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Headingwise Public Examination Question Paper Analysis

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	Total Marks	**–**	**37/70**	**–**	**29/70**	**–**	**30/70**

UNIT-1: METALLURGY

EVALUATION

Choose the Best Answer

1. Bauxite has the composition
   (a) Al_2O_3 (b) $Al_2O_3.nH_2O$ (c) $Fe_2O_3.2H_2O$ (d) None of these
   Ans: (b) $Al_2O_3.nH_2O$
2. Roasting of sulphide ore gives the gas (A). (A) is a colourless gas. Aqueous solution of (A) is acidic. The gas (A) is
   (a) CO_2 (b) SO_3 (c) SO_2 (d) H_2S
   Ans: (c) SO_2
3. Which one of the following reaction represents calcinations?
   (a) $2Zn + O_2 \rightarrow 2ZnO$ (b) $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$
   (c) $MgCO_3 \rightarrow MgO + CO_2$ (d) Both (a) and (c)
   Ans: (c) $MgCO_3 \rightarrow MgO + CO_2$
4. The metal oxide which cannot be reduced to metal by carbon is
   (a) PbO (b) Al_2O_3 (c) ZnO (d) FeO
   Ans: (b) Al_2O_3
5. Which of the metal is extracted by Hall-Heroult process?
   (a) Al (b) Ni (c) Cu (d) Zn
   Ans: (a) Al
6. Which of the following statements, about the advantage of roasting of sulphide ore before reduction is not true?
   (a) ΔG_f^0 of sulphide is greater than those for CS_2 and H_2S
   (b) ΔG_r^0 is negative for roasting of sulphide ore to oxide
   (c) Roasting of the sulphide to its oxide is thermodynamically feasible.
   (d) Carbon and hydrogen are suitable reducing agents for metal sulphides.

   Ans: (d) Carbon and hydrogen are suitable reducing agents for metal sulphides

7. Match items in column - I with the items of column - II and assign the correct code.

Column-I		Column-II	
A	Cyanide process	(i)	Ultrapure Ge
B	Froth floatation process	(ii)	Dressing of ZnS
C	Electrolytic reduction	(iii)	Extraction of Al
D	Zone refining	(iv)	Extraction of Au
		(v)	Purification of Ni

	A	B	C	B
(a)	(i)	(ii)	(iii)	(iv)
(b)	(iii)	(iv)	(v)	(i)
(c)	(iv)	(ii)	(iii)	(i)
(d)	(ii)	(iii)	(i)	(v)

Ans: (c) A-iv, B-ii, C-iii, D-i

8. Wolframite ore is separated from tinstone by the process of ***(PTA MQ, MAR 20)***

(a) Smeting (b) Calcination
(c) Roasting (d) Electromagnetic separation

Ans: (d) Electromagnetic separation

9. Which one of the following is not feasible?

(a) $Zn_{(s)} + Cu^{2+}_{(aq)} \rightarrow Cu_{(s)} + Zn^{2+}_{(aq)}$
(b) $Cu_{(s)} + Zn^{2+}_{(aq)} \rightarrow Zn_{(s)} + Cu^{2+}_{(aq)}$
(c) $Cu_{(s)} + 2Ag^{+}_{(aq)} \rightarrow Ag_{(s)} + Cu^{2+}_{(aq)}$
(d) $Fe_{(s)} + Cu^{2+}_{(aq)} \rightarrow Cu_{(s)} + Fe^{2+}_{(aq)}$

Ans: (b) $Cu_{(s)} + Zn^{2+}_{(aq)} \rightarrow Zn_{(s)} + Cu^{2+}_{(aq)}$

10. Electrochemical process is used to extract

(a) Iron (b) Lead (c) Sodium (d) silver

Ans: (c) Sodium

11. Flux is a substance which is used to convert
(a) Mineral into silicate
(b) Infusible impurities to soluble impurities
(c) Soluble impurities to infusible impurities (d) All of these

Ans: (b) Infusible impurities to soluble impurities

12. Which one the following ores is best concentrated by froth – floatation method?
(a) Magnetite (b) Hematite (c) Galena (d) Cassiterite

Ans: (c) Galena

13. In the extraction of aluminium from alumina by electrolysis, cryolite is added to
(a) Lower the melting point of alumina
(b) Remove impurities from alumina
(c) Decrease the electrical conductivity
(d) Increases the rate of reduction

Ans: (a) Lower the melting point of alumina

14. Zinc is obtained from ZnO by
(a) Carbon reduction (b) Reduction using silver
(c) Electrochemical process (d) Acid leaching

Ans: (a) Carbon reduction

15. Extraction of gold and silver involves leaching with cyanide ion. Silver is later recovered by ***(NEET-2017 Corona 20)***
(a) Distillation (b) Zone refining
(c) Displacement with zinc (d) liquation

Ans: (c) Displacement with zinc

16. Considering Ellingham diagram, which of the following metals can be used to reduce alumina? ***(NEET-2018)***
(a) Fe (b) Cu (c) Mg (d) Zn

Ans: (c) Mg

17. The following set of reactions are used in refining Zirconium

$Zr\ (impure) + 2I_2 \xrightarrow{523K} ZrI_4$ This method is known is

$ZrI_4 \xrightarrow{1800K} Zr(pure) + 2I_2$

(a) Liquation (b) van Arkel process

(c) zone refining (d) Mond's process

Ans: (b) van Arkel process

18. Which of the following is used for concentrating ore in metallurgy?

(a) Leaching (b) Roasting

(c) Froth floatation (d) Both (a) and (c)

Ans: (d) Both (a) and (c)

19. This incorrect statement among the following is ***(Sep-20)***

(a) Nickel is refined by Mond's process

(b) Titanium is refined by Van Arkel's process

(c) Zinc blende is concentrated by froth floatation

(d) In the metallurgy of gold, the metal is leached with dilute sodium chloride solution

Ans: (d) In the metallurgy of gold, the metal is leached with dilute sodium chloride solution

20. In the electrolytic refining of copper, which one of the following is used as anode?

(a) Pure copper (b) Impure copper

(c) Carbon rod (d) Platinum electrode

Ans: (b) Impure copper

21. Which of the following plot gives Ellingham diagram?

(a) ΔS Vs T (b) ΔG^0 Vs T (c) ΔG^0 Vs $\frac{1}{T}$ (d) ΔG^0 Vs T^2

Ans: (b) ΔG^0 Vs T

22. In the Ellingham diagram, for the formation of carbon monoxide

(a) $\left(\frac{\Delta S^0}{\Delta T}\right)$ is negative (b) $\left(\frac{\Delta G^0}{\Delta T}\right)$ is positive

(c) $\left(\frac{\Delta G^0}{\Delta T}\right)$ is negative

(d) initially $\left(\frac{\Delta T}{\Delta G^0}\right)$ is positive, after 700^0C, $\left(\frac{\Delta G^0}{\Delta T}\right)$ is negative

Ans: (c) $\left(\frac{\Delta G^0}{\Delta T}\right)$ is negative

23. Which of the following reduction is not thermodynamically feasible?

(a) $Cr_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Cr$

(b) $Al_2O_3 + 2Cr \longrightarrow Cr_2O_3 + 2Al$

(c) $3TiO_2 + 4Al \longrightarrow 2Al_2O_3 + 3Ti$ (d) none of these

Ans: (b) $Al_2O_3 + 2Cr \longrightarrow Cr_2O_3 + 2Al$

24. Which of the following is not true with respect to Ellingham diagram?

(a) Free energy, changes follow a straight line. Deviation occurs when there is a phase change.

(b) The graph for the formation of CO_2 is a straight line almost parallel to free energy axis.

(c) Negative slope of CO shows that it becomes more stable with increase in temperature.

(d) Positive slope of metal oxides shows that their stabilities decrease with increase in temperature.

Ans: (b) The graph for the formation of CO_2 is a straight line almost parallel to free energy axis

UNIT-2: p-BLOCK ELEMENTS-I

EVALUATION

Choose the Best Answer

1. An aqueous solution of borax is
(a) neutral (b) acidic (c) basic (d) amphoteric

Ans: (c) basic

Solution:

$$Na_2B_4O_7 + 7H_2O \rightleftharpoons 2NaOH + 4H_3BO_3$$

Strong base Weak acid

2. Boric acid is an acid because its molecule. ***(NEET)***
(a) contains replaceable H^+ ion (b) gives up a proton
(c) combines with proton to form water molecule
(d) accepts OH^- from water, releasing proton.

Ans: (d) accepts OH^- from water, releasing proton

Solution: $B(OH)_3 + H_2O \rightleftharpoons [B(OH)_4] + H^+$

3. Which among the following is not a borane?
(a) B_2H_6 (b) B_3H_6 (c) B_4H_{10} (d) none of these

Ans: (b) B_3H_6

Solution:

Nido borane: B_aH_{4-n}

Aracno borane: B_nH_{6-n}

4. Which of the following metals has the largest abundance in the earth's crust?
(a) Aluminium (b) calcium (c) Magnesium (d) Sodium

Ans: (a) Aluminium

5. In diborane, the number of electrons that accounts for banana bonds is
(a) Six (b) two (c) four (d) three

Ans: (c) four

Solution:

There are two 3c – 2e bounds i.e., the bonding in the bridges account for 4 electrons.

6. The element that does not show catenation among the following p-block elements is

(a) Carbon (b) silicon (c) Lead (d) germanium

Ans: (c) Lead

7. Carbon atoms in fullerene with formula C_{60} have

(a) sp^3 hybidised (b) sp hybridised (c) sp^2 hybridised (d) partially sp^2 and partially sp^3 hybridised

Ans: (c) sp^2 hybridised

8. Oxidation state of carbon in its hydrides

(a) +4 (b) -4 (c) +3 (d) +2

Ans: (a) +4

Solution:

CH_4 in which the oxidation state of carbon is +4

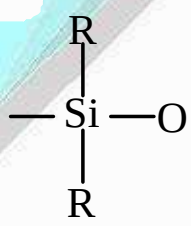
9. The basic structural unit of silicates is ***(NEET), (PTA MQ)***

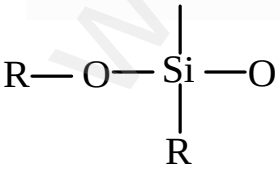
(a) $(SiO_3)^{2-}$ (b) $(SiO_4)^{2-}$ (c) $(SiO)^-$ (d) $(SiO_4)^{4-}$

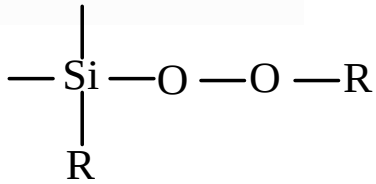
Ans: (d) $(SiO_4)^{4-}$

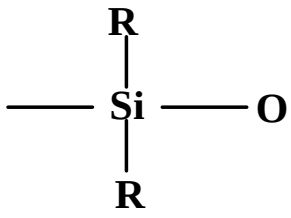
10. The repeating unit in silicone is

(a) SiO_2

(b)


(c)


(d)


Ans: (b)


11. Which of these is not a monomer for a high molecular mass silicone polymer?
(a) Me_3SiCl (b) $PhSiCl_3$ (c) $MeSiCl_3$ (d) Me_2SiCl_2

Ans: (a) Me_3SiCl

12. Which of the following is not sp^2 hybridised?
(a) Graphite (b) Graphene (c) Fullerene (d) Dry ice

Ans: (d) Dry ice

13. The geometry at which carbon atom in diamond are bonded to each other is
(a) Tetrahedral (b) hexagonal (c) Octahedral (d) none of these

Ans: (a) Tetrahedral

14. Which of the following statements is not correct?
(a) Beryl is a cyclic silicate (b) Mg_2SiO_4 is an orthosilicate
(c) SiO_4^{4-} is the basic structural unit of silicates
(d) Feldspar is not aluminosilicate

Ans: (d) Feldspar is not aluminosilicate

15. Match items in column-I with the items of column-II and assign the correct code.

Column-I		Column-II	
A	Borazole	1	$B(OH)_3$
B	Boric acid	2	$B_3N_3H_6$
C	Quartz	3	$Na_2[B_4O_5(OH)_4]8H_2O$
D	Borax	4	SiO_2

	A	B	C	D
(a)	2	1	4	3
(b)	1	2	4	3
(c)	1	2	4	3
(d)	None of these			

Ans: (a) A-2, B-1, C-4, D-3

16. Duralumin is an alloy of
(a) Cu, Mn (b) Cu, Al, Mg (c) Al, Mn (d) Al, Cu, Mn, Mg

Ans: (d) Al, Cu, Mn, Mg

Solution: Al-95%, Cu-4%, Mn-0.5%, Mn – 0.5%

17. The compound that is used in nuclear reactors as protective shields and control rods is
(a) Metal borides (b) metal oxides
(c) Metal carbonates (d) metal carbide

Ans: (a) Metal borides

18. The stability of +1 oxidation state increases in the sequence
(a) A*l* < Ga < In < T*l* (b) T*l* > In < Ga < A*l*
(c) In < T*l* < Ga < A*l* (d) Ga < In < A*l* < T*l*

Ans: (a) A*l* < Ga < In < T*l*

Solution:
Stability of +1 oxidation state decreases down the group due to inert pair effect.

UNIT - 3: p-BLOCK ELEMENTS-II

EVALUATION

Choose the Best Answer

1. In which of the following, NH_3 is not used?
(a) Nessler's reagent
(b) Reagent for the analysis of IV group basic radical
(c) Reagent for the analysis of III group basic radical
(d) Tollen's reagent

Ans: (a) Nessler's reagent

2. Which is true regarding nitrogen?
(a) Least electronegative element
(b) has low ionisation enthalpy than oxygen

(c) d-orbitals available

(d) ability to form pπ-pπ bonds with itself

Ans: (d) ability to form pπ-pπ bonds with itself

3. An element belongs to group 15 and 3rd period of the periodic table, its electronic configuration would be

(a) $1s^2\ 2s^2\ 2p^4$ (b) $1s^2\ 2s^2\ 2p^3$

(c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$ (d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

Ans: (d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

4. Solid (A) reacts with strong aqueous NaOH liberating a foul smelling gas (B) which spontaneously burn in air giving smoky rings. A and B are respectively.

(a) P_4(red) and PH_3 (b) P_4(white) and PH_3

(c) S_8 and H_2S (d) P_4(white) and H_2S

Ans: (b) P_4(white) and PH_3

5. In the brown ring test, brown colour of the ring is due to

(a) a mixture of NO and NO_2 (b) Nitroso ferrous sulphate

(c) Ferous nitrate (d) Ferric nitrate

Ans: (b) Nitroso ferrous sulphate

6. On hydrolysis, PCl_3 gives

(a) H_3PO_3 (b) PH_3 (c) H_3PO_4 (d) $POCl_3$

Ans: (a) H_3PO_3

7. P_4O_6 reacts with cold water to give

(a) H_3PO_3 (b) $H_4P_2O_7$ (c) HPO_3 (d) H_3PO_4

Ans: (a) H_3PO_3

8. The basicity of pyrophosphorous acid ($H_4P_2O_5$) is

(a) 4 (b) 2 (c) 3 (d) 5

Ans: (b) 2

9. The molarity of given orthophosphoric acid solution is 2M. Its normality is

(a) 6N (b) 4N (c) 2N (d) none of these

Ans: (a) 6N

10. **Assertion :** Bond dissociation energy of fluorine is greater than chlorine gas.
Reason : Chlorine has more electronic repulsion than fluorine.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true and reason is the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.
Ans: (d) Both assertion and reason are false

11. Among the following, which is the strongest oxidizing agent?
(a) Cl_2 (b) F_2 (c) Br_2 (d) I_2
Ans: (b) F_2

12. The correct order of the thermal stability of hydrogen halide is ***(PTA MQ)***
(a) HI > HBr > HCl > HF (b) HF > HCl > HBr > HI
(c) HCl > HF > HBr > HI (d) HI > HCl > HF > HBr
Ans: (b) HF > HCl > HBr > HI

13. Which one of the following compounds is not formed?
(a) $XeOF_4$ (b) XeO_3 (c) XeF_2 (d) NeF_2
Ans: (d) NeF_2

14. Most easily liquefiable gas is
(a) Ar (b) Ne (c) He (d) Kr
Ans: (c) He

15. XeF_6 on complete hydrolysis produces
(a) $XeOF_4$ (b) XeO_2F_2 (c) XeO_3 (d) XeO_2
Ans: (c) XeO_3

16. On oxidation with iodine, sulphite ion is transformed to
(a) $S_4O_6^{2-}$ (b) $S_2O_6^{2-}$ (c) SO_4^{2-} (d) SO_3^{2-}
Ans: (c) SO_4^{2-}

17. Which of the following is strongest acid among all?
(a) HI (b) HF (c) HBr (d) HCl

Ans: (a) HI

18. Which one of the following orders is correct for the bond dissociation enthalpy of halogen molecules? ***(NEET)***
(a) $Br_2 > I_2 > F_2 > Cl_2$ (b) $F_2 > Cl_2 > Br_2 > l_2$
(c) $I_2 > Br_2 > Cl_2 > F_2$ (d) $Cl_2 > Br_2 > F_2 > I_2$

Ans: (d) $Cl_2 > Br_2 > F_2 > I_2$

19. Among the following the correct order of acidity is ***(NEET)***
(a) $HClO_2 < HClO < HClO_3 < HClO_4$
(b) $HClO_4 < HClO_2 < HClO < HClO_3$
(c) $HClO_3 < HClO_4 < HClO_2 < HClO$
(d) $HClO < HClO_2 < HClO_3 < HClO_4$

Ans: (d) $HClO < HClO_2 < HClO_3 < HClO_4$

20. When copper is heated with conc. HNO_3 it produces
(a) $Cu(NO_3)_2$, NO and NO_2 (b) $Cu(NO_3)_2$ and N_2 O
(c) $Cu(NO_3)_2$ and NO_2 (d) $Cu(NO_3)_2$ and NO

Ans: (c) $Cu(NO_3)_2$ and NO_2

UNIT - 4: TRANSITION AND INNER TRANSITION ELEMENTS

EVALUATION

Choose the Best Answer

1. Sc (Z = 21) is a transition element but Zinc (Z = 30) is not because
(a) both Sc^{3+} and Zn^{2+} ions are colourless and form white compounds.
(b) in case of Sc, 3d orbital partially filled but in Zn these are completely filled.

(c) last electron as assumed to be added to 4s level in case of zinc.

(d) both Sc and Zn do not exhibit variable oxidation states.

Ans: (b) in case of Sc, 3d orbital are partially filled but in Zn these are completely filled

2. Which of the following d block element has half filled penultimate d sub shell as well as half filled valence sub shell?

(a) Cr (b) Pd (c) Pt (d) none of these

Ans: (a) Cr

3. Among the transition metals of 3d series, the one that has highest negative $\left(M^{2+}/M\right)$

(a) Ti (b) Cu (c) Mn (d) Zn

Ans: (a) Ti

4. Which one of the following ions has the same number of unpaired electrons as present in V^{3+}?

(a) Ti^{3+} (b) Fe^{3+} (c) Ni^{2+} (d) Cr^{3+}

Ans: (c) Ni^{2+}

5. The magnetic moment of Mn^{2+} ion is

(a) 5.92BM (b) 2.80BM (c) 8.95BM (d) 3.90BM

Ans: (a) 5.92BM

Solution:

$Mn^{2+} \Rightarrow 3d^5$ contains 5 unpaired electrons

n = 5; $\mu = \sqrt{n(n+2)}BM$

$\mu = \sqrt{5(5+2)} = \sqrt{35} = 5.92$ BM

6. The catalytic behaviour of transition metals and their compounds is ascribed mainly due to

(a) their magnetic behaviour (b) their unfilled d orbitals

(c) their ability to adopt variable oxidation states

(d) their chemical reactivity

Ans: (c) their ability to adopt variable oxidation states

7. The correct order of increasing oxidizing power in the series

(a) $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$ (b) $Cr_2O_7^{2-} < VO_2^+ < MnO_4^-$

(c) $Cr_2O_7^{2-} < MnO_4^- < VO_2^+$ (d) $MnO_4^- < Cr_2O_7^{2-} < VO_2^+$

Ans: (a) $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$

Solution: $\overset{+5}{V}O_2^+ < \overset{+6}{Cr}_2O_1^{2-} < \overset{+7}{Mn}O_4^-$ greater the oxidation state, higher is the oxidising power.

8. In acid medium, potassium permanganate oxidizes oxalic acid to

(a) Oxalate (b) Carbon dioxide (c) acetate (d) acetic acid

Ans: (b) Carbon dioxide

Solution:

$$5(COO)_2^{2-} + 2MNO_4^- + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 \uparrow + 8H_2O$$

9. Which of the following statements is not true?

(a) on passing H_2S, through acidified $K_2Cr_2O_7$ solution, a milky colour is observed.

(b) $Na_2Cr_2O_7$ is preferred over $K_2Cr_2O_7$ in volumetric analysis.

(c) $K_2Cr_2O_7$ solution in acidic medium is orange in colour.

(d) $K_2Cr_2O_7$ solution becomes yellow on increasing the P^H beyond 7.

