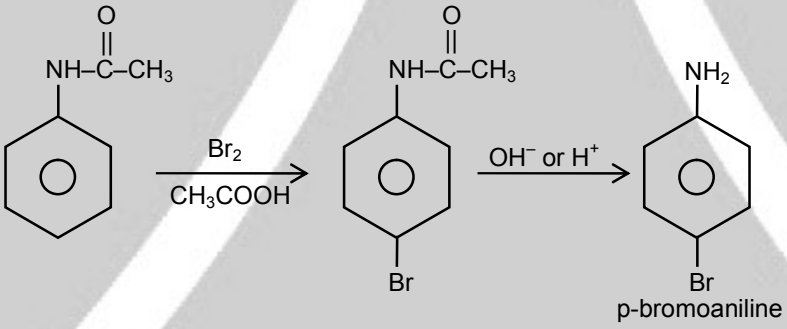
How do you convert the following :

(a) N – phenylethanamide to p – bromoaniline

(b) Benzene diazonium chloride to nitrobenzene

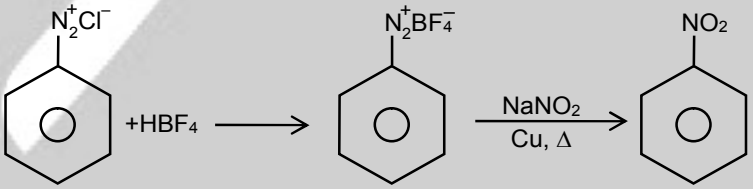
(c) Benzoic acid to aniline

Ans. (a)

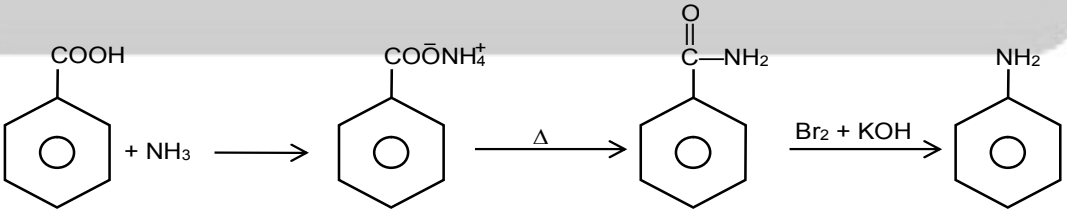


p-bromoaniline

(b)



(c)



Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | **Email :** pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | **Toll Free :** 1800 258 5555 | **CIN :** U80302RJ2007PLC024029

21. (a) Pick out the odd one from the following on the basis of their medicinal properties :
Equanil, Seconal, Bithional, Luminal
(b) What type of detergents are used in dishwashing liquids?
(c) Why is the use of aspartame limited to cold foods?

Ans. (a) Bithional is odd one because it is a antimicrobial while other all are tranquilizers.
(b) Non-ionic detergent is used as dish washing liquid. It is formed when stearic acid reacts with polyethylene glycol
(c) Aspartame is limited to cold food because it is unstable at cooking temperature.

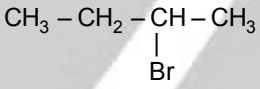
OR

Define the following terms with a suitable example of each :
(a) Antibiotics
(b) Antiseptics
(c) Anionic detergents

Ans. (a) Antibiotics : the drugs which are produced by micro organisms or synthesized and are used to kill or prevent the growth of other micro-organism by intervening in their metabolic process. Example – Penicilline
(b) Antiseptics : Drugs which are used either to kill or stop the growth of micro organism these preventing its infection are called antiseptic. Example : Furacine and soframycine.
(c) Anionic detergents : These are sodium salts of sulphonated long chain alcohols or hydrocarbons. They have anions at the soluble ends of the chain. Example. Sodium p-Dodecyl Bengene Sulphonate.

22. Among all the isomers of molecular formula C_4H_9Br , identify
(a) the one isomer which is optically active.
(b) the one isomer which is highly reactive towards S_N2.
(c) the two isomers which give same product on dehydrohalogenation with alcoholic KOH.

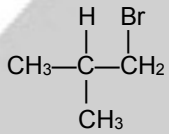
Ans.
(a) Optically active isomer of C_4H_9Br is 2-Bromo butane :



2-Bromo butane

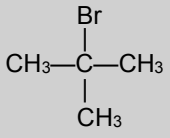
(b) $CH_3CH_2CH_2CH_2Br$ 1-bromo butane is highly reactive towards SN^2.