Ans: (b) $Na_2Cr_2O_7$ is preferred over $K_2Cr_2O_7$ in volumetric analysis

10. Permanganate ion changes to ..... in acidic medium

(a) MnO_4^{2-} (b) Mn^{2+} (c) Mn^{3+} (d) MnO_2

Ans: (b) Mn^{2+}

Solution: $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

11. How many moles of I_2 are liberated when 1 mole of potassium dichromate react with potassium iodide?

(a) 1 (b) 2 (c) 3 (d) 4

Ans: (c) 3

Solution:

$$K_2Cr_2O_7 + 6KI + 7H_2SO_4 \longrightarrow 4K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3I_2$$

12. The number of moles of acidified $KMnO_4$ required to oxidize 1 mole of ferrous oxalate (FeC_2O_4) is

(a) 5 (b) 3 (c) 0.6 (d) 1.5

Ans: (c) 0.6

Solution:

$$\overset{7+}{Mn}O_4^- + Fe\overset{+2\ +3}{C}_2O_4 \longrightarrow Mn^{2+} + Fe^{3+} + 2\overset{+4}{C}O$$

$5e^-$ accept $3e^-$ release

5 moles of $FeC_2O_4 \equiv 3$ moles of $KMnO_4$

1 mole of $FeC_2O_4 \equiv \left(\frac{3}{5}\right)$ moles of $KMnO_4$

1 mole of $FeC_2O_4 \equiv 0.6$ moles of $KMnO_4$

13. Which one of the following statements related to lanthanons is incorrect?

(a) Europium shows +2 oxidation state.

(b) The basicity decreases as the ionic radius decreases from Pr to Lu.

(c) All the lanthanons are much more reactive than aluminium.

(d) Ce^{4+} solutions are widely used as oxidising agents in volumetric analysis.

Ans: (c) All the lanthanons are much more reactive than aluminium

Solution:

As we move from La to Lu, their metallic behaviour because almost similar to that of aluminium.

14. Which of the following lanthanoid ions is diamagnetic?

(a) Eu^{2+} (b) Yb^{2+} (c) Ce^{2+} (d) Sm^{2+}

Ans: (b) Yb^{2+}

Solution:

Yb^{2+} - $4f^{14}$ – no unpaired electrons – diamagnetic

15. Which of the following oxidation states is most common among the lanthanoids?
(a) 4 (b) 2 (c) 5 (d) 3

Ans: (d) 3

16. **Assertion :** Ce^{4+} is used as an oxidizing agent in volumetric analysis.
Reason : Ce^{4+} has the tendency of attaining +3 oxidation state.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

Ans: (a) Both assertion and reason are true and reason is the correct explanation of assertion

17. The most common oxidation state of actinoids is ***(PTA MQ)***
(a) +2 (b) +3 (c) +4 (d) +6

Ans: (c) +3

18. The actinoid elements which show the highest oxidation state of +7 are
(a) Np, Pu, Am (b) U, Fm, Th (c) U, Th, Md (d) Es, No, Lr

Ans: (a) Np, Pu, Am

19. Which one of the following is not correct? ***(PTA MQ)***
(a) $La(OH)_3$ is less basic than $Lu(OH)_3$
(b) In lanthanoid series ionic radius of Ln^{3+} ions decreases
(c) La is actually an element of transition metal series rather than lanthanide series
(d) Atomic radii of Zr and Hf are same because of lanthanide contraction.

Ans: (a) $La(OH)_3$ is less basic than $Lu(OH)_3$

UNIT - 5: COORDINATION CHEMISTRY

EVALUATION

Choose the Best Answer

1. The sum of primary valency and secondary valency of the metal M in the complex $[M(en)_2(Ox)]Cl$ is

(a) 3 (b) 6 (c) -3 (d) 9

Ans: (d) 9

Solution:

In the complex $[N(en)_2(Ox)]Cl$ For the central metal ion M^{3+}

The primary valance is = + 3

The secondary valance = 6

Sum of primary valance and secondary valance = 3 + 6 = 9

2. An excess of silver nitrate is added to 100 ml of a 0.01 M solution of pentaaquachloridochromium (III) chloride. The number of moles of AgCl precipitated would be

(a) 0.02 (b) 0.002 (c) 0.01 (d) 0.2

Ans: (b) 0.002

Solution: The complex is $[M(H_2O)_5Cl]Cl_2$

1000 ml of 1M solution of the complex gives 2 moles of Cl^- ions

100 ml of 0.01 M solution of the complex will give

$$\frac{2Cl^- \times 100ml \times 0.01m}{1000\ ml \times 1M} = 0.02 \text{ moles of } Cl^- \text{ ions}$$

3. A complex has a molecular formula $MSO_4Cl.6H_2O$. The aqueous solution of it gives white precipitate with Barium chloride solution and no precipitate is obtained when it is treated with silver nitrate solution. If the secondary valancy of the metal is six, which one of the following correctly represents the complex?

(a) $[M(H_2O)_4Cl]SO_4.2H_2O$ (b) $[M(H_2O)_6]SO_4$

(c) $[M(H_2O)_5Cl]SO_4.H_2O$ (d) $[M(H_2O)_3Cl]SO_4.3H_2O$

Ans: (c) $[M(H_2O)_5Cl]SO_4.H_2O$

Solution:

Molecular formula: $MSO_4Cl.6H_2O$

Formation of white precipitate with Barium chloride indicates that SO_4^{2-} ions are outside the coordination sphere, and no precipitate with $AgNO_3$ solution indicates that the Cl^- ions are inside the coordination sphere. Since the coordination number of M is 6, Cl^- and 5 H_2O are ligands, remaining 1 H_2O molecule and SO_4^{2-} are in the outer coordination sphere.

4. Oxidation state of Iron and the charge on the ligand NO in $[Fe(H_2O)_5NO]SO_4$ are

(a) +2 and 0 respectively (b) +3 and 0 respectively

(c) +3 and -1 respectively (d) +1 and +1 respectively

Ans: (d) +1 and +1 respectively

Solution:

$$\left[\overset{+}{F}e(H_2O)_5\overset{+}{N}O\right]^{2+}SO_4^{2-}$$

+1 and +1 respectively.

5. As per IUPAC guidelines, the name of the complex $[Co(en)_2(ONO)Cl]Cl$ is

(a) Chlorobisetylenediaminenitritocobalt(III) chloride

(b) chlorobis(ethane-1,2-diamine)nitro k-Ocobaltate(III) chloride

(c) chloridobis(ethane-1,2-diammine) nitrito k-Ocobalt(II) chloride

(d) chloridobis(ethane-1,2-diamine) nitro k-Ocobalt(III) chloride

Ans: (d) chloridobis(ethane-1,2-diamine) nitro k-Ocobalt(III) chloride

6. IUPAC name of the complex $K_3[Al(C_2O_4)_3]$ is

(a) potassiumtrioxalatoaluminium(III)
(b) potassiumtrioxalatoaluminate(II)
(c) potassiumtrisoxalatoaluminate(III)
(d) potassiumtroixalatoaluminate(III)

Ans: (d) potassiumtroixalatoaluminate(III)

7. A magnetic moment of 1.73BM will be shown by one among the following ***(NEET) Corona-20***

(a) $TiCl_4$ (b) $[CoCl_6]^{4-}$ (c) $[Cu(NH_3)_4]^{2+}$ (d) $[Ni(CN)_4]^{2-}$

Ans: (c) $[Cu(NH_3)_4]^{2+}$

Solution:

Ti^{4+} ($d^{\circ} \Rightarrow 0$ BM)

Co^{2+} (d^7 spin free $t_{2g}^5, e_g^2; n = 3; \mu = 3.9BM$)

Cu^{2+} (d^9 Low spin $\Rightarrow t_{2g}^6, e_g^3; n = 1; \mu = 1.732BM$)

Ni^{2+} (d^8 Low spin $\Rightarrow t_{2g}^6, e_g^3; n = 1; \mu = 2.44BM$)

8. Crystal field stabilization energy for high spin d^5 octahedral complex is

(a) $-0.6\Delta_0$ (b) 0 (c) $2(P-\Delta_0)$ (d) $2(P+\Delta_0)$

Ans: (b) 0

Solution:

The electronic configuration t_{2g}^3, e_g^2

$[3\times(-0.4)+2(0.6)]\Delta_0$

$[-1.2+1.2]\Delta_0 = 0$

9. In which of the following coordination entities the magnitude of Δ_0 will be maximum?

(a) $[Co(CN)_6]^{3-}$ (b) $[Co(C_2O_4)_3]^{3-}$

(c) $[Co(H_2O)_6]^{3+}$ (d) $[Co(NH_3)_6]^{3+}$

Ans: (a) $[Co(CN)_6]^{3-}$

Solution:

In all the complexes, the central metal ion is Co^{3+}, among the given ligands CN^- is the strongest ligand, which causes large crystal field splitting i.e. maximum $\varnothing_0$.

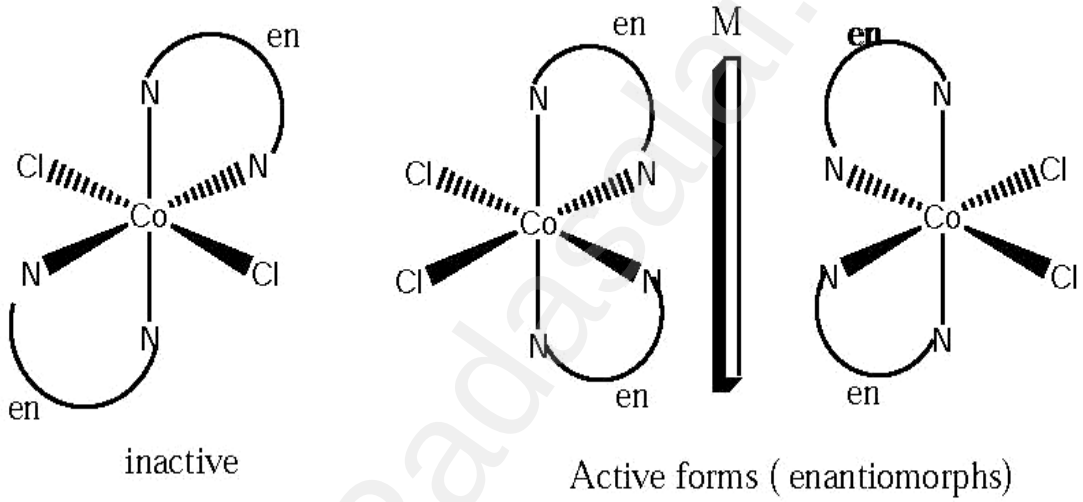
10. Which one of the following will give a pair of enantiomorphs?

(a) $[Cr(NH_3)_6][Co(CN)_6]$ (b) $[Co(en)_2Cl_2]Cl$

(c) $[Pt(NH_3)_4][PtCl_4]$ (d) $[Co(NH_3)_4Cl_2]NO_2$

Ans: (b) $[Co(en)_2Cl_2]Cl$

Solution:



Complexes given in other options (a), (c) and (d) have symmetry elements and hence they are optically inactive.

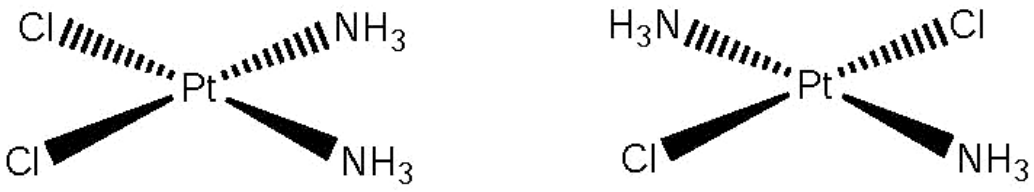
11. Which type of isomerism is exhibited by $[Pt(NH_3)_2Cl_2]$?

(a) Coordination isomerism (b) Linkage isomerism

(c) Optical isomerism (d) Geometrical isomerism

Ans: (d) Geometrical isomerism

Solution:



12. How many geometrical isomers are possible for [Pt(Py)(NH_3)(Br)(Cl)]?

(a) 3 (b) 4 (c) 0 (d) 15

Ans: (a) 3

Solution:

Three isomers. If we consider any one of the ligands as reference (say Py), the arrangement of other three lignads (NH_3, Br and Cl) with respect to (Py) gives three giometrical isomers.

13. Which one of the following pairs represents linkage isomers?

(a) $[Cu(NH_3)_4][PtCl_4]$ and $[Pt(NH_3)_4][CuCl_4]$

(b) $[Co(NH_3)_5(NO_3)]SO_4$ and $[Co(NH_3)_5(ONO)]$

(c) $[Co(NH_3)_4(NCS)_2]Cl$ and $[Co(NH_3)_4(SCN)_2]Cl$

(d) both (b) and (c)

Ans: (c) $[Co(NH_3)_4(NCS)_2]Cl$ and $[Co(NH_3)_4(SCN)_2]Cl$

Solution:

(a) Coordination isomers

(b) No isomerism (different molecular formula)

(c) ←NCS, ← SCN coordinating atom differs: linkage isomers.

14. Which kind of isomerism is possible for a complex $[Co(NH_3)_4Br_2]Cl$? ***(PTA MQ)***

(a) geometrical and ionization (b) geometrical and optical

(c) optical and ionization (d) geometrical only

Ans: (a) geometrical and ionization

Solution:

For $[MA_4B_2]^{n+}$ complexes geometrical isomers possible

$$\left.\begin{matrix}[Co(NH_3)_4Br_2]Cl \\ [Co(NH_3)_4Br\ Cl]Br\end{matrix}\right\} \longrightarrow \text{ionisation isomers}$$

15. Which one of the following complexes is not expected to exhibit isomerism?

(a) $[Ni(NH_3)_4(H_2O)_2]^{2+}$ (b) $[Pt(NH_3)_2Cl_2]$

(c) $[Co(NH_3)_5SO_4]Cl$ (d) $[Fe(en)_3]^{3+}$

Ans: (d) $[Fe(en)_3]^{3+}$

Solution:

Option (a) and (b) – geometrical isomerism is possible

Option (c) – ionization isomerism is possible

Option (d) – no possibility to show either constitutional isomerism or stereo isomerism.

16. A complex in which the oxidation number of the metal is zero is

(a) $K_4[Fe(CN)_6]$ (b) $[Fe(CN)_3(NH_3)_3]$

(c) $[Fe(CO)_5]$ (d) both (b) and (c)

Ans: (c) $[Fe(CO)_5]$

Solution:

(a) Fe^{2+} (b) Fe^{3+} (c) Fe^{0}

17. Formula of tris (ethane-1,2-diamine) iron (II) phosphate

(a) $[Fe(CH_3-CH(NH_2)_2)_3](PO_4)_3$

(b) $[Fe(H_2N-CH_2-CH_2-CH_2-NH_2)_3](PO_4)$

(c) $[Fe(H_2N-CH_2-CH_2-NH_2)_3](PO_4)_2$

(d) $[Fe(H_2N-CH_2-CH_2-NH_2)_3]_3(PO_4)_2$

Ans: (d) $[Fe(H_2N-CH_2-CH_2-NH_2)_3]_3(PO_4)_2$

Solution:

$[Fe(en)_3]^{2+}(PO_4^{3-})$

18. Which of the following is paramagnetic in nature? ***(PTA MQ)***

(a) $[Zn(NH_3)_4]^{2+}$ (b) $[Co(NH_3)_6]^{3+}$

(c) $[Ni(H_2O)_6]^{2+}$ (d) $[Ni(CN)_4]^{2-}$

Ans: (c) $[Ni(H_2O)_6]^{2+}$

Solution:

(a) $Zn^{2+}\left(d^{10} \Rightarrow \text{diamagnetic}\right)$

(b) $Co^{3+}\left(d^6 \text{Low spin} \Rightarrow t_{2g}^6, e_g^0; \text{diamagnetic}\right)$

(c) $Ni^{2+}\left(d^8 \text{ Low spin} \Rightarrow t_{2g}^6, e_g^2; \text{paramagnetic}\right)$

(d) $[Ni(CN)_4]^{2-}\left(dsp^2; \text{square planar, diamagnetic}\right)$

19. Fac-mer isomerism is shown by ***(Sep-20)***

(a) $[Co(en)_3]^{3+}$ (b) $[Co(NH_3)_4(Cl)_2]^{+}$

(c) $[Co(NH_3)_3(Cl)_3]$ (d) $[Co(NH_3)_5Cl]SO_4$

Ans: (c) $[Co(NH_3)_3(Cl)_3]$

20. Choose the correct statement.

(a) Square planar complexes are more stable than octahedral complexes.

(b) The spin only magnetic moment of $[Cu(Cl)_4]^{2-}$ is 1.732 BM and it has square planar structure.

(c) Crystal field splitting energy (Δ_0) of $[FeF_6]^{4-}$ is higher than the (Δ_0) of $[Fe(CN)_6]^{4-}$.

(d) Crystal field stabilization energy of $[V(H_2O)_6]^{2+}$ is higher than the crystal field stabilization of $[Ti(H_2O)_6]^{2+}$.

Ans: (d) crystal field stabilization energy of $[V(H_2O)_6]^{2+}$ is higher than the crystal field stabilization of $[Ti(H_2O)_6]^{2+}$

Solution:

$V^{2+}\left(t_{2g}^3, e_g^0; CFSE = 3\times(-0.4)\Delta_0 = 1.2\Delta_0\right)$

$Ti^{2+}\left(t_{2g}^2, e_g^0; CFSE = 2\times(-0.4)\Delta_0 = -0.8\Delta_0\right)$

Statements given in option (a), (b), and (c) are wrong.

The current statements are

(a) since, the crystal field stabilization in more octahedral field, octahedral complexes are more stable than square planar complexes

(b) $[FeF_6]^{4-} - \begin{bmatrix} Fe^{2+} - d^6 \text{High Spin} - t_{2g}^4, e_g^2 \\ CFSE = 4\times(-0.4) + (0.6)\times 2 + P \end{bmatrix}$

UNIT – 6: SOLID STATE

EVALUATION

Choose the Best Answer

1. Graphite and diamond are

(a) covalent and molecular crystals (b) ionic and covalent crystals

(c) both covalent crystals (d) both molecular crystals

Ans: (c) both covalent crystals

2. An ionic compound $A_x B_y$ crystallizes in fcc type crystal structure with B ions at the centre of each face and A ion occupying centre of the cube the correct formula of $A_x B_y$

(a) AB (b) AB_3 (c) A_3B (d) $A_8 B_6$

Ans: (b) AB_3

Solution:

Number of A ions = $\left(\frac{N_c}{8}\right) = \left(\frac{8}{8}\right) = 1$

Number of B ions = $\left(\frac{N_f}{8}\right) = \left(\frac{6}{2}\right) = 3$

Simplest formula AB_3

3. The ratio of close packed atoms to tetrahedral hole in cubic packing is

(a) 1:1 (b) 1:2 (c) 2:1 (d) 1:4

Ans: (b) 1:2

Solution:

If number of close packed atoms = N; then,

The number of Tetrahedral holes formed = 2N

Number of Octahedral holes formed = N

Therefore N: 2N = 1:2

4. Solid CO_2 is an example of

(a) Covalent solid (b) metallic solid

(c) molecular solid (d) ionic solid

Ans: (c) molecular solid

Solution:

Lattice points are occupied by CO_2 molecules.

5. **Assertion :** monoclinic sulphur is an example of monoclinic crystal system.

Reason : for a monoclinic system, $a \neq b \neq c$ and $\alpha = \gamma = 90°$, $\beta \neq 90°$.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

Ans: (a) Both assertion and reason are true and reason is the correct explanation of assertion.

6. In calcium fluoride, having the fluorite structure the coordination number of Ca^{2+} ion and F^- ion are ***(NEET)***

(a) 4 and 2 (b) 6 and 6 (c) 8 and 4 (d) 4 and 8

Ans: (c) 8 and 4

Solution:

CaF_2 has cubical close packed arrangement.

Ca^{2+} Ions are in face centered cubic arrangement, each Ca^{2+} ions is surrounded by $8F^-$ ions and each F^- ion is surrounded by 4 Ca^{2+} ions.

Therefore coordination number of Ca^{2+} is 8 and of F^- is 4.

7. The number of unit cells in 8gm of an element X (atomic mass 40) which crystallizes in bcc pattern is (N_A is the Avogadro number)

(a) 6.023×10^{23} (b) 6.023×10^{22}

(c) 60.23×10^{23} (d) $\left(\frac{6.023\times10^{23}}{8\times40}\right)$

Ans: (b) 6.023×10^{22}

Solution:

In bcc unit cell,

2 atoms ≡ 1 unit cell

Number of atoms in 8 g of element is,

$$\text{Number of moles} = \frac{8\text{ g}}{40\text{ g mol}^{-1}} = 0.2\text{ mol}$$

1 mole contains 6.023×10^{23} atoms

0.2 mole contains $0.2 \times 6.023 \times 10^{23}$ atoms

0.2 mole contains $0.2 \times 6.023 \times 10^{23}$

$$\left(\frac{1\text{ unit cell}}{2\text{ atoms}}\right)\times0.2\times6.023\times10^{23}$$

6.023×10^{22} unit cells

8. In a solid atom M occupies ccp lattice and $\left(\frac{1}{3}\right)$ of tetrahedral voids are occupied by atom N. Find the formula of solid formed by M and N.

(a) MN (b) M_3N (c) MN_3 (d) M_3N_2

Ans: (d) M_3N_2

Solution:

If the total number of M atoms is n, then the number of tetrahedral voids = 2n given that $\left(\frac{1}{3}\right)^{rd}$ of tetrahedral voids are occupied i.e., $\left(\frac{1}{3}\right)\times 2n$ are occupied by N atoms.

$\therefore$ M: N $\Rightarrow$ n: $\left(\frac{2}{3}\right)$n

1: $\left(\frac{2}{3}\right)$

3: 2 $\Rightarrow$ M_3 N_2

9. The ionic radii of A^+ and B^- are 0.98×10^{-10} m and 1.81×10^{-10} m. The coordination number of each ion in AB is

(a) 8 (b) 2 (c) 6 (d) 4

Ans: (c) 6

Solution:

$$\frac{r_{c^+}}{r_{A^-}}=\frac{0.98\times10^{-10}}{1.81\times10^{-10}}=0.54$$

It is in the range of 0.414 - 0.732, hence the coordination number of each ion is 6.

10. CsCl has bcc arrangement, its unit cell edge length is 400pm, its inter atomic distance

(a) 400pm (b) 800pm (c) $\sqrt{3}\times100$pm (d) $\left(\frac{\sqrt{3}}{2}\right)\times400\,pm$

Ans: (d) $\left(\frac{\sqrt{3}}{2}\right)\times$ **400pm**

Solution:

$$\sqrt{3}a = r_{cs^+} + 2r_{cl^-} + r_{cs^+}$$

$$\left(\frac{\sqrt{3}}{2}\right)a = \left(r_{cs^+} + r_{cr^-}\right)$$

$$\left(\frac{\sqrt{3}}{2}\right)400 = \text{inter ionic distance}$$

11. A solid compound XY has NaCl structure. If the radius of the cation is 100 pm, the radius of the anion will be

(a) $\left(\frac{100}{0.414}\right)$ (b) $\left(\frac{0.732}{100}\right)$ (c) 100×0.414 (d) $\left(\frac{0.414}{100}\right)$

Ans: (a) $\left(\frac{\mathbf{100}}{\mathbf{0.414}}\right)$

Solution:

for an fcc structure $\frac{r_{x^+}}{r_{y^-}} = 0.414$

given that $r_{x^+} = 100$pm

$$r_{y^-} = \frac{100pm}{0.414}$$

12. The vacant space in bcc lattice unit cell is ***(MAR 20)***

(a) 48% (b) 23% (c) 32% (d) 26%

Ans: (c) 32%

Solution:

Packing efficiency = 68%

Therefore empty space percentage = (100 – 68) = 32%

13. The radius of an atom is 300 pm, if it crystallizes in a face centered cubic lattice, the length of the edge of the unit cell is

(a) 488.5pm (b) 848.5pm (c) 884.5pm (d) 484.5pm

Ans: (b) 848.5pm

Solution:

Let edge length = a

$\sqrt{2}a = 4r$

$a = \frac{4 \times 300}{\sqrt{2}}$

$a = 600 \times 1.414$

a = 848.4 pm

14. The fraction of total volume occupied by the atoms in a simple cubic is

(a) $\left(\frac{\pi}{4\sqrt{2}}\right)$ (b) $\left(\frac{\pi}{6}\right)$ (c) $\left(\frac{\pi}{4}\right)$ (d) $\left(\frac{\pi}{3\sqrt{2}}\right)$

Ans: (b) $\left(\frac{\pi}{6}\right)$

Solution:

$$\left(\frac{\frac{4}{3}\pi r^3}{a^3}\right) = \left(\frac{\frac{4}{3}\pi\left(\frac{a}{2}\right)^3}{a^3}\right) = \left(\frac{\pi}{6}\right)$$

15. The yellow colour in NaCl crystal is due to

(a) excitation of electrons in F centers

(b) reflection of light from Cl ion on the surface

(c) refraction of light from Na^+ ion (d) all of the above

Ans: (a) excitation of electrons in F centers

16. If 'a' stands for the edge length of the cubic system; sc, bcc, and fcc. Then the ratio of radii of spheres in these systems will be respectively.

(a) $\left(\frac{1}{2}a : \frac{\sqrt{3}}{2}a : \frac{\sqrt{2}}{2}a\right)$ (b) $\left(\sqrt{1a} : \sqrt{3a} : \sqrt{2a}\right)$

(c) $\left(\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a\right)$ (d) $\left(\frac{1}{2}a : \sqrt{3a} : \frac{1}{\sqrt{2}}a\right)$

Ans: (c) $\left(\mathbf{\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a}\right)$

Solution:

$$sr \Rightarrow 2r = a \Rightarrow r = \frac{a}{2}$$

$$bcc \Rightarrow 4r = \sqrt{3a} \Rightarrow r = \frac{\sqrt{3a}}{4}$$

$$fcc \Rightarrow 4r = \sqrt{2}a \Rightarrow r = \frac{\sqrt{2a}}{4} = \frac{a}{2\sqrt{2}}$$

$$\left(\frac{a}{2}\right) : \left(\frac{\sqrt{3a}}{4}\right) : \left(\frac{a}{2\sqrt{2}}\right)$$

17. If 'a' is the length of the side of the cube, the distance between the body centered atom in one corner atom in the cube will be

(a) $\left(\frac{2}{\sqrt{3}}\right)a$ (b) $\left(\frac{4}{\sqrt{3}}\right)a$ (c) $\left(\frac{\sqrt{3}}{4}\right)a$ (d) $\left(\frac{\sqrt{3}}{2}\right)a$

Ans: (d) $\left(\mathbf{\frac{\sqrt{3}}{2}}\right)\mathbf{a}$

Solution:

If a is the length of the side $\sqrt{3}$a, then the length of the leading diagonal passing through the body centered atom is $\frac{\sqrt{3}}{2}$a.

18. Potassium has a bcc structure with nearest neighbour distance 4.52A°. Its atomic weight is 39. Its density will be

(a) 915 kg m^{-3} (b) 2142 kg m^{-3} (c) 452 kg m^{-3} (d) 390 kg m^{-3}

Ans: (a) 915 kg m^{-3}

Solution:

$$\rho = \frac{n \times M}{a^3 N_A}$$

for bcc

n = 2

M = 39

Nearest distance 2r = 4.52

$$a = \frac{4r}{\sqrt{3}} = \frac{2 \times 4.52 \times 10^{-10}}{\sqrt{3}} = 5.21 \times 10^{-10}$$

$$p = \frac{2 \times 39}{\left(5.21 \times 10^{-10}\right)^3 \times \left(6.023 \times 10^{23}\right)}$$

$$\rho = 915 \text{ Kg m}^{-3}$$

19. Schottky defect in a crystal is observed when

(a) unequal number of cations and anions are missing from the lattice

(b) equal number of cations and anions are missing from the lattice

(c) an ion leaves its normal site and occupies an interstitial site

(d) no ion is missing from its lattice.

Ans: (b) equal number of cations and anions are missing from the lattice

20. The cation leaves its normal position in the crystal and moves to some interstitial position, the defect in the crystal is known as

(a) Schottky defect (b) F center

(c) Frenkel defect (d) non-stoichiometric defect

Ans: (c) Frenkel defect

21. **Assertion :** Due to Frenkel defect, density of the crystalline solid decreases.

Reason : In Frenkel defect cation and anion leaves the crystal.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

Ans: (d) Both assertion and reason are false

22. The crystal with a metal deficiency defect is ***(PTA MQ)***

(a) NaCl (b) FeO (c) ZnO (d) KCl

Ans: (b) FeO

23. A two dimensional solid pattern formed by two different atoms X and Y is shown below. The black and white squares represent atoms X and Y respectively. The simplest formula for the compound based on the unit cell from the pattern is

(a) XY_8 (b) X_4Y_9 (c) XY_2 (d) XY_4

Ans: (a) XY_8

UNIT – 7: CHEMICAL KINETICS

EVALUATION

Choose the Best Answer

1. For a first order reaction A → B, the rate constant is x min^{-1}. If the initial concentration of A is 0.01M, the concentration of A after one hour is given by the expression.
(a) 0.01 e^{-x} (b) 1×10^{-2} (1-e^{-60x}) (c) $(1\times10^{-2})e^{-60x}$ (d) none of these

Ans: (c) $(1 \times 10^{-2})e^{-60x}$

Solution:

$$k = \left(\frac{2.303}{t}\right)\log\left(\frac{[A_0]}{[A]}\right)$$

$$k = \left(\frac{1}{t}\right)\ln\left(\frac{[A_0]}{[A]}\right)$$

$$e^{-kt} = \left(\frac{[A_0]}{[A]}\right)$$

$$[A] = [A_0]e^{-kt}$$

In this case

k = x, min^{-1} and $[A_0] = 0.01M = 1\times10^{-2}\,M$

t = 1 hour = 60min

$$[A] = 1\times10^{-2}\left(e^{-60x}\right)$$

2. A zero order reaction X → Product, with an initial concentration 0.02 M has a half life of 10 min. If one starts with concentration 0.04 M, then the half life is
(a) 10s (b) 5 min (c) 20 min
(d) cannot be predicted using the given information

Ans: (c) 20 min

Solution:

for $n \neq 1$ $\quad t_{1/2} = \dfrac{2^{n-1}-1}{(n-1)\,k\,[A_0]^{n-1}}$

for $n = 0$ $\quad t_{1/2} = \dfrac{1}{2k[A_0]^{-1}}$

$$t_{1/2} = \frac{[A_0]}{2k}$$

$t_{1/2} \alpha\ [A_0]$ ... (1)

Given

$[A_0] = 0.02M; t_{1/2} = 10\,min$

$[A_0] = 0.04M; t_{1/2} = ?$

Substitute in (1)

10 min α 0.02M ... (2)

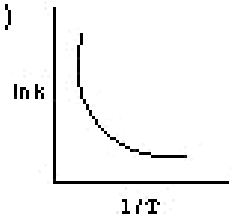
$t_{1/2} \alpha$ 0.04M ... (3)

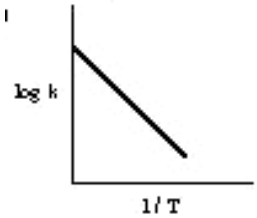
(3)/(2)

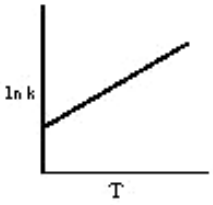
$$\Rightarrow \frac{t_{1/2}}{10\,min} = \frac{0.04M}{0.02M}$$

$t_{1/2} = 2 \times 10\ min = 20\ min$

3. Among the following graphs showing variation of rate constant with temperature (T) for a reaction, the one that exhibits Arrhenius behavior over the entire temperature range is

(a) 

(b) 

(c) 

(d) both (b) and (c)

Ans: (b)

Solution:

$k = Ae^{\left(\frac{E_a}{RT}\right)}$

$\ln k = \ln A - \left(\frac{E_a}{R}\right)\left(\frac{1}{T}\right)$

This equation is in the form of a straight line equation

$y = c + mx$

A plot lnk vs $\left(\frac{1}{T}\right)$ is a straight line with negative slope

4. For a first order reaction A → product with initial concentration x mol L^{-1}, has a half life period of 2.5 hours. For the same reaction with initial concentration $\left(\frac{x}{2}\right)$ mol L^{-1} the half life is

(a) (2.5×2) hours (b) $\left(\frac{2.5}{2}\right)$ hours (c) 2.5 hours

(d) Without knowing the rate constant, $t_{1/2}$ cannot be determined from the given data

Ans: (c) 2.5 hours

Solution:

For a first order reaction

$t_{1/2} = \frac{0.693}{k}$

$t_{1/2}$ does not depend on the initial concentration and it remains constant (whatever may be the initial concentration).

$t_{1/2}$ = 2.5 hrs.

5. For the reaction, $2NH_3 \rightarrow N_2 + 3H_2$, if $\frac{-d[NH_3]}{dt} = k_1[NH_3]$, $\frac{d[N_2]}{dt} = k_2[NH_3], \frac{d[H_2]}{dt} = k_3[NH_3]$ then the relation between k_1, k_2 and k_3 is

(a) $k_1 = k_2 = k_3$ (b) $k_1 = 3k_2 = 2k_3$

(c) $1.5\ k_1 = 3k_2 = k_3$ (d) $2k_1 = k_2 = 3k_3$

Ans: (c) $1.5\ k_1 = 3k_2 = k_3$

Solution:

$$\text{Rate} = \left(\frac{-1}{2}\right)\frac{d[NH_3]}{dt} = \frac{d[N_2]}{dt} = \left(\frac{1}{3}\right)\frac{d[H_2]}{dt}$$

$$\left(\frac{1}{2}\right)k_1[NH_3] = k_2[NH_3] = \left(\frac{1}{3}\right)k_3[NH_3]$$

$$\left(\frac{3}{2}\right)k_1 = 3k_2 = k_3$$

$1.5k_1 = 3k_2 = k_3$

6. The decomposition of phosphine (PH_3) on tungsten at low pressure is a first order reaction. It is because the ***(NEET)***

(a) rate is proportional proportional to the surface coverage

(b) rate is inversely proportional to the surface coverage

(c) rate is independent of the surface coverage

(d) rate of decomposition is slow

Ans: (a) rate is proportional proportional to the surface coverage

Solution:

At low pressure the reaction follows first order, therefore

Rate α [reactant]^1

Rate α [surface area]

At high pressure due to the complete coverage of surface area, the reaction follows zero order.

Rate α[reactant]^0

Therefore the rate is independent of surface area.

7. For a reaction Rate = k [acetone]$^{3/2}$ then unit of rate constant and rate of reaction respectively is

(a) $\left(\text{mol L}^{-1}\text{s}^{-1}\right),\left(\text{mol}^{-1/2}\text{L}^{1/2}\text{s}^{-1}\right)$ (b) $\left(\text{mol}^{-1/2}\text{L}^{1/2}\text{s}^{-1}\right),\left(\text{mol L}^{-1}\text{s}^{-1}\right)$

(c) $\left(\text{mol}^{1/2}\text{L}^{1/2}\text{s}^{-1}\right),\left(\text{mol L}^{-1}\text{s}^{-1}\right)$ (d) $\left(\text{mol L s}^{-1}\right),\left(\text{mol}^{1/2}\text{L}^{1/2}\text{s}\right)$

Ans: (b) $\left(\text{mol}^{-1/2}\text{L}^{1/2}\text{s}^{-1}\right),\left(\text{mol L}^{-1}\text{s}^{-1}\right)$

Solution:

Rate = k[A]^n

$$\text{Rate} = \frac{-d[A]}{dt}$$

$$\text{Unit of rate} = \frac{\text{mol L}^{-1}}{\text{s}} = \text{mol L}^{-1}\text{s}^{-1}$$

In this case

Rate = k [Acetone]$^{3/2}$

n = 3/2

$= \text{mol}^{1-(3/2)}\ \text{L}^{(3/2)-1}\text{s}^{-1}$

$= \text{mol}^{-(1/2)}\ \text{L}^{(1/2)}\text{s}^{-1}$

8. The addition of a catalyst during a chemical reaction alters which of the following quantities? ***(NEET)***

(a) Enthalpy (b) Activation energy

(c) Entropy (d) Internal energy

Ans: (b) Activation energy

Solution:

A catalyst provides a new path to the reaction with low activation energy. i.e., it lowers the activation energy.

9. Consider the following statements:

(i) increase in concentration of the reactant increases the rate of a zero order reaction.

(ii) rate constant k is equal to collision frequency A if $E_a = 0$

(iii) rate constant k is equal to collision frequency A if $E_a = 0$

(iv) a plot of ln (k) Vs T is a straight line.

(v) a plot of ln (k) Vs $\left(\frac{1}{T}\right)$ is a straight line with a positive slope.

Correct statements are:

(a) (ii) only (b) (ii) and (iv) (c) (ii) and (v) (d) (i), (ii) and (v)

Ans: (a) (ii) only

Solution:

In zero order reaction, increase in the concentration of reactant does not alter the rate. So statement (i) is wrong.

$$k = Ae^{\left(\frac{E_a}{RT}\right)}$$

If $E_a = 0$ so, statement (ii) is correct, and statement (iii) is wrong.

$$k = Ae^0$$

$$k = A$$

$$\text{In } k = \ln A - \left(\frac{E_a}{R}\right)\left(\frac{1}{T}\right)$$

This equation is in the form of a straight line equation

$$y = c + mx$$

A plot of lnk vs $\left(\frac{1}{T}\right)$ is a straight line with negative slope

So statement (iv) and (v) are wrong.

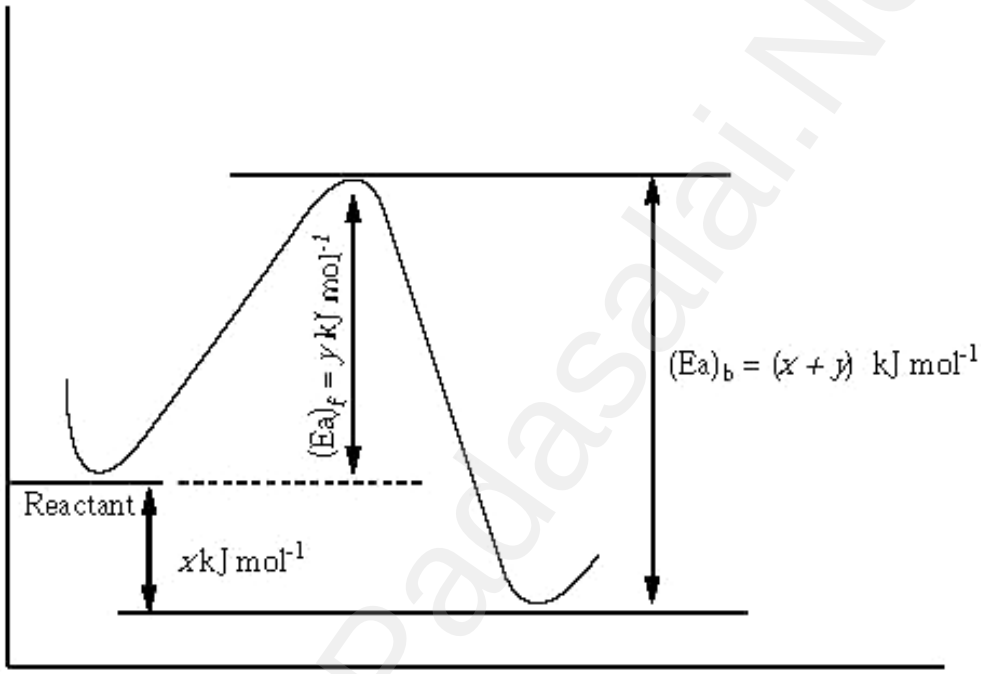
10. In a reversible reaction, the enthalpy change and the activation energy in the forward direction are respectively –x kJ mol^{-1} and y kJ mol^{-1}. Therefore, the energy of activation in the backward direction is

(a) (y – x) kJ mol^{-1} (b) (x + y) J mol^{-1}

(c) (x – y) kJ mol^{-1} (d) (x + y) × 10^3 J mol^{-1}

Ans: (d) (x + y) × 10^3 J mol^{-1}

Solution:



(x + y) kJ mol^{-1}

(x + y) × 10^3 Jmol^{-1}

11. What is the activation energy for a reaction if its rate doubles when the temperature is raised from 200 K to 400 K? (R = 8.314 JK^{-1} mol^{-1})

(a) 234.65 kJ mol^{-1} K^{-1} (b) 434.65 kJ mol^{-1} K^{-1}

(c) 434.65 J mol^{-1} K^{-1} (d) 334.65 J mol^{-1} K^{1}

Ans: (c) 434.65 J mol^{-1} K^{-1}

Solution:

$T_1 = 200K; k = k_1$

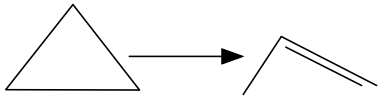
$T_2 = 400K; k = k_2 = 2k_1$

$$\log\left(\frac{k_2}{k_1}\right)=\frac{2.303}{R}\left(\frac{T_2-T_1}{T_1\,T_2}\right)$$

$$\log\left(\frac{2k_2}{k_1}\right)=\frac{2.303}{8.314\text{JK}^{-1}\text{mol}^{-1}}\left(\frac{400\text{K}-200\text{K}}{200\text{K}\times 400\text{K}}\right)$$

$$E_a=\frac{0.3010\times 8.314\text{ J mol}^{-1}\times 200\times 400}{2.303\times 200}$$

$E_a = 434.65$ J mol^{-1}.

12.  This reaction follows first order kinetics. The rate constant at particular temperature is 2.303×10^{-2} hour^{-1}. The initial concentration of cyclopropane is 0.25 M. What will be the concentration of cyclopropane after 1806 minutes? (log 2 = 0.3010)

(a) 0.125M (b) 0.215M (c) 0.25×2.303M (d) 0.05M

Ans: (a) 0.125M

Solution:

$$k=\left(\frac{2.303}{t}\right)\log\left(\frac{A_0}{[A]}\right)$$

$$2.303\times 10^{-2}\text{hour}^{-1}=\left(\frac{2.303}{1806\text{ min}}\right)\log\left(\frac{0.25}{[A]}\right)$$

$$\frac{2.303\times 10^{-2}\text{hour}^{-1}\times 1806\text{min}}{2.303}=\log\left(\frac{0.25}{[A]}\right)$$

$$\left(\frac{1806\times 10^{-2}}{60}\right)=\log\left(\frac{0.25}{[A]}\right)$$

$$0.301 = \log\left(\frac{0.25}{[A]}\right)$$

$$\log 2 = \log\left(\frac{0.25}{[A]}\right)$$

$$2 = \left(\frac{0.25}{[A]}\right)$$

$$[A] = \left(\frac{0.25}{2}\right) = 0.125M$$

13. For a first order reaction, the rate constant is 6.909 min^{-1}. The time taken for 75% conversion in minutes is ***(PTA MQ)***

(a) $\left(\frac{3}{2}\right)\log 2$ (b) $\left(\frac{2}{3}\right)\log 2$ (c) $\left(\frac{3}{2}\right)\log\left(\frac{3}{4}\right)$ (d) $\left(\frac{2}{3}\right)\log\left(\frac{4}{3}\right)$

Ans: (b) $\left(\frac{2}{3}\right)\log 2$

Solution:

$$k = \left(\frac{2.303}{t}\right)\log\left(\frac{A_0}{[A]}\right)$$

$$[A_0] = 100; [A] = 25$$

$$6.909 = \left(\frac{2.303}{t}\right)\log\left(\frac{100}{25}\right)$$

$$t = \left(\frac{2.303}{6.909}\right)\log(4)$$

$$t = \left(\frac{1}{3}\right)\log 2^2$$

$$t = \left(\frac{2}{3}\right)\log 2$$

14. In a first order reaction x → y; if k is the rate constant and the initial concentration of the reactant x is 0.1 M, then, the half life is

(a) $\left(\frac{\log 2}{k}\right)$ (b) $\left(\frac{0.693}{(0.1)k}\right)$ (c) $\left(\frac{\ln 2}{k}\right)$ (d) none of these

Ans: (c) $\left(\frac{\mathbf{ln2}}{\mathbf{k}}\right)$

Solution:

$$k = \left(\frac{1}{t}\right)\ln\left(\frac{[A_0]}{[A]}\right)$$

$$[A_0] = 0.1; [A] = 0.05$$

$$k = \left(\frac{1}{t_{1/2}}\right)\ln\left(\frac{0.1}{0.05}\right)$$

$$k = \left(\frac{1}{t_{1/2}}\right)\ln(2)$$

$$t_{1/2} = \frac{\ln(2)}{k}$$

15. Predict the rate law of the following reaction based on the data given below 2A + B → C + 3D.

Reaction number	[A] (min)	[B] (min)	Initial rate ($M\ s^{-1}$)
1	0.1	0.1	x
2	0.2	0.1	2x
3	0.1	0.2	4x
4	0.2	0.2	8x

(a) rate = k $[A]^2$ [B] (b) rate = k [A] $[B]^2$

(c) rate = k [A] [B] (d) rate = k $[A]^{1/2}$ $[B]^{3/2}$

Ans: (b) rate = k [A] $[B]^2$

Solution:

$rate_1 = k[0.1]^n[0.1]^m$ ... (1)

$rate_2 = k[0.2]n\ [0.1]m$ ... (2)

(2) / (1)

$$\frac{2x}{x} = \frac{k[0.2]^n[0.1]^m}{k[0.1]^n[0.1]^m}$$

$$\frac{2x}{x} = 2^n \qquad \therefore\ m = 2$$

$\therefore$ rate = $k[A]^1$ $[B]^2$

16. **Assertion :** rate of reaction doubles when the concentration of the reactant is double if it is a first order reaction.