(c) (i)

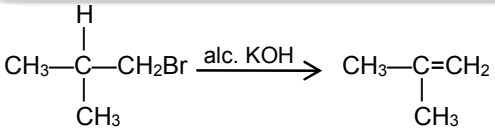


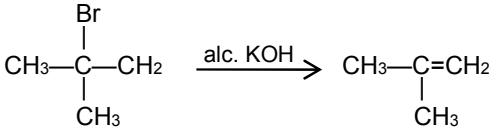
1-bromo-2-methyl propane

(ii)



2-bromo-2-methyl propane

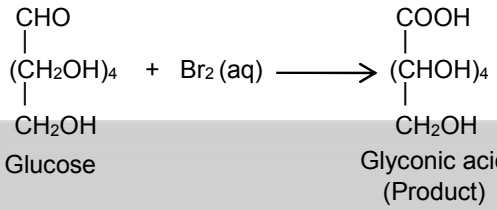




Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029

23. (a) Write the product when D – glucose reacts with Br_2(aq).
(b) What type of bonding provides stability to α -helix structure of protein ?
(c) Name the vitamin whose deficiency causes pernicious anaemia.

Ans. (a)



Glucose — Glyconic acid (Product)

(b) Hydrogen-bonding provides stability to α-helix structure of protein.
(c) Vitamin B_{12}

OR

Define the following terms :
(a) Invert sugar
(b) Native protein
(c) Nucleotide

Ans. (a) Invert sugar : Hydrolysis of sugar brings about a change in the sign of rotation, from dextro(+) to laevo (–) and the product is named as invert sugar.
(b) Native protein : Protein found in a biological system with a unique three – dimensional structure and biological activity is called a native protein.
(c) Nucleotide : It is obtained by the addition of one molecule of phosphoric acid with nucleoside at 5-position. If is obtained by the combining three different monomer units.
Nucleotide : Phosphoric acid + Pentose sugar + N-base

24. (a) Give reasons :
(i) Benzoic acid is a stronger acid than acetic acid.
(ii) Methanal is more reactive towards nucleophilic addition reaction than ethanal.
(b) Give a simple chemical test to distinguish between propanal and propanone.

Ans. (a) (i) Benzoic acid is a stronger acid than acetic acid due to electron with drawing effect of bengene ring which stabilises the carboxylate anion while alkyl group distablises the carboxylate anion due to electron donating nature.
(ii) Methanal is more reactive than ethanal towards Nucleophilic addition reaction due to steric and electronic reasons. Presence of methyl group in ethanal hinders the approach of nucleophile to carbonyl carbon than in methanal. Methyl group also reduces the electrophilicity of the carbonyl more effectively than in methanal.
(b) To distinguish between propanal and propanone Tollen's reagent is used. This reagent oxidises the propanal and silver mirror is produced due to the formation of silver metal.

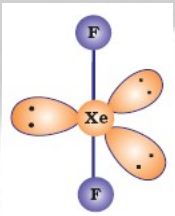
$$CH_3CH_2CHO + [Ag(NH_3)_2]^+ + 3OH^- \longrightarrow CH_3CH_2COO^- + \underset{(\text{mirror})}{2Ag} + 2H_2O + 4NH_3$$

$$CH_3-\overset{\overset{O}{\|}}{C}-CH_3 + [Ag(NH_3)_2]^+ + 3OH^- \longrightarrow \text{No silver mirror}$$

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029

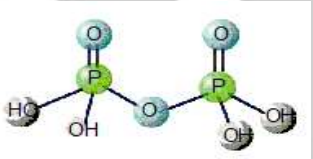
25. (a) Account for the following :
(i) Tendency to show –3 oxidation state decreases from N to Bi in group 15.
(ii) Acidic character increases from H_2O to H_2Te.
(iii) F_2 is more reactive than ClF_3, whereas ClF_3 is more reactive than Cl_2.
(b) Draw the structure of (i) XeF_2, (ii) $H_4P_2O_7$.