Reason : rate constant also doubles.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

Ans: (c) Assertion is true but reason is false

Solution:

For a first reaction, when the concentration of reactant is doubled, then the rate of reaction also doubled.

Rate constant is independent of concentration and is a constant at a constant temperature, i.e., it depends on the temperature and hence, it will not be doubled and when the concentration of the reactant is doubled.

17. The rate constant of a reaction is 5.8×10^{-2} s^{-1}. The order of the reaction is ***(PTA MQ) Sep-20***

(a) First order (b) Zero order (c) Second order (d) Third order

Ans: (a) First order

Solution:

The unit of rate constant is s^{-1} and it indicates that the reaction is first order.

18. For the reaction $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$, the value of rate of disappearance of N_2O_5 is given as 6.5×10^{-2} mol L^{-1} s^{-1}. The rate of formation of NO_2 and O_2 is given respectively is

(a) $\left(3.5\times10^{-2}\text{mol L}^{-1}\text{s}^{-1}\right)$ and $\left(1.3\times10^{-2}\text{mol L}^{-1}\text{s}^{-1}\right)$

(b) $\left(1.3\times10^{-2}\text{ mol L}^{-1}\text{s}^{-1}\right)$ and $\left(3.25\times10^{-2}\text{mol L}^{-1}\text{s}^{-1}\right)$

(c) $\left(1.3\times10^{-1}\text{mol L}^{-1}\text{s}^{-1}\right)$ and $\left(3.25\times10^{-2}\text{ mol L}^{-1}\text{s}^{-1}\right)$

(d) None of these

Ans: (c) $\left(1.3\times10^{-1}\text{mol L}^{-1}\text{s}^{-1}\right)$ and $\left(3.25\times10^{-2}\text{ mol L}^{-1}\text{s}^{-1}\right)$

Solution:

$$\text{Rate} = \frac{d[N_2O_3]}{dt} = \left(\frac{1}{2}\right)\frac{d[NO_2]}{dt} = \frac{2d[O_2]}{dt}$$

Given that

$$\frac{d[N_2O_5]}{dt} = 6.5\times10^{-2}\text{ mol L}^{-1}\text{s}^{-1}$$

$$\frac{d[NO_2]}{dt} = 6.5\times10^{-2} = 1.3\times10^{-1}\text{mol L}^{-1}\text{s}^{-1}$$

$$\frac{d[O_2]}{dt} = \frac{6.5\times10^{-2}}{2} = 3.25\times10^{-2}\text{mol L}^{-1}\text{s}^{-1}$$

19. During the decomposition of H_2O_2 to give dioxygen, 48 g O_2 is formed per minute at certain point of time. The rate of formation of water at this point is

(a) 0.75 mol min^{-1} (b) 1.5 mol min^{-1}

(c) 2.25 mol min^{-1} (d) 3.0 mol min^{-1}

Ans: (d) 3.0 mol min^{-1}

Solution:

$$H_2O_2 \longrightarrow H_2O + \frac{1}{2}O_2$$

$$\text{Rate} = \frac{-d[H_2O_2]}{dt} = \frac{d[H_2O]}{dt} = \frac{2d[O_2]}{dt}$$

$$\text{No. of moles of oxygen} = \left(\frac{48}{32}\right) = 1.5 \text{ mol}$$

$\therefore$ Rate of formation of oxygen = 2 x 1.5 = 3 mol min^{-1}

20. If the initial concentration of the reactant is doubled, the time for half reaction is also doubled. Then the order of the reaction is

(a) Zero (b) one (c) Fraction (d) none

Ans: (a) Zero

Solution:

For a first order reaction $t_{1/2}$ is independent of initial concentration .i.e., $\therefore$ $n \neq 1$; for such cases

$$t_{1/2} \alpha \frac{1}{[A_0]^{n-1}} \quad \ldots (1)$$

If $[A_0] = 2[A_0]$; then $t_{1/2} = 2t_{1/2}$

$$2t_{1/2} a \frac{1}{[2A_0]^{n-1}} \quad \ldots (2)$$

$$\frac{(2)}{(1)} \Rightarrow$$

$$2 = \frac{1}{[2A_0]^{n-1}} \times \frac{[A_0]^{n-1}}{1}$$

$$2 = \frac{[A_0]^{n-1}}{[2A_0]^{n-1}}$$

$$2 = \left(\frac{1}{2}\right)^{n-1}$$

$$2 = \left(2^{-1}\right)^{n-1}$$

$$2^1 = \left(2^{-n+1}\right)$$

$$n = 0$$

21. In a homogeneous reaction A → B + C + D, the initial pressure was P_0 and after time 't' it was P. expression for rate constant in terms of P_0. P and t will be

(a) $k = \left(\frac{2.303}{t}\right) \log\left(\frac{2P_0}{3P_0 - P}\right)$

(b) $k = \left(\frac{2.303}{t}\right) \log\left(\frac{2P_0}{P_0 - P}\right)$

(c) $k = \left(\frac{2.303}{t}\right) \log\left(\frac{3P_0 - P}{2P_0}\right)$

(d) $k = \left(\frac{2.303}{t}\right) \log\left(\frac{2P_0}{3P_0 - 2P}\right)$

Ans: (a) $\mathbf{k = \left(\frac{2.303}{t}\right) \log\left(\frac{2P_0}{3P_0 - P}\right)}$

Solution:

	A	$\longrightarrow$	B	C	D
Initial	a		0	0	0
Reacted at time t	x		x	x	x
After time t	$(a-x)$		x	x	x
Total number of moles	$= (a + 2x)$				

$$a \propto P_0$$

$$(a + 2x) \propto P$$

$$\frac{a}{(a+2x)} = \frac{P_0}{P}$$

$$x = \frac{(P - P_0)a}{P_0}$$

$$(a - x) = a\left(\frac{(P - P_0)a}{P_0}\right)$$

$$(a - x) = a\left\{\frac{(3P_0 - P)}{2P_0}\right\}$$

$$k = \left(\frac{2.303}{t}\right)\log\left(\frac{a}{a-x}\right)$$

$$k = \left(\frac{2.303}{t}\right)\log\left(\frac{a}{\left\{\frac{3P_0 - P}{2P_0}\right\}}\right)$$

$$k = \left(\frac{2.303}{t}\right)\log\left(\frac{2P_0}{3P_0 - P}\right)$$

22. If 75% of a first order reaction was completed in 60 minutes, 50% of the same reaction under the same conditions would be completed in

(a) 20 minutes (b) 30 minutes (c) 35 minutes (d) 75 minutes

Ans: (b) 30 minutes

Solution:

$$t_{75\%} = 2t_{50\%}$$

$$t_{50\%} = \left(\frac{t_{75\%}}{2}\right) = \left(\frac{60}{2}\right) = 30\,\text{min}$$

23. The half life period of a radioactive element is 140 days. After 560 days, 1 g of element will be reduced to

(a) $\left(\frac{1}{2}\right)$g (b) $\left(\frac{1}{4}\right)$g (c) $\left(\frac{1}{8}\right)$g (d) $\left(\frac{1}{16}\right)$g

Ans: (d) $\left(\frac{1}{16}\right)$g

Solution:

In 140 days $\Rightarrow$ initial concentration reduced to $\left(\frac{1}{2}\right)$g

In 280 days $\Rightarrow$ initial concentration reduced to $\left(\frac{1}{4}\right)$g

In 420 days $\Rightarrow$ initial concentration reduced to $\left(\frac{1}{8}\right)$g

In 560 days $\Rightarrow$ initial concentration reduced to $\left(\frac{1}{16}\right)$g

24. The correct difference between first and second order reactions is that ***(NEET)***

(a) A first order reaction can be catalysed; a second order reaction cannot be catalysed.

(b) The half life of a first order reaction does not depend on $[A_0]$; the half life of a second order reaction does depend on $[A_0]$.

(c) The rate of a first order reaction does not depend on reactant concentrations, the rate of a second order reaction does depend on reactant concentrations.

(d) The rate of a first order reaction does depend on reactant concentrations: the rate of a second order reaction does not depend on reactant concentrations.

Ans: (b) The half life of a first order reaction does not depend on $[A_0]$; the half life of a second order reaction does depend on $[A_0]$

Solution:

For a first order reaction

$$t_{1/2} = \frac{0.6932}{k}$$

For a Second order reaction

$$t_{1/2} = \frac{2^{n-1} - 1}{(n-1)k[A_0]^{n-1}}$$

n = 2

$$t_{1/2} = \frac{2^{2-1} - 1}{(2-1)k[A_0]^{2-1}}$$

$$t_{1/2} = \frac{1}{k[A_0]}$$

25. After 2 hours, a radioactive substance becomes $\left(\frac{1}{16}\right)^{th}$ of original amount. Then the half life (in min) is

(a) 60 minutes (b) 120 minutes (c) 30 minutes (d) 15 minutes

Ans: (c) 30 minutes

Solution :

$$1 \xrightarrow{t_{1/2}} \left(\frac{1}{2}\right) \xrightarrow{t_{1/2}} \left(\frac{1}{4}\right) \xrightarrow{t_{1/2}} \left(\frac{1}{8}\right) \xrightarrow{t_{1/2}} \left(\frac{1}{16}\right)$$

$\therefore 4\,t_{1/2} = 2$ hours

$t_{1/2} = 30$ min

UNIT - 8: IONIC EQUILIBRIUM

EVALUATION

Choose the Best Answer

1. Concentration of the Ag^+ ions in a saturated solution of $Ag_2C_2O_4$ is 2.24×10^{-4} mol L^{-1}. Solubility product of $Ag_2C_2O_4$. ***(NEET-2017)***

(a) 2.42×10^{-8} mol^3 L^{-3} (b) 2.66×10^{-12} mol^3 L^{-3}

(c) 4.5×10^{-11} mol^3 L^{-3} (d) 5.619×10^{-12} mol^3 L^{-3}

Ans: (d) 5.619×10^{-12} mol^3 L^{-3}

Solution:

$$Ag_2C_2O_4 \rightleftharpoons 2Ag^+ + C_2O_4^{2-}$$

$[Ag^+] = 2.24 \times 10^{-4}$ mol L^{-1}

$$[C_2O_4^{2-}] = \frac{2.24 \times 10^{-4}}{2} \text{ mol } L^{-1}$$

$= 1.12 \times 10^{-4}$ mol L^{-1}

$K_{sp} = [Ag^+]^2[C_2O_4^{2-}]$

$= (2.24 \times 10^{-4} \text{ mol } L^{-1})^2 (1.12 \times 10^{-4} \text{ mol } L^{-1})$

$= 5.619 \times 10^{-12}$ mol^3 L^{-3}

2. Following solutions were prepared by mixing different volumes of NaOH of HCl different concentrations. ***(NEET-2018)***

(i) $60\,mL\,\frac{M}{10}\,HCl + 40\,mL\,\frac{M}{10}\,NaOH$

(ii) $55\,mL\,\frac{M}{10}\,HCl + 45\,mL\,\frac{M}{10}\,NaOH$

(iii) $75\,mL\,\frac{M}{5}\,HCl + 25\,mL\,\frac{M}{5}\,NaOH$

(iv) $100\,mL\,\frac{M}{10}\,HCl + 100\,mL\,\frac{M}{10}\,NaOH$

pH of which one them will be equal to 1?

(a) iv (b) i (c) ii (d) iii

Ans: (d) iii

Solution:

$75\,mL\,\frac{M}{5}\,HCl + 25\,mL\,\frac{M}{5}\,NaOH$

No of Moles of HCl $= 0.2 \times 75 \times 10^{-3} = 15 \times 10^{-3}$

No of Moles of NaOH $= 0.2 \times 25 \times 10^{-3} = 15 \times 10^{-3}$

No of Moles of HCl after mixing $= (15 \times 10^{-3}) - (5 \times 10^{-3})$

$= (15-5) \times 10^{-3} = 10 \times 10^{-3}$

$$\therefore HCl = \frac{\text{No of moles of HCl}}{\text{Volume (lit)}}$$

$$= \frac{10 \times 10^{-3}}{100 \times 10^{-3}} = 0.1\,M$$

pH of 0.1 m HCl $= -\log_{10}(0.1) = 1$.

3. The solubility of $BaSO_4$ in water is $2.42 \times 10^{-3}\,gL^{-1}$ at 298K. The value of its solubility product (K_{SP}) will be ***(NEET-2018)***

(Given molar mass of $BaSO_4 = 233g\,mol^{-1}$)

(a) $1.08 \times 10^{-14}\,mol^2\,L^{-2}$ (b) $1.08 \times 10^{-12}\,mol^2L^{-2}$

(c) $1.08 \times 10^{-10}\,mol^2\,L^{-2}$ (d) $1.08 \times 10^{-8}\,mol^2L^{-2}$

Ans: (c) $1.08 \times 10^{-10}\,mol^2L^{-2}$

Solution:

$$BaSO_4 \rightleftharpoons Ba^{2+} + SO_4^{2-}$$

$$Ksp = (s)(s)$$

$$Ksp = (s)^2$$

$$= (2.42\times10^{-3}\,gL^{-1})^2$$

$$= \left(\frac{2.42\times10^{-3}\,g\,L^{-1}}{233g\,mol^{-1}}\right)$$

$$= (0.01038\times10^{-3})^2$$

$$= (1.038\times10^{-5})^2$$

$$= 1.077\times10^{-10}$$

$$= 1.08\times10^{-10}\,mol^2\,L^{-2}$$

4. pH of a saturated solution of $Ca(OH)_2$ is 9. The solubility product (K_{SP}) of $Ca(OH)_2$

(a) 0.5×10^{-15} (b) 0.25×10^{-10} (c) 0.125×10^{-15} (d) 0.5×10^{-10}

Ans: (a) 0.5×10^{-15}

Solution:

$$Ca(OH)_2 \rightleftharpoons Ca^{2+} + 2OH^-$$

Given: $pH = 9$

$pOH = 14 - 9 = 5$

$[pOH] = -\log_{10}[OH^-]]$

$\therefore [OH^-] = 10^{-pOH}$

$[OH^-] = 10^{-5}\,M$

$K_{sp} = [Ca^{2+}]\,[OH^-]^2$

$$= \frac{10^{-5}}{2}\times(10^{-5})^2$$

$$= 0.5\times10^{-15}$$

5. Conjugate base for bronsted acids H_2O and HF are ***(Sep-20)***

(a) OH^- and H_2FH^+, respectively (b) H_3O^+ and F^-, respectively

(c) OH^- and F^-, respectively (d) H_3O^+ and H_2F^-, respectively

Ans: (c) OH^- and F^-, respectively

Solution:

$$\underset{\text{Acid 1}}{H_2O} + \underset{\text{Base 1}}{H_2O} \rightleftharpoons \underset{\text{Acid 2}}{H_3O^+} + \underset{\text{Base 2}}{OH^-}$$

$$\underset{\text{Acid 1}}{HF} + \underset{\text{Base 1}}{H_2O} \rightleftharpoons \underset{\text{Acid 2}}{H_3O^+} + \underset{\text{Base 2}}{F^-}$$

Conjugate base for bronsted acids are OH^- and F^-.

6. Which will make basic buffer?

(a) 50 mL of 0.1 M HCl + 25 mL of 0.1 M CH_3COOH

(b) 100 mL of 0.1 M CH_3COOH + 100 mL of 0.1 M NH_4OH

(c) 100 mL of 0.1 M HCl + 200 mL of 0.1 M NH_4OH

(d) 100 mL of 0.1 M HCl + 100 mL of 0.1 M Na OH

Ans: (c) 100 mL of 0.1 M HCl + 200 mL of 0.1 M NH_4OH

Solution:

Basic buffer is the solution which has weak base and its salt.

$$\underset{\text{200 ml}}{NH_4OH} + \underset{\text{100 ml}}{HCl} \rightarrow \underset{\text{Salt}}{NH_4Cl} + H_2O + \underset{\text{(100 ml } \textit{weak base}\text{)}}{NH_4OH}$$

7. Which of the following fluoro-compounds is most likely to behave as a Lewis base? ***(NEET-2016)***

(a) BF_3 (b) PF_3 (c) CF_4 (d) SiF_4

Ans: (b) PF_3

Solution:

$BF_3 \rightarrow$ Electron deficient $\rightarrow$ Lewis acid

$PF_3 \rightarrow$ Electron rich $\rightarrow$ Lewis base

$CF_4 \rightarrow$ Neutral $\rightarrow$ neither lewis acid nor base

$SiF_4 \rightarrow$ Neutral $\rightarrow$ neither lewis acid nor base

8. Which of these is not likely to act as lewis base?

(a) BF_3 (b) PF_3 (c) CO (d) F^-

Ans: (a) BF_3

Solution:

$BF_3 \rightarrow$ Electron deficient $\rightarrow$ Lewis acid

$PF_3 \rightarrow$ Electron rich $\rightarrow$ Lewis base

CO → Having lone pair of electron → Lewis base

F^- → Unshared pari of electron → Lewis base

9. The aqueous solutions of sodium formate, anilinium chloride and potassium cyanide are respectively.

(a) acidic, acidic, basic (b) basic, acidic, basic

(c) basic, neutral, basic (d) none of these

Ans: (b) basic, acidic, basic

Solution:

$$\underset{\text{basic in nature}}{HCOONa} + H.OH \rightleftharpoons \underset{\text{strong base}}{NaOH} + \underset{\text{weak acid}}{H-COOH}$$

$$C_6H_5NH_3Cl^- + H.OH \rightleftharpoons H_3O^+ + \underset{\text{acidic}}{C_6H_5-NH_2} + Cl^-$$

$$\underset{\text{basic}}{KCN} + H-OH \rightleftharpoons \underset{\text{Strong base}}{KOH} + \underset{\text{weak acid}}{HCN}$$

Option (b): basic, acidic, basic is correct

10. The percentage of pyridine (C_5H_5N) that forms pyridinium ion (C_5H_5NH) in a 0.10 M aqueous pyridine solution (K_b for $C_5H_5N = 1.7 \times 10^{-9}$) is

(a) 0.006% (b) 0.013% (c) 0.77% (d) 1.6%

Ans: (b) 0.013%

Solution:

$$C_5H_5N + H-OH \rightleftharpoons C_5H_5\overset{+}{N}H + OH^-$$

$$\frac{\alpha_2 C}{1-\alpha} = K_b$$

$$\alpha_2 C \simeq K_b$$

$$\alpha = \sqrt{\frac{K_b}{C}} = \sqrt{\frac{1.7\times10^{-9}}{0.1}} = \sqrt{1.7\times10^{-4}}$$

$$\%\ \text{of dissociation} = \sqrt{1.7}\times10^{-4}\times100$$

$$= 1.3\times10^{-2} = 0.013\%$$

11. Equal volumes of three acid solutions of pH 1, 2 and 3 are mixed in a vessel. What will be the H^+ ion concentration in the mixture?

(a) 3.7×10^{-2} (b) 10^{-6} (c) 0.111 (d) none of these

Ans: (a) 3.7×10^{-2}

Solution:

$pH = -\log_{10}[H^+]$

$\therefore [H^+] = 10^{-pH}$

Let the volume be x *ml*

$V_1M_1 + V_2M_2 + V_3M_3 = VM$

$\therefore$ X ml of 10^{-1} m + x ml of 10^{-2} M + x ml of 10^{-3} M

= 3x ml of $[H^+]$

$$\therefore [H^+] = \frac{x[0.1 + 0.01 + 0.001]}{3x}$$

$$= \frac{0.1 + 0.01 + 0.001}{3}$$

$$= \frac{0.111}{3} = 0.037 = 3.7 \times 10^{-2}$$

12. The solubility of AgCl(s) with solubility product 1.6×10^{-10} in 0.1M NaCl solution would be

(a) 1.26×10^{-5} M (b) 1.6×10^{-9} M (c) 1.6×10^{-11} M (d) Zero

Ans: (b) 1.6×10^{-9} M

Solution:

$AgCl_{(s)} \rightleftharpoons Ag^+_{(ag)} + Cl^-_{(ag)}$

$\underset{0.1M}{NaCl} \rightarrow \underset{0.1M}{Na^+} + \underset{0.1M}{Cl^-}$

$K_{sp} = 1.6 \times 10^{-10}$

$K_{sp} = [Ag^+][Cl^-]$

$K_{sp} = (s)(s + 0.1)$

$0.1 >>> s$

$\therefore s + 0.1 \simeq 0.1$

$\therefore S = \frac{1.6\times10^{-10}}{0.1} = 1.6\times10^{-9}$

13. If the solubility product of lead iodide is 3.2×10^{-8}, its solubility will be ***(PTA MQ)***

(a) 2×10^{-3} M (b) 4×10^{-4} M (c) 1.6×10^{-5} M (d) 1.8×10^{-5} M

Ans: (a) 2×10^{-3} M

Solution:

$PbI_{2(s)} \rightleftharpoons Pb^{2+}_{(ag)} + 2I^{-}_{(ag)}$

$K_{sp} = (s)(2s)^2$

$3.2\times10^{-8} = 4s^3$

$s = \left(\frac{3.2\times10^{-8}}{4}\right)^{\frac{1}{3}} = \left(8\times10^{-9}\right)^{\frac{1}{3}} = 2\times10^{-3}\,M$

14. MY and NY_3, are insoluble salts and have the same K_{Sp} values of 6.2×10^{-13} at room temperature. Which statement would be true with regard to MY and NY_3?

(a) The salts MY and NY_3 are more soluble in 0.5M KY than in pure water

(b) The addition of the salt of KY to the suspension of MY and NY_3 will have no effect on their solubility's

(c) The molar solubilites of MY and NY_3 in water are identical

(d) The molar solubility of MY in water is less than that of NY_3

Ans: (d) The molar solubility of MY in water is less than that of NY_3

Solution:

Addition of salt KY (having a common ion Y^-) decreases the solubility of MY and NY_3 due to common ion effect.

Option (a) and (b) are wrong.

For salt MY $MY \rightleftharpoons M^+ + Y^-$

$K_{sp} = (s)(s)$

$6.2 \times 10^{-13} = s^2$

$\therefore s = \sqrt{6.2 \times 10^{-13}} \simeq 10^{-7}$

for salt NY_3

$NY_3 \rightleftharpoons N_3 + 3Y^-$

$K_{sp} = (s)(3s)^3$

$K_{sp} = 27s^4$

$$s = \left(\frac{6.2 \times 10^{-13}}{27}\right)^{\frac{1}{4}}$$

$s. \simeq 10^{-4}$

The molar solubility of MY in water is less than of NY_3.

15. What is the pH of the resulting solution when equal volumes of 0.1M NaOH and 0.01M HCl are mixed?

(a) 2.0 (b) 3 (c) 7.0 (d) 12.65

Ans: (d) 12.65

Solution:

x ml 0.1 M NaOH + x ml 0.01 M HCl

No. of moles of NaOH $= 0.1 \times x \times 10^{-3}$

$= 0.1 \times x \times 10^{-3}$

No. of moles of HCl $= 0.01 \times x \times 10^{-3}$

$= 0.01 \times x \times 10^{-3}$

No. of moles of NaOH after mixing

$= (0.1 \times x \times 10^{-3}) - (0.01 \times x \times 10^{-3})$

$= 0.09x \times 10^{-3}$

$$\text{Concentration of NaOH} = \frac{0.09x \times 10^{-3}}{2x \times 10^{-3}} = 0.045$$

$[OH^-] = 0.045$

pOH $= -\log (4.5 \times 10^{-2})$

$= 2 - \log 4.5$

$= 2 - 0.65 = 1.35$

pH $= 14 - 1.35 = 12.65$

16. The dissociation constant of a weak acid is 1×10^{-3}. In order to prepare a buffer solution with a pH = 4, the $\frac{[Acid]}{[Salt]}$ ratio should be

(a) 4:3 (b) 3:4 (c) 10:1 (d) 1:10

Ans: (d) 1:10

Solution:

$K_a = 1 \times 10^{-3}$

pH = 4

$\frac{[Salt]}{[Acid]} = ?$

$$pH = pK_a + \log \frac{[Salt]}{[Acid]}$$

$$4 = -\log_{10}\left(1 \times 10^{-3}\right) + \log \frac{[Salt]}{[Acid]}$$

$$4 = 3 + \log \frac{[Salt]}{[Acid]}$$

$$1 = \log_{10} \frac{[Salt]}{[Acid]}$$

$$\Rightarrow \frac{[Salt]}{[Acid]} = 10^1$$

i.e., $\frac{[Acid]}{[Salt]} = \frac{1}{10}$ 1:10

17. The pH of 10^{-5} M KOH solution will be

(a) 9 (b) 5 (c) 19 (d) none of these

Ans: (a) 9

Solution:

$$\underset{10^{-5}\,m}{KOH} \longrightarrow \underset{10^{-5}\,m}{K^+} + \underset{10^{-5}\,m}{OH^-}$$

$$\left[OH^-\right] = 10^{-5}\,M$$

$$pH = 14 - pOH$$

$$pH = 14 - \left(-\log\left[OH^-\right]\right)$$

$$= 14 + \log\left[OH^-\right]$$

$$= 14 + \log 10^{-5}$$

$$= 14 - 5$$

$$= 9$$

18. $H_2PO_4^-$ the conjugate base of

(a) PO_4^{3-} (b) P_2O_5 (c) H_3PO_4 (d) HPO_4^{2-}

Ans: (c) H_3PO_4

Solution:

$$\underset{\text{Acid 1}}{H_3PO_4} + \underset{\text{Base 1}}{H-OH} \rightleftharpoons \underset{\text{Base 2}}{H_3O^+} + \underset{\text{Acid 2}}{H_2PO_4^-}$$

$\therefore$ $H_2PO_4^-$ is the cojugate base of H_3PO_4

19. Which of the following can act as lowery-Bronsted acid as well as base?

(a) HCl (b) SO_4^{2-} (c) HPO_4^{2-} (d) Br^-

Ans: (c) HPO_4^{2-}

Solution:

HPO_4^{2-} can have the ability to accept a proton to form $H_2PO_4^-$.

It can also have the ability to donate a proton to form PO_4^{-3}.

20. The pH of an aqueous solution is Zero. The solution is

(Corona-20)

(a) slightly acidic (b) strongly acidic (c) neutral (d) basic

Ans: (b) strongly acidic

Solution:

$$pH = -\log_{10}[H^+]$$

$$\therefore [H^+] = 10^{-pH}$$

$$= 10^{\circ} = 1$$

$$[H^+] = 1\ M$$

The solution is strongly acidic.

21. The hydrogen ion concentration of a buffer solution consisting of a weak acid and its salts is given by

(a) $[H^+] = \frac{K_a[acid]}{[salt]}$ (b) $[H^+] = K_a[salt]$

(c) $[H^+] = K_a[acid]$ (d) $[H^+] = \frac{K_a[salt]}{[acid]}$

Ans: (a) $\mathbf{[H^+] = \frac{K_a[acid]}{[salt]}}$

Solution:

According to Henderson equation

$$pH = pK_a + \log\frac{[Salt]}{[Acid]}$$

$$\text{i.e.} -\log[H^+] = -\log K_a + \log\frac{[Salt]}{[Acid]}$$

$$-\log[H^+] = \log\frac{[Salt]}{[Acid]} \times \frac{1}{K_a}$$

$$\log\frac{1}{[H^+]} = \log\frac{[Salt]}{[Acid]} \times \frac{1}{K_a}$$

$$\therefore \left[H^+\right] = K_a \frac{[\text{Acid}]}{[\text{Salt}]}$$

22. Which of the following relation is correct for degree of hydrolysis of ammonium acetate?

(a) $h = \sqrt{\frac{K_h}{C}}$ (b) $h = \sqrt{\frac{K_a}{K_b}}$ (c) $h = \sqrt{\frac{K_h}{K_a.K_b}}$ (d) $h = \sqrt{\frac{K_a.K_b}{K_h}}$

Ans: (c) $h = \sqrt{\frac{K_h}{K_a.K_b}}$

23. Dissociation constant of NH_4OH is 1.8×10^{-5} the hydrolysis constant of NH_4Cl would be

(a) 1.8×10^{-19} (b) 5.55×10^{-10} (c) 5.55×10^{-5} (d) 1.80×10^{-5}

Ans: (b) 5.55×10^{-10}

Solution:

$$K_h = \frac{K_w}{K_b} = \frac{1\times10^{-14}}{1.8\times10^{-5}} = 0.55\times10^{-9} = 5.5\times10^{-10}$$

UNIT - 9: ELECTRO CHEMISTRY

EVALUATE

Choose the Best Answer

1. The number of electrons that have a total charge of 9650 coulombs is ***(PTA MQ)***

(a) 6.22×10^{23} (b) 6.022×10^{24}

(c) 6.022×10^{22} (d) 6.022×10^{-34}

Ans: (c) 6.022×10^{22}

Solution:

1F = 96500 C = 1 mole of e^-

$= 6.023\times10^{23} e^-$

$$\therefore 9650C = \frac{6.022\times10^{23}}{96500}\times9650 = 6.022\times10^{22}$$

2. Consider the following half cell reactions:

$Mn^{2+} + 2e^- \longrightarrow Mn \quad E° = -1.18\ V$

$Mn^{2+} \longrightarrow Mn^{3+} + e^- \quad E° = -1.51\ V$

The E° for the reaction $3Mn^{2+} \longrightarrow Mn + 2Mn^{3+}$, and the possibility of the forward reaction are respectively.

(a) 2.69 V and spontaneous

(b) -2.69 V and non spontaneous

(c) 0.33 V and spontaneous

(d) 4.18 V and non spontaneous

Ans: (b) -2.69 V and non spontaneous

Solution:

$$Mn^{2+} + 2e^- \longrightarrow Mn \left[E^o_{red}\right] = -1.18V$$

$$2\left[Mn^{2+} \longrightarrow Mn^{3+} + e^-\right]\left(E^o_{ox}\right) = -1.51V$$

$$3Mn^{2+} \longrightarrow Mn^{3+} + 2Mn^{3+}\ E^o_{cell} = ?$$

$$E^o_{cell} = \left(E^o_{ox}\right) + \left(E^o_{red}\right)$$
$$= -1.51 - 1.18$$
$$= -2.69V$$

Since E° is –ve, ΔG is +Ve and the given forwarded cell is non-spontaneous.

3. The button cell used in watches function as follows

Half cell potentials are

$$Zn_{(s)} + Ag_2O_{(s)} + H_2O_{(l)} \rightleftharpoons 2Ag_{(s)} + Zn^{2+}_{(aq)} + 2OH^-_{(aq)}\ E°_{Ox} = 0.76V$$

$Ag_2O_{(s)} + H_2O_{(l)} + 2e^- \longrightarrow 2Ag_{(s)} + 2OH^-_{(aq)}\ E° = 0.34\ V$

the cell potential will be

(a) 0.84 V (b) 1.34 V (c) 1.10 V (d) 0.42 V

Ans: (c) 1.10 V

Solution:

$\therefore\ E^{o}_{cell} = \left(E^{o}_{ox}\right) + \left(E^{o}_{red}\right)$

$= 0.76 + 0.34 = 1.1V$

4. The molar conductivity of a 0.5 mol dm^{-3} solution of $AgNO_3$ with electrolytic conductivity of 5.76×10^{-3} S cm^{-1} at 298 K is

(a) 2.88 S cm^2 mol^{-1} (b) 11.52 S cm^2 mol^{-1}

(c) 0.086 S cm^2 mol^{-1} (d) 28.8 S cm^2 mol^{-1}

Ans: (b) 11.52 S cm^2 mol^{-1}

Solution:

$$\Lambda = \frac{\kappa}{M} \times 10^{-3}\ mol^{-1} m^3$$

$$= \frac{5.76 \times 10^{-3}\ S\ cm^{-1} \times 10^{-3}}{0.5}\ mol^{-1}\ m^3$$

$$= \frac{5.76 \times 10^{-3} \times 10^{-3} \times 10^{6}}{0.5} S\ cm^{-1}\ mol^{-1}\ cm^3 = 11.52\ S\ cm^2\ mol^{-1}$$

5.

Electrolyte	KCl	KNO_3	HCl	NaOAC	NaCl
Λ_{-} (S cm^2 mol^{-1})	149.9	145.0	426.2	91.0	126.5

Calculate Λ°_{HOAC} using appropriate molar conductances of the electrolytes listed above at infinite dilution in water at 25°C.

(a) 517.2 (b) 552.7 (c) 390.7 (d) 217.5

Ans: (c) 390.7

Solution:

$$(\Lambda_{\infty})_{HoAC} = \left[(\Lambda^{\circ})_{HCl} + (\Lambda^{\circ})_{NaOAC}\right] - (\Lambda^{\circ})_{NaCl}$$

$$= (426.2 + 91) - (126.5) = 390.7$$

6. Faradays constant is defined as ***(PTA MQ)***

(a) charge carried by 1 electron

(b) charge carried by one mole of electrons

(c) charge required to deposit one mole of substance

(d) charge carried by 6.22×10^{10} electrons

Ans: (b) charge carried by one mole of electrons

Solution:

1 F = 96500 C = 1 Charge of mole of e^- = Charge of electron 6.022×10^{23} e^-

7. How many faradays of electricity are required for the following reaction to occur $MnO_4^- \longrightarrow Mn^{2+}$

(a) 5F (b) 3F (c) 1F (d) 7F

Ans: (a) 5 F

Solution: $7MnO_4^- + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

5 moles of electrons i.e., 5F charge is required.

8. A current strength of 3.86 A was passed through molten Calcium oxide for 41 minutes and 40 seconds. The mass of Calcium in grams deposited at the cathode is (atomic mass of Ca is 40 g / mol and 1 F = 96500 C).

(a) 4 (b) 2 (c) 8 (d) 6

Ans: (b) 2

Solution:

m = Zlt (t = 41 minutes 40 seconds = 2500 seconds)

$$= \frac{40 \times 3.86 \times 2500}{2 \times 96500} \quad Z = \frac{m}{n \times 96500} = \frac{40}{2 \times 96500} = 2g$$

9. During electrolysis of molten sodium chloride, the time required to produce 0.1 mole of chlorine gas using a current of 3A is

(a) 55 minutes (b) 107.2 minutes (c) 220 minutes (d) 330 minutes

Ans: (b) 107.2 minutes

Solution:

m = ZIt (mass of 1 mole of Cl_2 gas = 71)

$t = \frac{m}{ZI}$ ($\therefore$ mass of 0.1 mole of Cl_2 gas $= 7.1\ g\ mol^{-1}$)

$= \frac{7.1}{\frac{71}{2\times96500}\times 3}$ $\qquad (2Cl^- \longrightarrow Cl_2 + 2e^-)$

$= \frac{2\times96500\times7.1}{71\times3} = 6433.33$ seconds $= 107.2$ minutes

10. The number of electrons delivered at the cathode during electrolysis by a current of 1 A in 60 seconds is (charge of electron = 1.6×10^{-19} C)

(a) 6.22×10^{23} (b) 6.022×10^{20}

(c) 3.75×10^{20} (d) 7.48×10^{23}

Ans: (c) 3.75×10^{20}

11. Which of the following electrolytic solution has the least specific conductance?

(a) 2N (b) 0.002 N (c) 0.02 N (d) 0.2 N

Ans: (b) 0.002 N

Solution:

In general, specific conductance of an electrolyte decreases with dilution. So, 0.002N solution has least specific conductance.

12. While charging lead storage battery

(a) $PbSO_4$ on cathode is reduced to Pb

(b) $PbSO_4$ on anode is oxidised to PbO_2

(c) $PbSO_4$ on anode is reduced to Pb

(d) $PbSO_4$ on cathode is oxidised to Pb

Ans: (c) $PbSO_4$ on anode is reduced to Pb

Solution:

Charging: anode

$$PbSO_{4(s)} + 2e^- \longrightarrow Pb_{(s)} + SO^{-2}_{4(aq)}$$

Cathode:

$$PbSO_{4(s)} + 2H_2O_{(l)} \longrightarrow PbO_{2(s)} + SO^{-2}_{4(aq)} + 2e^-$$

13. Among the following cells

(I) Leclanche cell (II) Nickel-Cadmium cell

(III) Lead storage battery (IV) Mercury cell

Primary cells are

(a) I and IV (b) I and III (c) III and IV (d) II and III

Ans: (a) I and IV

14. Zinc can be coated on iron to produce galvanized iron but the reverse is not possible. It is because

(a) Zinc is lighter than iron

(b) Zinc has lower melting point than iron

(c) Zinc has lower negative electrode potential than iron

(d) Zinc has higher negative electrode potential than iron

Ans: (d) Zinc has higher negative electrode potential than iron

Solution:

$E^{0}_{Zn^{+}|Zn} = -0.76V$ and $E^{o}_{Fe^{2+}|Fe} = -0.44V$ Zinc has higher negative electrode potential than iron, iron cannot be coated on zinc.

15. **Assertion :** Pure iron when heated in dry air is converted with a layer of rust.

Reason : Rust has the composition Fe_3O_4.

(a) If both assertion and reason are true and reason is the correct explanation of assertion

(b) If both assertion and reason are true but reason is not the correct explanation of assertion

(c) Assertion is true but reason is false

(d) Both assertion and reason are false

Ans: (d) Both assertion and reason are false

Solution: Both are false

i) Dry air has no reaction with iron

ii) Rust has the compostion $Fe_2O_3.x\ H_2O$

16. In $H_2 - O_2$ fuel cell the reaction occurs at cathode is

(a) $O_{2(g)} + 2H_2O_{(l)} + 4e^- \longrightarrow 4OH^-_{(aq)}$ ***(Corona-20)***

(b) $H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$

(c) $2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(g)}$

(d) $H^+ + e^- \longrightarrow \frac{1}{2}H_2$

Ans: (a) $O_{2(g)} + 2H_2O_{(l)} + 4e^- \longrightarrow 4OH^-_{(aq)}$

17. The equivalent conductance of $\frac{M}{36}$ solution of a weak monobasic acid is 6 mho cm^2 $equivalent^{-1}$ and at infinite dilution is 400 mho cm^2 $equivalent^{-1}$. The dissociation constant of this acid is

(a) 1.25×10^{-6} (b) 6.25×10^{-6} (c) 1.25×10^{-4} (d) 6.25×10^{-5}

Ans: (b) 6.25×10^{-6}

Solution:

$$\alpha = \frac{\Lambda}{\Lambda_\circ} = \frac{6}{400}$$

$$K_a = \alpha^2 C$$

$$= \frac{6}{400} \times \frac{6}{400} \times \frac{1}{36}$$

$$= 6.25 \times 10^{-6}$$

18. A conductivity cell has been calibrated with a 0.01 M, 1:1 electrolytic solution (specific conductance ($\kappa = 1.25 \times 10^{-3}$ S cm^{-1}) in the cell and the measured resistance was 800 Ω at 25°C. The cell constant is,

(a) 10^{-1} cm^{-1} (b) 10^{1} cm^{-1} (c) 1 cm^{-1} (d) 5.7×10^{-12}

Ans: (c) 1 cm^{-1}

Solution:

$$R = \rho \frac{l}{A}$$

$$\text{Cell constant} = \frac{R}{\rho}$$

$$= \kappa.R \qquad \left(\frac{1}{\rho} = \kappa\right)$$

$$= 1.25 \times 10^{-3} \mu^{-1} cm^{-1} \times 800\ \Omega$$

$$= 1\ cm^{-1}$$

19. Conductivity of a saturated solution of a sparingly soluble salt AB (1:1 electrolyte) at 298 K is 1.85×10^{-5} S m^{-1}. Solubility product of the salt AB at 298 K $\left(\Lambda^{\circ}_{m}\right)_{AB} = 14 \times 10^{-3}$ S m^2 mol^{-1}.

(a) 5.7×10^{-12} (b) 1.32×10^{-12} (c) 7.5×10^{-12} (d) 1.74×10^{-12}

Ans: (d) 1.74×10^{-12}

20. In the electrochemical cell: Zn | $ZnSO_4$ (0.01 M) || $CuSO_4$ (1.0 M) | Cu, the emf of this Daniel cell is E_1. When the concentration of $ZnSO_4$ is changed to 1.0 M and that $CuSO_4$ changed to 0.01 M, the emf changes to E_2. From the above, which one is the relationship between E_1 and E_2?