Ans. (a)(i) The tendency to exhibit –3 oxidation state decreases down the group due to increase in size and metallic characters.
(ii) Acidic character increases from H_2O to H_2Te because decrease in bond enthalpy for the dissociation of H – E bond down the group.
(iii)F – F bond is weaker than Cl–F bond due to small size and high electron density, more repulsion between fluorine atoms therefore F_2 is more reactive than ClF_3. Where as When we compare to Cl_2, with ClF_3,Cl – Cl bond is stronger than ClF_3. Therefore ClF_3 is more reactive than Cl_2
(b)(i) XeF_2



(a)Linear

(ii) $H_4P_2O_7$



OR

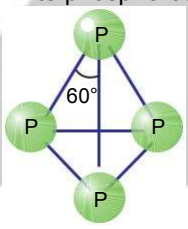
(a) Give one example to show the anomalous reaction of fluorine.
(b) What is the structural difference between white phosphorus and red phosphorus?
(c) What happens when XeF_6 reacts with NaF?
(d) Why is H_2S a better reducing agent than H_2O?
(e) Arrange the following acids in the increasing order of their acidic character :
HF, HCl, HBr and HI

Ans. (a) $2F_2(g) + 2H_2O(l) \rightarrow 4H^+(aq) + 4F^-(aq) + O_2(g)$

$X_2(g) + H_2O(l) \rightarrow HX(aq) + HOX(aq)$

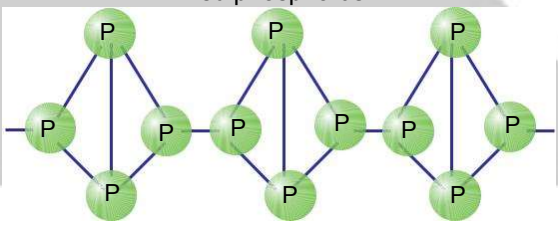
(Where X = Cl or Br)
Fluorine oxidises water to oxygen whereas chlorine and bromine react with water to form corresponding hydrohalic and hypohalous acids.
(b)

White phosphorous



It consists of discrete tetrahedral p_4 molecule

Red phosphorus



It is polymeric, consisting of chain of p_4 tetrahedral linked together

(c) $XeF_6 + NaF \rightarrow Na^+[XeF_7]^-$

(d) In H_2O Bond dissociation enthalpy of O–H is more than S – H bond of H_2S therefore H_2S is better reducing agent than H_2O

(e) $HI > HBr > HCl > HF$

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029

26. (a) The conductivity of 0.001 mol L^{-1} acetic acid is 4.95 ×10^{-5} S cm^{-1}. Calculate the dissociation constant if Λ_m^0 for acetic acid is 390.5 S cm^2 mol^{-1}.

(b) Write Nernst equation for the reaction at 25°C :

$2Al(s) + 3Cu^{2+}(aq) \longrightarrow 2Al^{3+}(aq) + 3Cu(s)$

(d) What are secondary batteries? Give an example.

Ans. (a) $\Lambda_m = \frac{K}{C} = \frac{4.95\times10^{-5}Scm^{-1}}{.001\,mol\,L^{-1}} \times \frac{1000c.m^3}{L} = 4.95\times10Scm^2mol^{-1}$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^0} = \frac{4.95\times10\ Scm^2mol^{-1}}{390.5Scm^2mol^{-1}} = 0.1268$$

$$K_a = \frac{C\alpha^2}{(1-\alpha)} = \frac{0.001\times(.1268)^2}{(1-0.1268)} = \frac{.00001607824}{.8732} = 1.84\times10^{-5}mol\,L^{-1}$$

(b) $2(Al \rightarrow Al^{+3} + 3e)$

$3(Cu^{+2} + 2e \rightarrow Cu)$

$2Al(s) + 3Cu^{2+}(aq) \longrightarrow 2Al^{3+}(aq) + 3Cu(s)$

$$E_{Cell} = E_{Cell}^0 - \frac{2.303\,RT}{nF}\log\frac{\left[Al^{+3}\right]^2}{\left[Cu^{+2}\right]^3} \qquad (T = 298\ K)$$

$$E_{Cell} = E_{Cell}^0 - \frac{0.059}{6}\log\frac{\left[Al^{+3}\right]^2}{\left[Cu^{+2}\right]^3}$$

(c) A secondary cell after use can be recharged by passing current through it in the opposite direction so that it can be used again. The most important secondary cell is the lead storage battery Commonly used in automobiles and invertors. It consists of a lead anode and a grid of lead packed with lead dioxide (PbO_2) as cathode. A 38% solution of sulphuric acid is used as an electrolyte.