(a) $E_1 < E_2$ (b) $E_1 > E_2$ (c) $E_2 \geq E_1$ (d) $E_1 = E_2$

Ans: (b) $E_1 > E_2$

Solution:

$$E_{Cell} = E^{o}_{Cell} - \frac{0.0591}{2} \log \frac{\left[Zn^{2+}\right]}{\left[Cu^{2+}\right]}$$

$$E_1 = E^{o}_{Cell} - \frac{0.0591}{2} \log \frac{10^{-2}}{1}$$

$$Zn_{(s)} \longrightarrow Zn^{2+}_{(aq)} + 2e^{-}$$

$$E_1 = E^{o}_{Cell} + 0.0591 \quad \ldots (1)$$

$Cu^{2+}_{(aq)} + 2e^- \longrightarrow Cu_{(s)}$

$Zn_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$

$E_2 = E^o_{Cell} - \frac{0.0591}{2}.\log\frac{1}{10^{-2}}$

$E_2 = E^o_{Cell} - 0.0591$ ... (2)

$\therefore E_1 > E_2$

21. Consider the change in oxidation state of Bromine corresponding to different emf values as shown in the diagram below:

$BrO_4^- \xrightarrow{1.82V} BrO_3^- \xrightarrow{1.5V} HBrO \xrightarrow{1.595V} Br_2 \xrightarrow{1.06352V} Br^-$

Then the species undergoing disproportionation is

(a) Br_2 (b) BrO_4^- (c) BrO_3^- (d) HBrO

Ans: (d) HBrO

22. For the cell reaction

$2Fe^{3+}_{(aq)} + 2I^-_{(aq)} \longrightarrow 2Fe^{2+}_{(aq)} + I_{2(aq)}$

E°_{cell} = 0.24 V at 298 K. The standard Gibbs energy ($\Delta G°$) of the cell reactions is:

(a) -46.32 KJ mol^{-1} (b) -23.16 KJ mol^{-1}

(c) 46.32 KJ mol^{-1} (d) 23.16 KJ mol^{-1}

Ans: (a) -46.32 KJ mol^{-1}

23. A certain current liberated 0.504 gm of hydrogen in 2 hours. How many grams of copper can be liberated by the same current flowing for the same time through copper sulphate solution?

(a) 31.75 (b) 15.8 (c) 7.5 (d) 63.5

Ans: (b) 15.8

24. A gas X at 1 atm is bubbled through a solution containing a mixture of 1 MY^- and 1 MZ^- at 25°C. If the reduction potential of Z > Y > X, then

(a) Y will oxidize X and not Z

(b) Y will oxidize Z and not X

(c) Y will oxidize both X and Z

(d) Y will reduce both X and Z

Ans: (a) Y will oxidize X and not Z

25. Cell equation: $A + 2B^- \longrightarrow A^{2+} + 2B$;

$A^{2+} + 2e^- \longrightarrow A$ [$E° = +0.34$ V and $\log_{10}K = 15.6$ at 300 K] for cell reactions find $E°$ for $B^+ + e^- \longrightarrow B$ **(AIIMS-2018)**

(a) 0.80 (b) 1.26 (c) -0.54 (d) -10.94

Ans: (a) 0.80

UNIT - 10: SURFACE CHEMISTRY

EVALUATION

Choose the Best Answer

1. For Freundlich isotherm a graph of $\log\frac{x}{m}$ is plotted against log p. The slope of the line and its y-axis intercept respectively corresponds to ***(PTA MQ)***

(a) $\frac{1}{n}$, k (b) $\log\frac{1}{n}$, k (c) $\frac{1}{n}$, log k (d) $\log\frac{1}{n}$, log k

Ans: (c) $\frac{1}{n}$, log k

Solution:

$$\frac{X}{m} = k.p^{1/n}$$

$$\Rightarrow \log\left(\frac{x}{m}\right) = \log k + \frac{1}{n}\log p$$

$y = c + mx$ $\quad m = \frac{1}{n}$ and $c = \log k$

2. Which of the following is incorrect for physisorption?

(a) reversible

(b) increases with increase in temperature

(c) low heat of adsorption

(d) increases with increase in surface area

Ans: (b) increases with increase in temperature

Solution:

Wrong Statement:

Physisorption is an exothermic process. Hence increase in temperature decreases the physisorption.

3. Which one of the following characteristics are associated with adsorption? ***(NEET)***

(a) ΔG and ΔH are negative but ΔS is positive

(b) ΔG and ΔS are negative but ΔH is positive

(c) ΔG is negative but ΔH and ΔS are positive

(d) ΔG, ΔH and ΔS all are negative

Ans: (d) ΔG, ΔH and ΔS all are negative

Solution:

Adsorption leads to decrease in randomness (entropy). i.e. $\Delta S < 0$ for the adsoption to occur, ΔG should be – ve. We know that $\Delta G = \Delta H - T\Delta S$ if ΔS is –ve, $T\Delta S$ is +ve. It means that ΔG will become negative only when ΔH is –ve and $\Delta H > T\Delta S$.

4. Fog is colloidal solution of

(a) solid in gas (b) gas in gas (c) liquid in gas (d) gas in liquid

Ans: (c) liquid in gas

Solution:

Dispersion medium-gas, dispersed phase – liquid.

5. **Assertion :** Coagulation power of Al^{3+} is more than Na^{+}.

Reason : Greater the valency of the flocculating ion added, greater is its power to cause precipitation.

(a) if both assertion and reason are true and reason is the correct explanation of assertion

(b) if both assertion and reason are true but reason is not the correct explanation of assertion

(c) assertion is true but reason is false

(d) both assertion and reason are false

Ans: (a) if both assertion and reason are true and reason is the correct explanation of assertion

Solution: Hardy – Sechulze rule

6. **Statement:**

To stop bleeding from an injury, ferric chloride can be applied. Which comment about the statement is justified?

(a) It is not true, ferric chloride is a poison

(b) It is true, Fe^{3+} ions coagulate blood which is a negatively charged sol

(c) It is not true; ferric chloride is ionic and gets into the blood stream

(d) It is true, coagulation takes place because of formation of negatively charged sol with Cl^-

Ans: (b) It is true, Fe^{3+} ions coagulate blood which is a negatively charged sol

7. Hair cream is

(a) gel (b) emulsion (c) solid sol (d) sol

Ans: (b) emulsion

8. Which one of the following is correctly matched? ***(PTA MQ)***

(a) Emulsion - Smoke

(b) Gel - Butter

(c) Foam - Mist

(d) Whipped cream - Sol

Ans: (b) Gel - Butter

Solution:

Dispersed phase and dispersion medium - liquid

9. The most effective electrolyte for the coagulation of As_2S_3 Sol is

(a) NaCl (b) $Ba(NO_3)_2$ (c) $K_3[Fe(CN)_6]$ (d) $Al_2(SO_4)_3$

Ans: (d) $Al_2(SO_4)_3$

Solution:

As_2S_3 is a negatively charged colloid. It will be most effectively coagulated by the cation with greater valency i.e., Al^{3+}.

10. Which one of the following is not a surfactant?

(a) $CH_3-(CH_2)_{15}-\overset{+}{N}-(CH_3)_2CH_2BrsC$

(b) $CH_3-(CH_2)_{15}-NH_2$

(c) $CH_3-(CH_2)_{16}CH_2OSO_2^-Na^+$

(d) $OHC-(CH_2)_{14}-CH_2-COO^-Na^+$

Ans: (b) $CH_3-(CH_2)_{15}-NH_2$

11. The phenomenon observed when a beam of light is passed through a colloidal solution is

(a) Cataphoresis (b) Electrophoresis

(c) Coagulation (d) Tyndall effect

Ans: (d) Tyndall effect

Solution:

Tyndall effect – scattering of light

12. In an electrical field, the particles of a colloidal system move towards cathode. The coagulation of the same sol is studied using K_2SO_4 (i), Na_3PO_4 (ii), $K_4[Fe(CN)_6]$ (iii) and NaCl (iv). Their coagulating power should be

(a) II > I > IV > III (b) III > II > I > IV

(c) I > II > III > IV (d) none of these

Ans: (b) III > II > I > IV

13. Collodion is a 4% solution of which one of the following compounds in alcohol-ether mixture?

(a) Nitroglycerine (b) Cellulose acetate

(c) Glycoldinitrate (d) Nitrocellulose

Ans: (d) Nitrocellulose

Solution: Pyroxylin (Nitro cellulose)

14. Which one of the following is an example for homogeneous catalysis?
(a) manufacture of ammonia by Haber's process
(b) manufacture of sulphuric acid by contact process
(c) hydrogenation of oil
(d) hydrolysis of sucrose in presence of dil. HCl

Ans: (d) hydrolysis of sucrose in presence of dil. HCl

Solution:

Both reactant and catalyst are in same phase.

15. Match the following:

(A) V_2O_5 - (i) High density polyethylene
(B) Ziegler – Natta - (ii) PAN
(C) Peroxide - (iii) NH_3
(D) Finely divided Fe - (iv) H_2SO_4

	A	B	C	D
(a)	(iv)	(i)	(ii)	(iii)
(b)	(i)	(ii)	(iv)	(iii)
(c)	(ii)	(iii)	(iv)	(i)
(d)	(iii)	(iv)	(ii)	(i)

Ans: (a) (iv) (i) (ii) (iii)

16. The coagulation values in millimoles per litre of the electrolytes used for the coagulation of As_2S_3 are given below.
(I) (NaCl) = 52 (II) ($BaCl_2$) = 0.69 (III) ($MgSO_4$) = 0.22
The correct order of their coagulating power is
(a) III > II > I (b) I > II > III
(c) I > III > II (d) II > III > I

Ans: (a) III > II > I

Solution:

$$\text{Coaugulation power} \propto \frac{1}{\text{coaugulating value}}$$

17. Adsorption of a gas on solid metal surface is spontaneous and exothermic, then

(a) ΔH increases (b) ΔS increases

(c) ΔG increases (d) ΔS decreases

Ans: (d) ΔS decreases

Solution:

ΔS is negative

18. If x is the amount of adsorbate and m is the amount of adsorbent, which of the following relations is not related to adsorption process?

(a) $\frac{x}{m}$ = f(P) at constant T (b) $\frac{x}{m}$ = f(T) at constant P

(c) P = f(T) at constant $\frac{x}{m}$ (d) $\frac{x}{m}$ = PT

Ans: (d) $\frac{x}{m}$ = PT

19. On which of the following properties does the coagulating power of an ion depend? ***(NEET-2018)***

(a) Both magnitude and sign of the charge on the ion

(b) Size of the ion alone

(c) the magnitude of the charge on the ion alone

(d) the sign of charge on the ion alone

Ans: (a) Both magnitude and sign of the charge on the ion

20. Match the following:

(A) Pure nitrogen	-	(i) Chlorine
(B) Haber process	-	(ii) Sulphuric acid
(C) Contact process	-	(iii) Ammonia
(D) Deacons Process	-	(iv) Sodium azide (or) Barium azide

Which of the following is the correct option?

	A	B	C	D
(a)	(i)	(ii)	(iii)	(iv)
(b)	(ii)	(iv)	(i)	(iii)
(c)	(iii)	(iv)	(ii)	(i)
(d)	(iv)	(iii)	(ii)	(i)

Ans: (d) (iv) (iii) (ii) (i)

UNIT - 11: HYDROXY COMPOUNDS AND ETHERS

EVALUATION

Choose the Best Answer

1. An alcohol (x) gives blue colour in victor Mayer's test and 3.7g of X when treated with metallic sodium liberates 560 mL of hydrogen at 273 K and 1 atm pressure what will be the possible structure of X?

(a) CH_3 CH (OH) CH_2 CH_3 (b) $CH_3 - CH(OH) - CH_3$

(c) $CH_3 - C(OH) - (CH_3)_2$

(d) $CH_3 - CH_2 - CH(OH) - CH_2 - CH_3$

Ans: (a) CH_3 CH (OH) CH_2 CH_3

Solution:

$2R - OH + Na \longrightarrow 2RONa + 2H_2 \uparrow$ 2 moles of alcohol gives 1 mole of H_2 which occupies 22.4 L at 273 K and 1 atm

$\therefore$ Number of moles of alcohol

$$= \frac{2 \text{ moles of } R - OH}{22.4 \text{ L } H_2} \times 560 \text{ mL}$$

$$= 0.05 \text{ moles}$$

$$\therefore \text{No. of moles} = \frac{\text{mass}}{\text{molar mass}}$$

$$\Rightarrow \text{molar mass} = \frac{3.7}{0.05} = 74 \text{ g mol}^{-1}$$

General formula for $R - OH \Rightarrow C_nH_{2n+1} - OH$

$\therefore n(2) + (2n+1)(1) + 16 + 1 = 74$

$14n = 74 - 18$

$14n = 56$

The 2° alcohol which contains 4 carbon is

$CH_2CH(OH)CH_2CH_3$

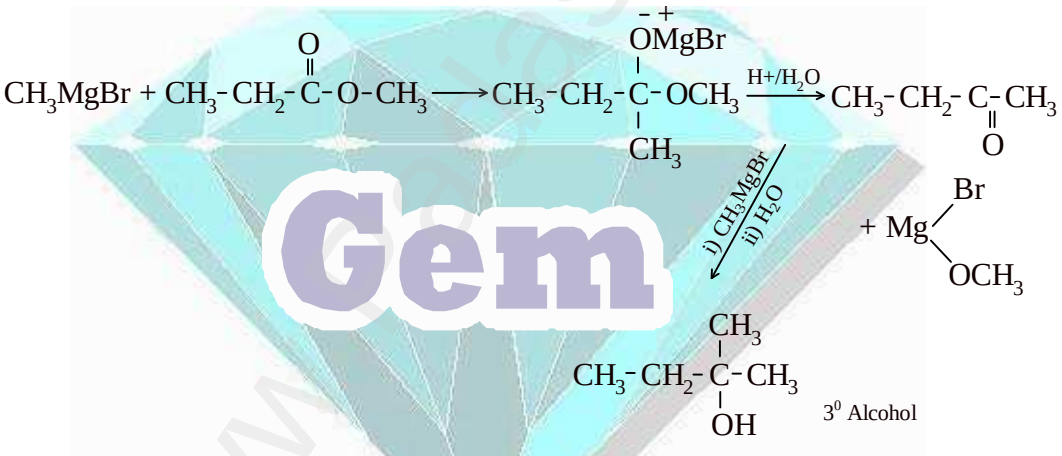
2. Which of the following compounds on reaction with methyl magnesium bromide will give tertiary alcohol?

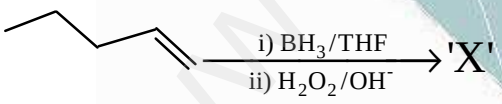
(a) benzaldehyde (b) propanoic acid

(c) methyl propanoate (d) acetaldehyde

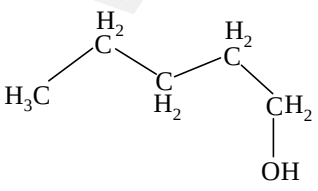
Ans: (c) methyl propanoate

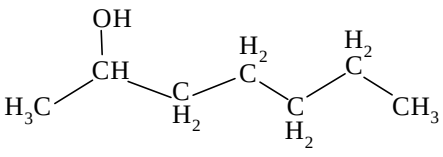
Solution:

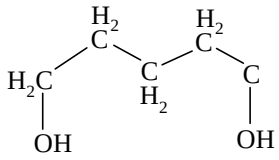


3. 

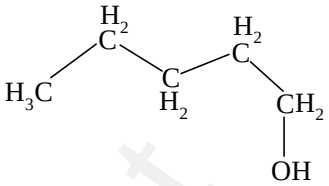
The X is

(a) 

b) 

c) 

d) None of these



Ans: (a)

Solution:

Hydro boration – Anti markownikof product i.e.,

$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - OH$

4. In the reaction sequence, Ethane $\xrightarrow{HOCl}$ A $\xrightarrow{X}$ ethan – 1,2-diol. A and X respectively are

(a) Chloroethane and NaOH

(b) ethanol and H_2SO_4

(c) 2-chloroethan-1-ol and $NaHCO_3$

(d) ethanol and H_2O

Ans: (c) 2-chloroethan-1-ol and $NaHCO_3$

Solution:

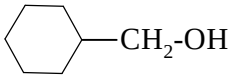
$$CH_2 = CH_2 \xrightarrow{HOCl} \underset{\underset{OH}{|}}{CH_2} - \underset{\underset{Cl}{|}}{CH_2} \xrightarrow[-NaCl\ -CO_2]{(X)\ NaHCO_3} \underset{\underset{OH}{|}}{CH_2} - \underset{\underset{OH}{|}}{CH_2}$$

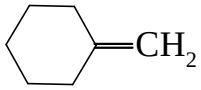
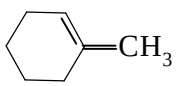
5. Which one of the following is the strongest acid?

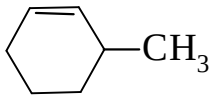
(a) 2-nitrophenol (b) 4-chlorophenol

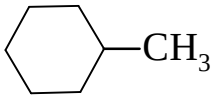
(c) 4-nitrophenol (d) 3-nitrophenol

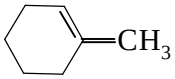
Ans: (c) 4-nitrophenol

6.  on treatment with Con H_2SO_4, predominately gives

(a)  (b) 

(c) 

(d) 

Ans: (b) 

7. Carbolic acid is

(a) Phenol (b) Picric acid

(c) benzoic acid (d) phenylacetic acid

Ans: (a) Phenol

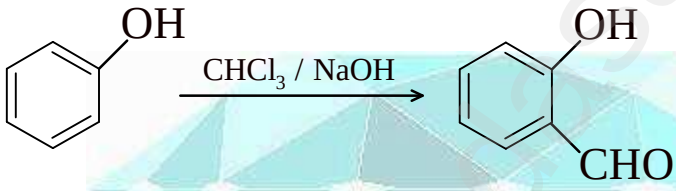
8. Which one of the following will react with phenol to give salicyladehyde after hydrolysis?

(a) Dichloro methane (b) trichloroethane

(c) trichloro methane (d) CO_2

Ans: (c) trichloro methane

Solution: Riemer – Tiemann reaction



9. $(CH_3)_3 - C - CH(OH)CH_3 \xrightarrow{\text{Con } H_2SO_4} X$ (major product)

(PTA MQ)

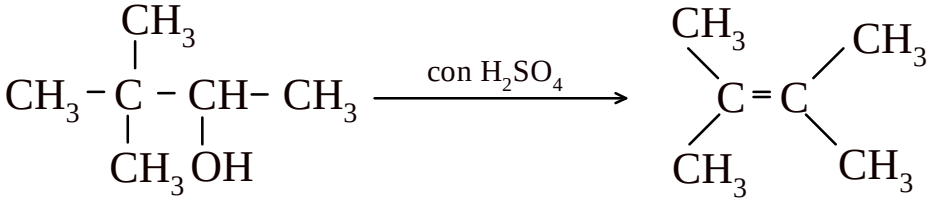
(a) $(CH_3)_3 CCH = CH_2$ (b) $(CH_3)_2 C = C(CH_3)_2$

(c) $CH_2 = C(CH_3)CH_2 - CH_2 - CH_3$

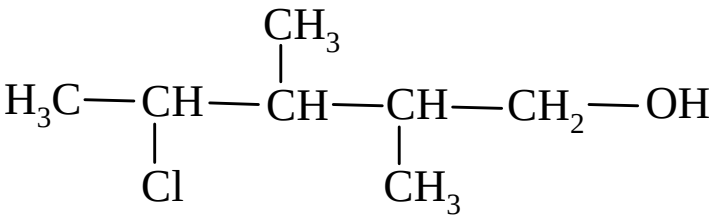
(d) $CH_2 = C(CH_3) - CH_2 - CH_2 - CH_3$

Ans: (b) $(CH_3)_2 C = C(CH_3)_2$

Solution:



10. The correct IUPAC name of the compound, ***(PTA MQ)***



(a) 4-chloro-2,3-dimethyl pentan-1-ol
(b) 2,3-dimethyl-4-chloropentan-1-ol
(c) 2,3,4-trimethyl-4-chlorobutan-1-ol
(d) 4-chloro-2,3,4-trimethyl pentan-1-ol

Ans: (a) 4-chloro-2,3-dimethyl pentan-1-ol

11. **Assertion :** Phenol is more acidic than ethanol.
Reason : Phenoxide ion is resonance stabilized.
(a) if both assertion and reason are true and reason is the correct explanation of assertion.
(b) if both assertion and reason are true but reason is not the correct explanation of assertion.
(c) assertion is true but reason is false
(d) both assertion and reason are false

Ans: (a) if both assertion and reason are true and reason is the correct explanation of assertion

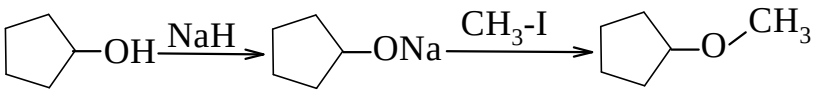
12. In the reaction Ethanol $\xrightarrow{PCl_5}$ X $\xrightarrow{alc.KOH}$ Y $\xrightarrow[298K]{H_2SO_4/H_2O}$ Z.
The 'Z' is
(a) ethane (b) ethoxyethane (c) ethylbisulphite (d) ethanol

Ans: (d) ethanol

Solution:

$$CH_3-CH_2-OH \xrightarrow{PCl_5} CH_3-CH_2-Cl \xrightarrow[KOH]{Alc.}$$

$$CH_2=CH_2 \xrightarrow{H_2SO_4/H_2O} CH_3-CH_2-OH(Z)Ethanol$$

13. The reaction 

can be classified as

(a) dehydration (b) Williams on alcohol synthesis

(c) Williamson ether synthesis (d) dehydrogenation of alcohol

Ans: (c) Williamson ether synthesis

Solution:

Cyclic alcohol ⟶ sodium cyclic alkoxide ⟶ Williamson ether synthesis

14. Isopropylbenzene on air oxidation in the presence of dilute acid gives

(a) C_6H_5COOH (b) $C_6H_5COCH_3$ (c) $C_6H_5COC_6H_5$ (d) C_6H_5–OH

Ans: (d) C_6H_5–OH

Solution: Phenol

15. **Assertion :** Phenol is more reactive than benzene towards electrophilic substitution reaction.

Reason : In the case of phenol, the intermediate arenium ion is more stabilized by resonance.

(a) if both assertion and reason are true and reason is the correct explanation of assertion.

(b) if both assertion and reason are true but reason is not the correct explanation of assertion.

(c) assertion is true but reason is false.

(d) both assertion and reason are false.

Ans: (a) if both assertion and reason are true and reason is the correct explanation of assertion

16. $HOCH_2 CH_2$ – OH on heating with periodic acid gives

(a) methanoic acid (b) Glyoxal (c) methanol (d) CO_2

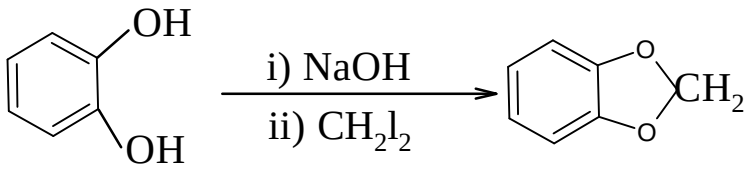
Ans: (c) methanol

17. Which of the following compound can be used as antifreeze in automobile radiators?

(a) methanol (b) ethanol (c) Neopentyl alcohol (d) ethan-1,2-diol

Ans: (d) ethan-1,2-diol (glycol)

18. The reactions



is an example of

(a) Wurtz reaction (b) cyclic reaction

(c) Williamson reaction (d) Kolbe reactions

Ans: (c) Williamson reaction

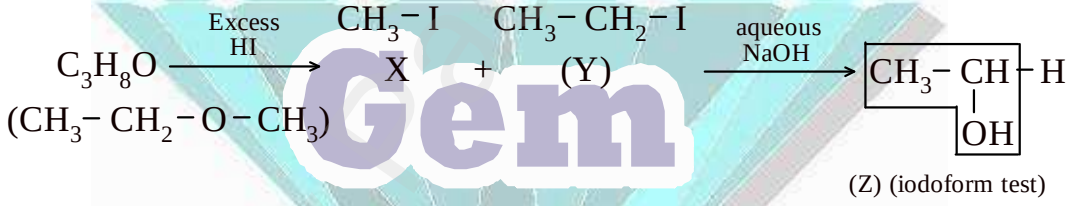
19. One mole of an organic compound (A) with the formula C_3H_8O reacts completely with two moles of HI to form X and Y. When Y is boiled with aqueous alkali it forms Z. Z answers the iodoform test. The compound (A) is

(a) propan-2-ol (b) propan-1-ol

(c) ethoxy ethane (d) methoxy ethane

Ans: (d) methoxy ethane

Solution:



20. Among the following ethers which one will produce methyl alcohol on treatment with hot HI?

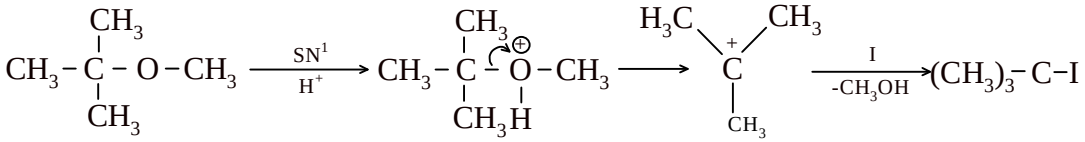
(a) $(H_3C)_3-C-O-CH_3$ (b) $(CH_3)_2-CH-CH_2-O-CH_3$

(c) $CH_3-(CH_2)_3-O-CH_3$

(d) $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-O-CH_3$

Ans: (a) $(H_3C)_3-C-O-CH_3$

Solution:



21. Williamson synthesis of preparing dimethyl ether is a/an

(a) SN^1 reactions (b) SN^2 reaction

(c) electrophilic addition (d) electrophilic substitution

Ans: (b) SN^2 reaction

22. On reacting with neutral ferric chloride, phenol gives

(a) red colour (b) violet colour

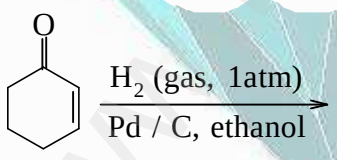
(c) dark green colour (d) no colouration

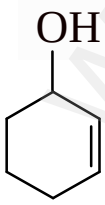
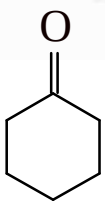
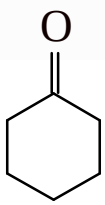
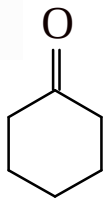
Ans: (b) violet colour

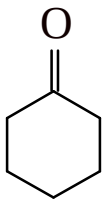
UNIT - 12: CARBONYL COMPOUNDS AND CARBOXYLIC ACIDS

EVALUATION

Choose the Best Answer

1. The correct structure of the product 'A' formed in the reaction  A is

(a)  (b)  (c)  (d) 

Ans: (b) 

2. The formation of cyanohydrin from acetone is an example of
(a) nucleophilic substitution (b) electrophilic substitution
(c) electrophilic addition (d) Nucleophilic addition

Ans: (d) Nucleophilic addition

3. Reaction of acetone with one of the following reagents involves nucleophilic addition followed by elimination of water. The reagent is
(a) Grignard reagent (b) Sn/HCl
(c) hydrazine in presence of slightly acidic solution
(d) hydrocyanic acid

Ans: (c) hydrazine in presence of slightly acidic solution

4. In the following reaction,

$HC \equiv CH \xrightarrow[HgSO_4]{H_2SO_4} X$, Product 'X' will not give

(a) Tollen's test (b) Victor Meyer test
(c) Iodoform test (d) Fehling test

Ans: (b) Victor Meyer test

Solution:

$$CH \equiv CH \xrightarrow[HgSO_4]{H_2SO_4} \underset{\underset{H}{|}}{CH} = \underset{\underset{O-H}{|}}{CH} \longrightarrow CH_3-\underset{\underset{O}{\|}}{C}-H$$

(X)

5. $CH_2 = CH_2 \xrightarrow[ii)\ Zn/H_2O]{i)\ O_3} X \xrightarrow{NH_3} Y$ 'Y' is

(a) Formaldelyde (b) diacetoneammonia
(c) hexamethylenetetraamine (d) oxime

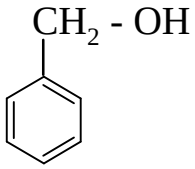
Ans: (c) hexamethylenetetraamine

Solution: X – HCHO; Y – $(CH_2)_6N_4$

6. Predict the product Z in the following series of reactions

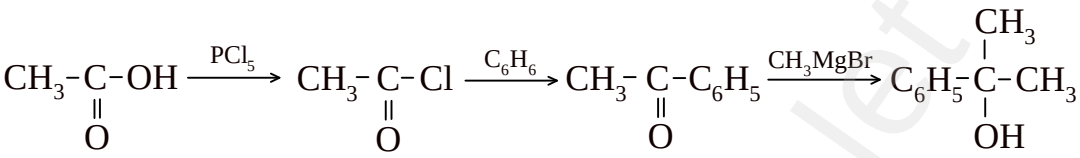
Ethanoic acid $\xrightarrow{PCl_5} X \xrightarrow[\text{Anhydrous } AlCl_3]{C_6H_6} Y \xrightarrow[ii)H_3O^+]{i)CH_3MgBr} Z.$

(a) $(CH_3)_2C(OH)C_6H_5$ (b) $CH_3CH(OH)C_6H_5$

(c) $CH_3CH(OH)CH_2\text{-}CH_3$ (d) 

Ans: (a) $(CH_3)_2C(OH)C_6H_5$

Solution:



7. **Assertion :** 2,2-dimethyl propanoic acid does not give HVZ reaction.

Reason : 2,2-dimethyl propanoic acid does not have α hydrogen atom.

(a) if both assertion and reason are true and reason is the correct explanation of assertion.

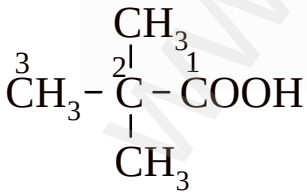
(b) if both assertion and reason are true but reason is not the correct explanation of assertion.

(c) assertion is true but reason is false

(d) both assertion and reason are false.

Ans: (a) if both assertion and reason are true and reason is the correct explanation of assertion

Solution:



8. Which of the following represents the correct order of acidity in the given compounds?

(a) $FCH_2COOH > CH_3COOH > BrCH_2COOH > ClCH_2COOH$

(b) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$

(c) $CH_3COOH > ClCH_2COOH > FCH_2COOH > BrCH_2COOH$

(d) $ClCH_2COOH > CH_3COOH > BrCH_2COOH > ICH_2COOH$

Ans: (b) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$

Solution:

-I effect increases the acidity. If electronegativity is high, -I effect is also high.

9. Benzoic acid $\xrightarrow[ii)\Delta]{i)NH_3} A \xrightarrow{NaOBr} B \xrightarrow{NaNO_2/HCl} C$ 'C' is

(a) anilinium chloride (b) O-nitro aniline

(c) benzene diazonium chloride (d) m-nitro benzoic acid

Ans: (c) benzene diazonium chloride

Solution:

$$C_6H_5COOH \xrightarrow[ii)]{i)\ NH_3} C_6H_5CONH_2 \xrightarrow{NaOBr}$$

(A)

$$C_6H_5 - NH_2 \xrightarrow{NaNO_2/HCl} C_6H_5 - N = N - Cl$$

(B)

10. Ethanoic acid $\xrightarrow{P/Br_2}$ 2-bromoethanoic acid. This reaction is called

(a) Finkelstein reaction (b) Haloform reaction

(c) Hell-Volhard-Zelinsky reaction (d) none of these

Ans: (c) Hell-Volhard-Zelinsky reaction

11. $CH_3Br \xrightarrow{KCN} (A) \xrightarrow{H_3O^+} (B) \xrightarrow{PCl_5} (C)$ Product (c) is

(a) acetylchloride (b) chloro acetic acid

(c) α-chlorocyano ethanoic acid (d) none of these

Ans: (a) acetylchloride

Solution:

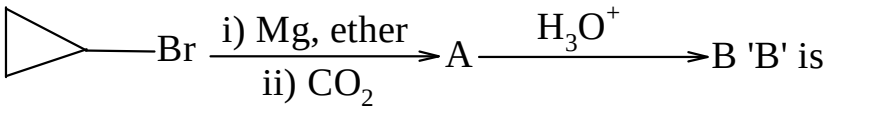
$$CH_3Br \xrightarrow{KCN} CH_3CN \xrightarrow{H_3O^+} CH_3COOH \xrightarrow{PCl_5} CH_3 - \overset{\overset{O}{\|}}{C} - Cl$$

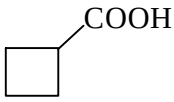
12. Which one of the following reduces tollens reagent

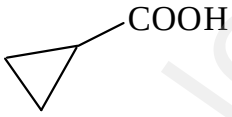
(a) formic acid (b) acetic acid

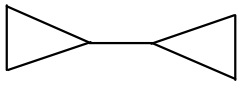
(c) benzophenone (d) none of these

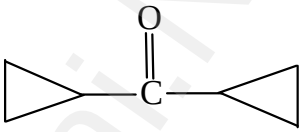
Ans: (a) formic acid HCOOH

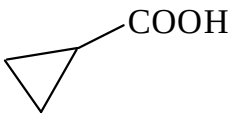
13. 

(a) 

(b) 

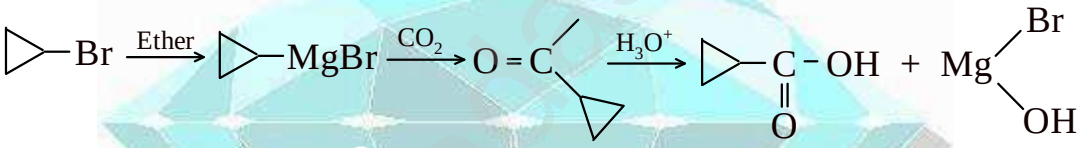
(c) 

(d) 



Ans: (b)

Solution:



14. The IUPAC name of 

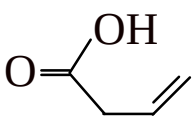
(PTA MQ)

(a) but-3-enoic acid (b) but-1-ene-4-oic acid

(c) but-2-ene-1-oic acid (d) but-3-ene-1-oic acid

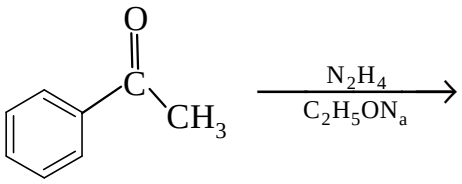
Ans: (a) but-3-enoic acid

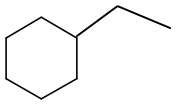
Solution:

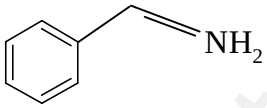


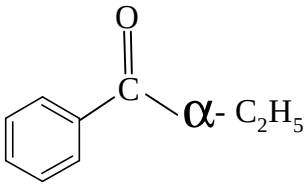
but-3-enoic acid

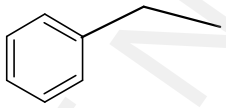
15. Identify the product formed in the reaction

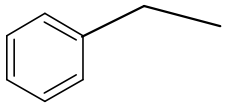


(a) 

(b) 

(c) 

(d) 

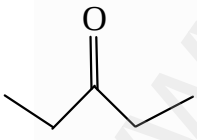
Ans: (d) 

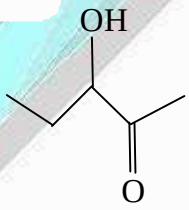
Solution:

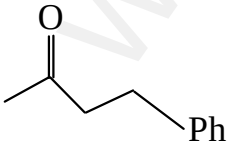
group reduced to CH_2- group

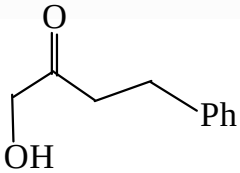
(Wolf-Kishner Reduction)

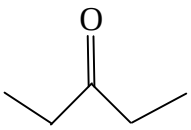
16. In which case chiral carbon is not generated by reaction with HCN

(a) 

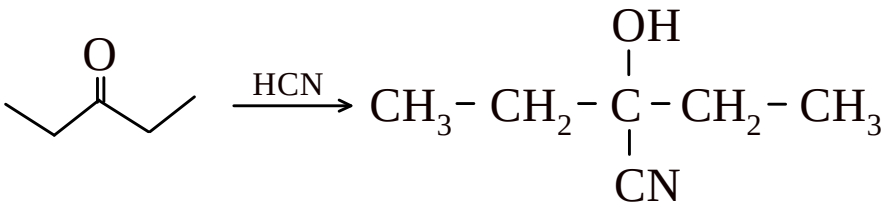
(b) 

(c) 

(d) 

Ans: (a) 

Solution:



17. **Assertion :** p-N,N-dimethyl aminobenzaldehyde undergoes benzoin condensation.

Reason : The aldehydic (-CHO) group is meta directing.

(a) if both assertion and reason are true and reason in the correct explanation of assertion.

(b) if both assertion and reason are true but reason is not the correct explanation of assertion.

(c) assertion is true but reason is false

(d) both assertion and reason are false

Ans: (b) if both assertion and reason are true but reason is not the correct explanation of assertion

18. Which one of the following reaction is an example of disproportionation reaction?

(a) Aldol condensation (b) cannizaro reaction

(c) Benzoin condensation (d) none of these

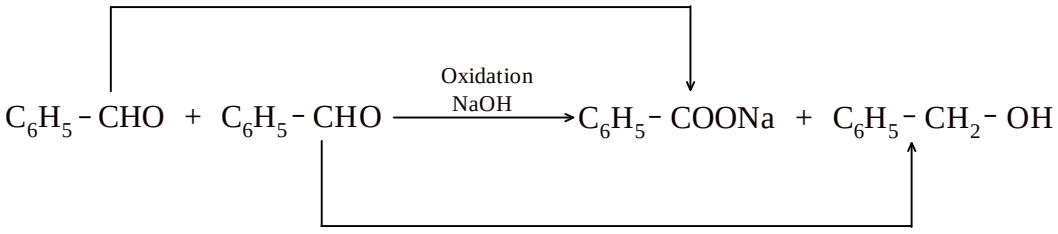
Ans: (b) cannizaro reaction

19. Which one of the following undergoes reaction with 50% sodium hydroxide solution to give the corresponding alcohol and acid?

(a) Phenylmethanal (b) ethanal (c) ethanol (d) methanol

Ans: (a) Phenylmethanal

Solution:



20. The reagent used to distinguish between acetaldehyde and benzaldehyde is

(a) Tollens reagent (b) Fehling's solution

(c) 2,4-dinitrophenyl hydrazine (d) semicarbazide

Ans: (b) Fehling's solution

21. Phenyl methanal is reacted with concentrated NaOH to give two products X and Y. X reacts with metallic sodium to liberate hydrogen. X and Y are

(a) Sodium benzoate and phenol

(b) Sodium benzoate and phenyl methanol

(c) Phenyl methanol and sodium benzoate

(d) None of these

Ans: (c) Phenyl methanol and sodium benzoate

Solution:

$$C_6H_5-CHO \xrightarrow[NaOH]{Con} C_6H_5-CH_2-OH + C_6H_5-COONa$$

$$C_6H_5-CH_2-OH \xrightarrow{Na} C_6H_5-CH_2-ONa + \frac{1}{2}H_2$$

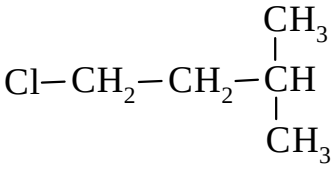
22. In which of the following reactions new carbon-carbon bond is not formed? ***(PTA MQ)***

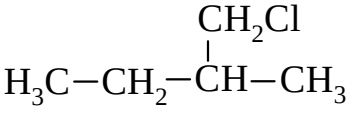
(a) Aldol condensation (b) Friedel craft reaction

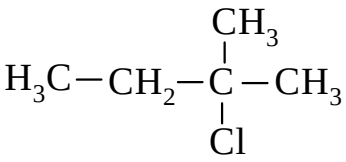
(c) Kolbe's reaction (d) Wolf kishner reduction

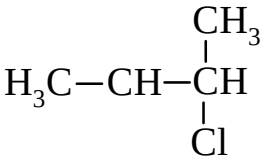
Ans: (d) Wolf kishner reduction

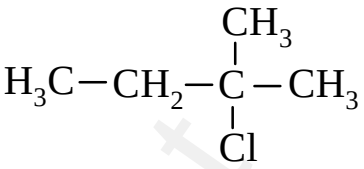
23. An alkene "A" on reaction with O_3 and Zn-H_2O gives propanone and ethanol in equimolar ratio. Addition of HCl to alkene "A" gives "B" as the major product. The structure of product "B" is

(a) 

(b) 

(c) 

(d) 



Ans: (c)

24. Carboxylic acids have higher boiling points than aldehydes, ketones and even alcohols of comparable molecular mass. It is due to their
    (a) more extensive association of carboxylic acid via van der Waals force of attraction
    (b) formation of carboxylate ion
    (c) formation of intramolecular H-bonding
    (d) formation of intermolecular H-bonding

Ans: (d) formation of intermolecular H-bonding

UNIT - 13: ORGANIC NITROGEN COMPOUNDS

EVALUATION

Choose the Best Answer

1. Which of the following reagent can be used to convert nitrobenzene to aniline?
    (a) Sn / HCl (b) ZnHg / NaOH (c) $LiAlH_4$ (d) all of these

Ans: (a) Sn / HCl

2. The method by which aniline cannot be prepared is
    (a) Degradation of benzamide with Br_2/NaOH
    (b) Potassium salt of phthalimide treated with chlorobenzene followed by hydrolysis with aqueous NaOH solution.

(c) Hydrolysis of phenylcyanide with acidic solution
(d) Reduction of nitrobenzene by Sn / HCl

Ans: (b) Potassium salt of phthalimide treated with chlorobenzene followed by hydrolysis with aqueous NaOH solution

3. Which one of the following will not undergo Hofmann bromamide reaction?

(a) $CH_3CONHCH_3$ (b) $CH_3CH_2CONH_2$
(c) CH_3CONH_2 (d) $C_6H_5CONH_2$

Ans: (a) $CH_3CONHCH_3$

Solution:

Only primary amides undergo hoffmann bromamide reaction.

4. **Assertion :** Acetamide on reaction with KOH and bromine gives acetic acid.

Reason : Bromine catalyses hydrolysis of acetamide.

(a) if both assertion and reason are true and reason is the correct explanation of assertion.
(b) if both assertion and reason are true but reason is not the correct explanation of assertion.
(c) assertion is true but reason is false.
(d) both assertion and reason are false.