The cell reactions when the battery is in use are given below:

Anode: $Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$

Cathode: $PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O(l)$ is:

$Pb(s)+PbO_2(s)+2H_2SO_4(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$

On charging the battery the reaction is reversed and $PbSO_4(s)$ on anode and cathode is converted into Pb and PbO_2, respectively.

OR

(a) Represent the cell in which the following reaction takes place :

$2Al(s) + 3Ni^{2+}(0.1\,M) \longrightarrow 2Al^{3+}(0.01M) + 3Ni(s)$

Calculate its emf if E_{cell}^0 = 1.41 V.

(b) How does molar conductivity vary with increase in concentration for strong electrolyte and weak electrolyte ? How can you obtain limiting molar conductivity $\left(\Lambda_m^0\right)$ for weak electrolyte?

Ans. (a) At Anode $2\left(Al \rightarrow Al^{+3} + 3e\right)$ (oxidation)

(b) At Cathode $3\left(Ni^{+2} + 2e \rightarrow Ni\right)$ (Reduction)

Overall reaction $2Al(s) + 3Ni^{2+} \longrightarrow 2Al^{3+} + 3Ni(s)$

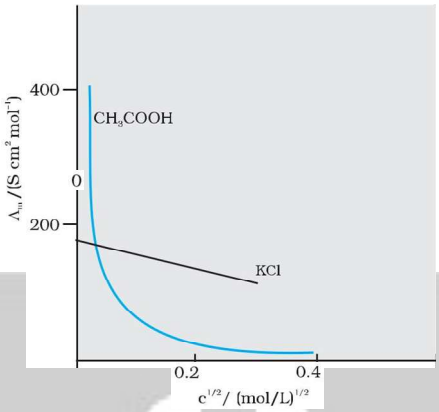
$$E_{Cell}^0 = E_{Cell}^0 - \frac{RT2.303}{nF}\log\frac{\left[Al^{+3}\right]^2}{\left[Ni^{+2}\right]^3}$$

$$= 1.41 - \frac{0.059}{6}\log\frac{(0.01)^2}{(0.1)^3}$$

= 1.41 + 0.01 = 1.42 V

(b) molar conductivity decrease with increase in concentration for strong electrolyte and weak electrolyte.

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | **Email :** pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | **Toll Free :** 1800 258 5555 | **CIN :** U80302RJ2007PLC024029



Molar conductivity versus $c^{½}$ for acetic acid (weak electrolyte) and potassium chloride (strong electrolyte) in aqueous solutions.

The Λ_m^0 for weak electrolytes is obtained by using Kohlrausch law of independent migration of ions. At any concentration c, if α is the degree of dissociation then it can be approximated to the ratio of molar conductivity at the Λ_m concentration c to limiting molar conductivity, Λ_m^0. Thus we have:

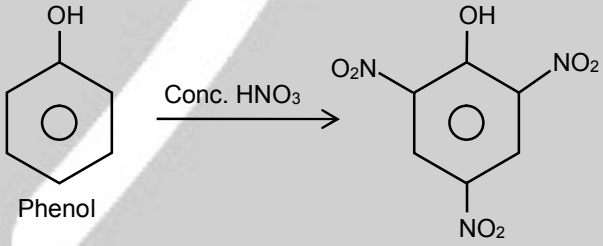
$$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$$

But we know that for a weak electrolyte like acetic acid

$$K_a = \frac{C\alpha^2}{(1-\alpha)} = \frac{C\Lambda_m^{\,2}}{\Lambda_m^{0\,2}\left(1-\frac{\Lambda_m}{\Lambda_m^0}\right)} = \frac{C\Lambda_m^2}{\Lambda_m^0(\Lambda_m^0-\Lambda_m)}$$

27. (a) Give equations of the following reactions :
(i) Phenol is treated with conc. HNO_3.
(ii) Propene is treated with B_2H_6 followed by H_2O_2/OH^-.
(iii) Sodium t – butoxide is treated with CH_3Cl.
(b) How will you distinguish between butan -1- ol and butan – 2 – ol ?
(c) Arrange the following in increasing order of acidity :
Phenol, ethanol, water

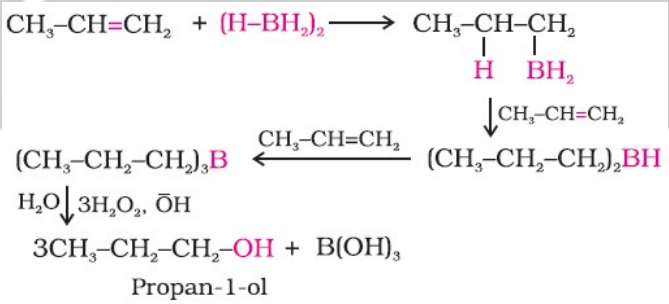
Ans. (i)



Phenol

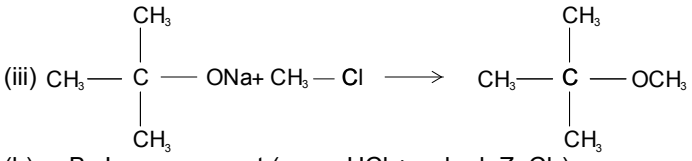
2, 4, 6-trinitro phenol

(ii)



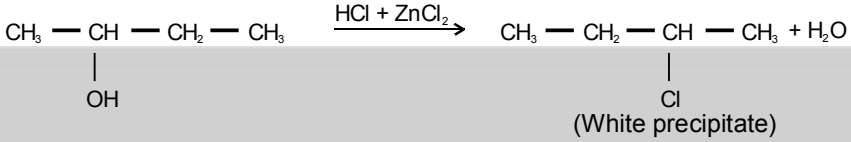
Propan-1-ol

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029

(iii) 

(b) By Lucas reagent (conc. HCl + anhyd. $ZnCl_2$)

$CH_3 - CH_2 - CH_2 - CH_2 - OH \xrightarrow{HCl+ZnCl_2} No\ reaction$



(White precipitate)

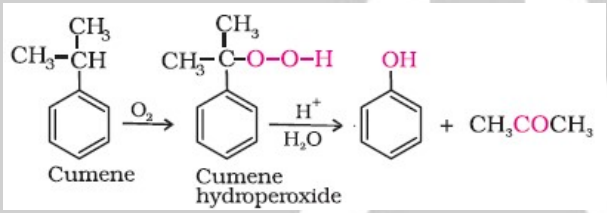
(c) ethanol < Water < phenol

OR

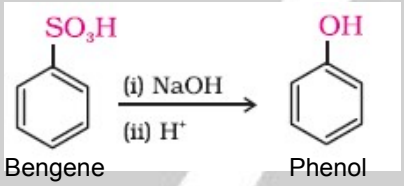
(a) How can you obtain Phenol from (i) Cumene, (ii) Benzene sulphonic acid, (iii) Benzene diazonium chloride ?

(b) Write the structure of the major product obtained from dinitration of 3- methylphenol.

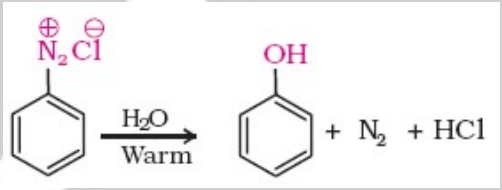
(c) Write the reaction involved in Kolbe's reaction.

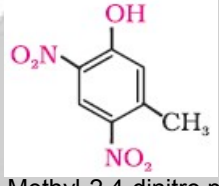
Ans. (a) (i) 

Cumene — Cumene hydroperoxide

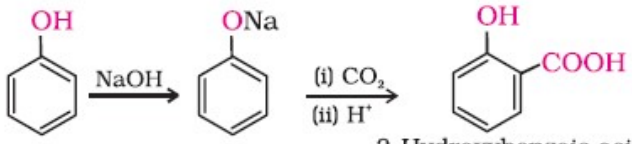
(ii) 

Bengene sulphonic acid — Phenol

(iii) 

(b) 

5-Methyl-2,4-dinitro phenol

(c) 

2-Hydroxybenzoic acid (Salicylic acid)

Resonance® Educating for better tomorrow
Corporate Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
PSPD OFFICE: C-392, Talwandi, Kota. (Raj.) - 324005
Website: www.pspd.resonance.ac.in | Email : pspd@resonance.ac.in
Contact : 7728890127, 9529123415 | Toll Free : 1800 258 5555 | CIN : U80302RJ2007PLC024029