Ans: (d) both assertion and reason are false

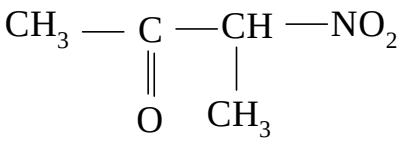
5. $CH_3CH_2Br \xrightarrow[\Delta]{aqNaOH} A \xrightarrow[\Delta]{KMnO_4/H^+} B \xrightarrow[\Delta]{NH_3} C \xrightarrow[\Delta]{Br_2/NaOH} D$

'D' is

(a) bromomethane (b) α-bromo sodium acetate
(c) methanamine (d) acetamide

Ans: (c) methanamine

6. Which one of the following nitro compounds does not react with nitrous acid

(a) $CH_3\text{-}CH_2\text{-}CH_2\text{-}NO_2$ (b) $(CH_3)_2CH\text{-}CH_2NO_2$
(c) $(CH_3)_3CNO_2$ (d) 

Ans: (c) $(CH_3)_3CNO_2$

7. Aniline + benzoylchloride $\xrightarrow{NaOH}$ C_6H_5 - NH - COC_6H_5 . This reaction is known as

(a) Friedel – crafts reaction (b) HVZ reaction

(c) Schotten – Baumann reaction (d) none of these

Ans: (c) Schotten – Baumann reaction

8. The product formed by the reaction an aldehyde with a primary amine ***(NEET)***

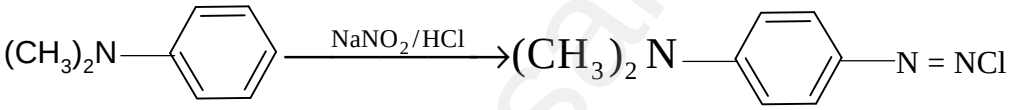
(a) carboxylic acid (b) aromatic acid

(c) Schiff's base (d) ketone

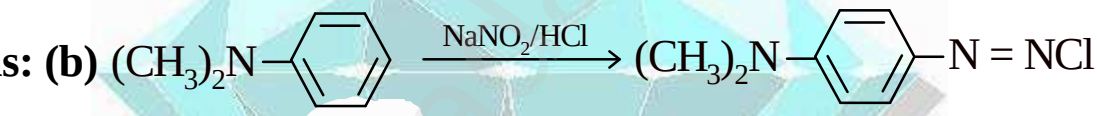
Ans: (c) Schiff's base

9. Which of the following reaction is not correct?

(a) $CH_3CH_2NH_2 \xrightarrow{HNO_2} CH_3CH_2OH + N_2$

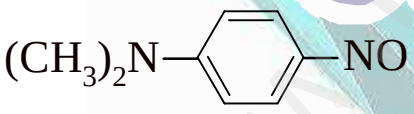
(b) 

(c) $CH_3CONH_2 \xrightarrow{Br/NaOH_2} CH_3NH_2$ (d) acetanilide

Ans: (b) 

Solution:

p-nitrosation takes places, the product is



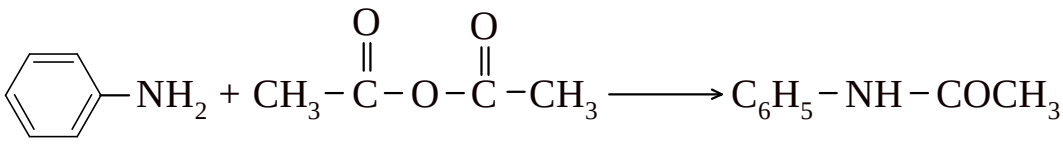
10. When aniline reacts with acetic anhydride the product formed is

(a) o-aminoacetophenone (b) m-aminoacetophenone

(c) p-aminoacetophenone (d) acetanilide

Ans: (d) acetanilide

Solution:



acetanilide

11. The order of basic strength for methyl substituted amines in aqueous solution is

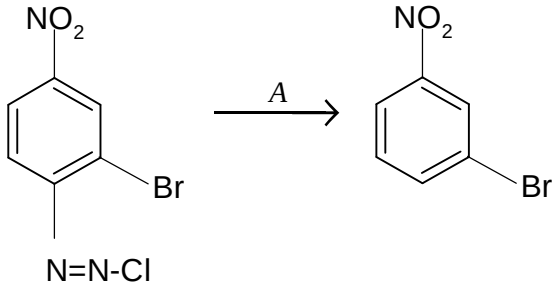
(a) $N(CH_3)_3 > N(CH_3)_2 H > N(CH_3) H_2 > NH_3$

(b) $N(CH_3) H_2 > N(CH_3)_2H > N(CH_3)_3 > NH_3$

(c) $NH_3 > N(CH_3) H_2 > N(CH_3)_2H > N(CH_3)_3$

(d) $N(CH_3)_2 H > N(CH_3) H_2 > N(CH_3)_3 > NH_3$

Ans: (d) $N(CH_3)_2 H > N(CH_3) H_2 > N(CH_3)_3 > NH_3$

12. 

(PTA MQ)

'A' is

(a) H_3PO_2 and H_2O (b) H^+/H_2O (c) $HgSO_4/H_2SO_4$ (d) Cu_2Cl_2

Ans: (a) H_3PO_2 and H_2O

13. $C_6H_5NO_2 \xrightarrow{Fe/HCl} A \xrightarrow[273K]{NaNO_2/HCl} B \xrightarrow[283K]{H_2O} C$ 'C' is

(a) C_6H_5-OH (b) C_6H_5-CH_2OH (c) C_6H_5-CHO (d) $C_6H_5NH_2$

Ans: (a) C_6H_5-OH

Solution:

$$C_6H_5NO_2 \xrightarrow{Fe/HCl} C_6H_5NH_2 \xrightarrow{NaNO_2/HCl} C_6H_5 - N_2Cl \xrightarrow{H_2O}$$

$$C_6H_5 - OH + N_2 + HCl$$

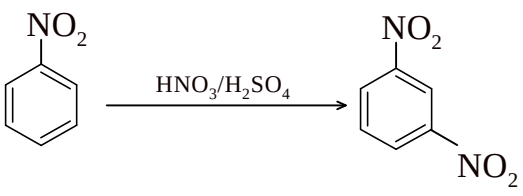
14. Nitrobenzene on reaction with con HNO_3/H_2SO_4 at 80-100°C forms which one of the following products?

(a) 1,4-dinitrobenzene (b) 2,4,6-tirnitrobenzene

(c) 1,2-dinitrobenzene (d) 1,3-dinitrobenzene

Ans: (d) 1,3-dinitrobenzene

Solution:



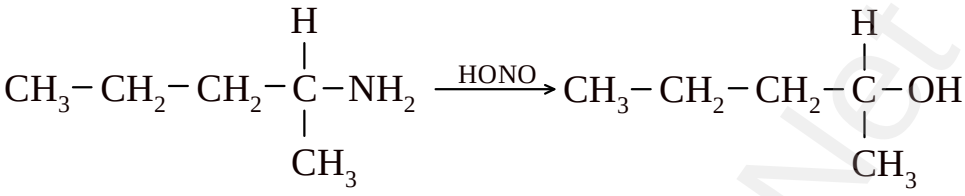
15. $C_5H_{13}N$ reacts with HNO_2 to give an optically active compound-The compound is

(a) pentan-1-amine (b) pentan-2-amine

(c) N,N-dimethylpropan-2-amine (d) N-methylbutan-2-amine

Ans: (b) pentan-2-amine

Solution:



16. Secondary nitro alkanes react with nitrous acid to form

(a) red solution (b) blue solution

(c) green solution (d) yellow solution

Ans: (b) blue solution

17. Which of the following amines does not undergo acetylation?

(a) t-butyl amine (b) ethylamine

(c) diethyl amine (d) triethylamine

Ans: (d) triethylamine

18. Which one of the following is most basic?

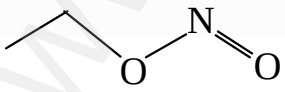
(a) 2,4-dichloroaniline (b) 2,4-dimethyl aniline

(c) 2,4-dinitroaniline (d) 2,4-dibromoaniline

Ans: (b) 2,4-dimethyl aniline

Solution:

CH_3 is a + I group, all other – I group. + I group increase the electron density on NH_2 and hence increaes the basic nature.

19. When  is reduced with Sn/HCl the pair of compounds formed are

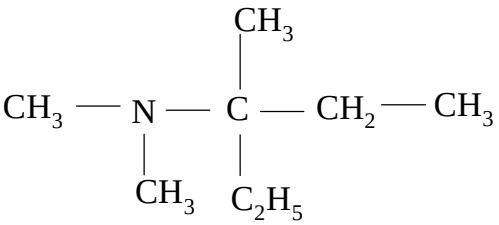
(a) Ethanol, hydroxylamine hydrochloride

(b) Ethanol, ammonium hydroxide

(c) Ethanol, . NH_4OH (d) $C_3H_5NH_2,H_2O$

Ans: (a) Ethanol, hydroxylamine hydrochloride

20. IUPAC name for the amine



is

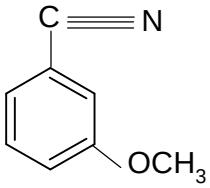
(a) 3-Bimethylamino-3-methylpentane

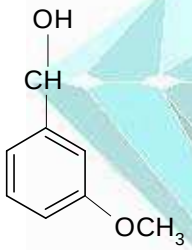
(b) 3 (N,N-Triethyl)-3-amino pentane

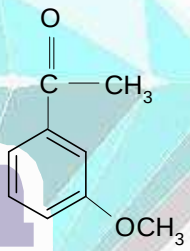
(c) 3-N,N-trimethyl pentanamine

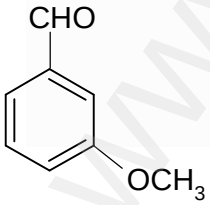
(d) 3-(N,N-Dimethyl amino)-3-methyl pentane

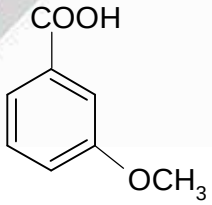
Ans: (d) 3-(N,N-Dimethyl amino)-3-methyl pentane

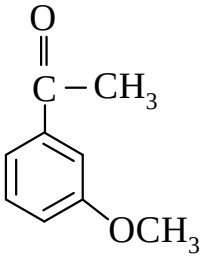
21.  + CH_3 MgBr $\xrightarrow{H_3O^+}$ P, Product 'P' in the above reaction is

(a) 

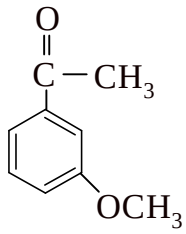
(b) 

(c) 

(d) 

Ans: (b) 

Solution:



22. Ammonium salt of benzoic acid is heated strongly with P_2O_5 and the product so formed is reduced and then treated with $NaNO_2$/HCl at low temperature. The final compound formed is

(a) Benzene diazonium chloride (b) Benzyl alcohol

(c) Phenol (d) Nitrosobenzene

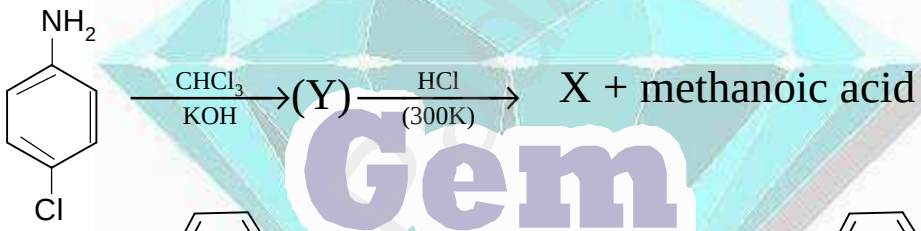
Ans: (b) Benzyl alcohol

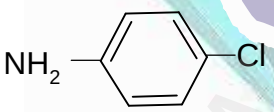
Solution:

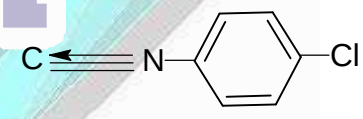
$$C_6H_5COONH_4 \xrightarrow[\text{Heat}]{P_2O_5} C_6H_5 - C \equiv N \xrightarrow{LiAlH_4}$$

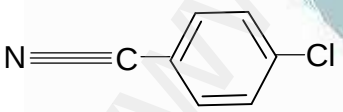
$$C_6H_5CH_2NH_2 \xrightarrow{HNO_2} C_6H_5CH_2OH$$

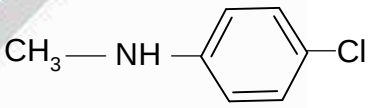
23. Identify X in the sequence give below.

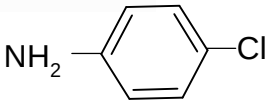


(a) 

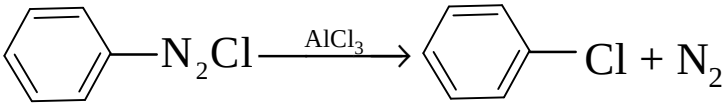
(b) 

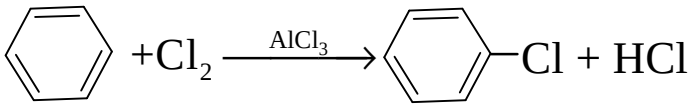
(c) 

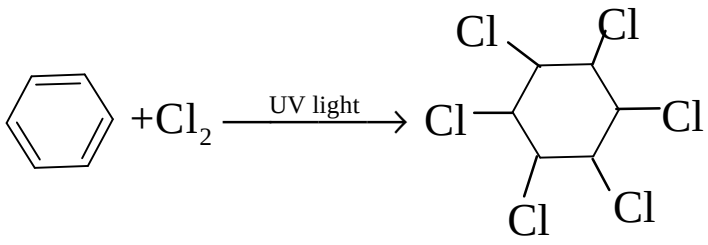
(d) 

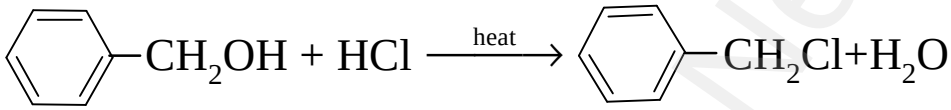
Ans: (a) 

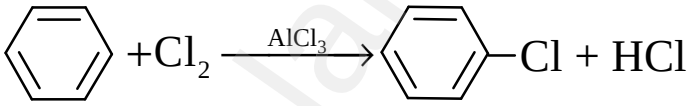
24. Among the following, the reaction that proceeds through an electrophilic substitution is

(a) 

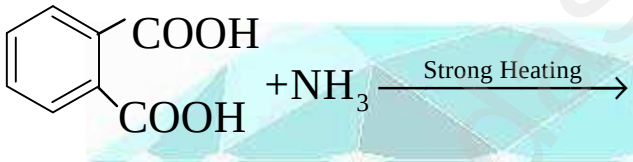
(b) 

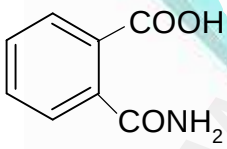
(c) 

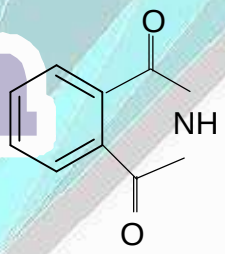
(d) 

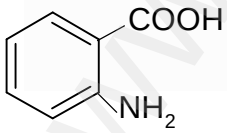
Ans: (b) 

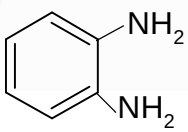
25. The major product of the following reaction

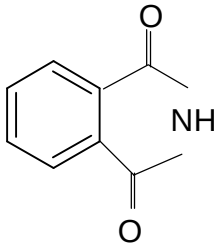


(a) 

(b) 

(c) 

(d) 

Ans: (b) 

UNIT - 14: BIOMOLECULES

EVALUATION

Choose the Best Answer

1. Which one of the following rotates the plane polarized light towards left? ***(NEET Phase-II)***

(a) D (+) Glucose (b) L (+) Glucose
(c) D(-) Fructose (d) D(+) Galactose

Ans: (c) D(-) Fructose

2. The correct corresponding order of names of four aldoses with configuration given below respectively is, ***(NEET Phase-I)***

(a) L-Erythrose, L-Threose, L-Erythrose, D-Threose
(b) D-Threose, L-Erythrose, L-Threose, L-Erythrose,
(c) L-Erythrose, L-Threose, D-Erythrose, D-Threose
(d) D-Erythrose, D-Threose, L-Erythrose, L-Threose

Ans: (d) D-Erythrose, D-Threose, L-Erythrose, L-Threose

3. Which one given below is a non-Reducing sugar? ***(PTA MQ, (NEET Phase-I))***

(a) Glucose (b) Sucrose (c) maltose (d) Lactose

Ans: (b) Sucrose

4. Glucose $\xrightarrow{(HCN)}$ Product $\xrightarrow{(hydrolysis)}$ Product $\xrightarrow{(HI+Heat)}$ A, the compound A is ***(PTA MQ)***

(a) Heptanoic acid (b) 2-Iodohexane
(c) Heptane (d) Heptanol

Ans: (a) Heptanoic acid

5. **Assertion :** A solution of sucrose in water is dextrorotatory. But on hydrolysis in the presence of little hydrochloric acid, it becomes leavorotatory.

Reason : Sucrose hydrolysis gives unequal amounts of glucose and fructose. As a result of this change in sign of rotation is observed. ***(AIMS)***

(a) If both assertion and reason are true and reason is the correct explanation of assertion

(b) If both assertion and reason are true but reason is not the correct explanation of assertion

(c) If assertion is true but reason is false

(d) If both assertion and reason are false

Ans: (a) If both assertion and reason are true and reason is the correct explanation of assertion

6. The central dogma of molecular genetics states that the genetic information flows from ***(NEET Phase-II)***

(a) Amino acids, Protein, DNA (b) DNA, Carbohydrates, Protein

(c) DNA, RNA, Proteins (d) DNA, RNA, Carbohydrates

Ans: (c) DNA, RNA, Proteins

7. In a protein, various amino acids linked together by ***(NEET Phase - I)***

(a) Peptide bond (b) Dative bond

(c) α-Glycosidic bond (d) β-Glycosidic bond

Ans: (a) Peptide bond

8. Among the following the achiral amino acid is ***(AIIMS)***

(a) 2-ethylalanine (b) 2-methylglycine

(c) 2-hydroxymethylserine (d) Tryptophan

Ans: (c) 2-hydroxymethylserine

9. The correct statement regarding RNA and DNA respectively is ***(NEET Phase-I)***

(a) The sugar component in RNA is an arabinose and the sugar component in DNA is ribose.

(b) The sugar component in RNA is 2-deoxyribose and the sugar component in DNA is arabinose.

(c) The sugar component in RNA is an arabionse and the sugar component in DNA is 2-deoxyribose.

(d) The sugar component in RNA is ribose and the sugar component in DNA is 2-deoxyribose.

Ans: (d) The sugar component in RNA is ribose and the sugar component in DNA is 2-deoxyribose

10. In aqueous solution of amino acids mostly exists in,
(a) NH_2-CH(R)-COOH (b) NH_2-CH(R)-COO^-
(c) H_3N^+-CH (R)-COOH (d) H_3N^+-CH(R)-COO^-

Ans: (d) H_3N^+-CH(R)-COO^-

11. Which one of the following is not produced by body?
(a) DNA (b) Enzymes (c) Harmones (d) Vitamins

Ans: (d) Vitamins

12. The number of sp^2 and sp^3 hybridised carbon in fructose are respectively
(a) 1 and 4 (b) 4 and 2 (c) 5 and 1 (d) 1 and 5

Ans: (d) 1 and 5

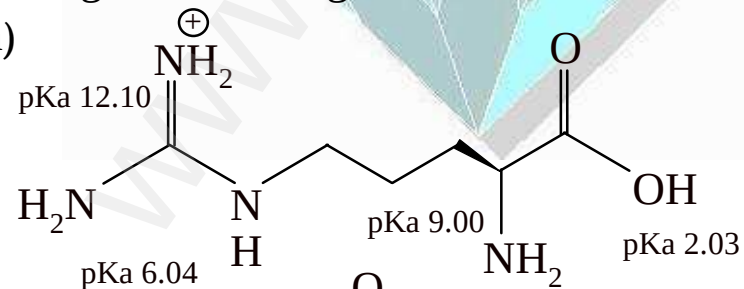
13. Vitamin B_2 is also known as
(a) Riboflavin (b) Thiamine (c) Nicotinamide (d) Pyridoxine

Ans: (a) Riboflavin

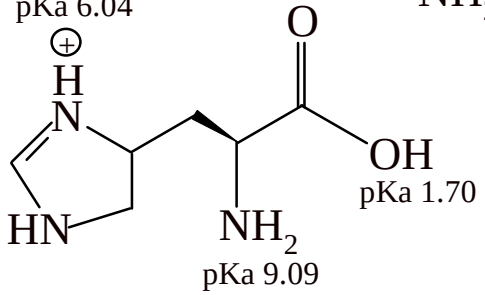
14. The pyrimidine bases present in DNA are
(a) Cytosine and Adenine (b) Cytosine and Guanine
(c) Cytosine and Thiamine (d) Cytosine and Uracil

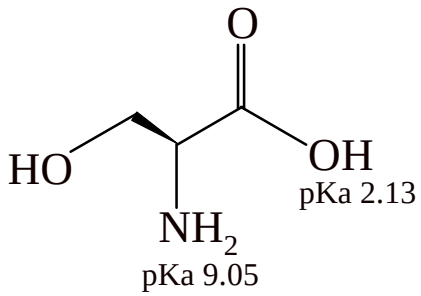
Ans: (c) Cytosine and Thiamine

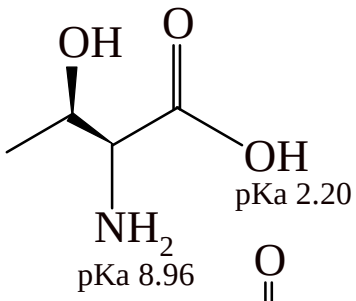
15. Among the following L-serine is
(a)

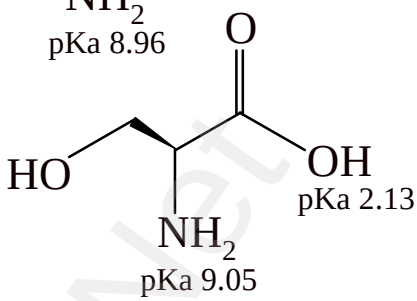


(b)



(c) 

(d) 

Ans: (c) 

16. The secondary structure of a protein refers to
    (a) fixed configuration of the polypeptide backbone
    (b) hydrophobic interaction
    (c) sequence of α-amino acids (d) α-helical backbone

    Ans: (d) α-helical backbone

17. Which of the following vitamins is water soluble?
    (a) Vitamin E (b) Vitamin K (c) Vitamin A (d) Vitamin B

    Ans: (d) Vitamin B

18. Complete hydrolysis of cellulose gives
    (a) L-Glucose (b) D-Fructose (c) D-Ribose (d) D-Glucose

    Ans: (d) D-Glucose

19. Which of the following statement is correct?
    (a) Ovalbumin is simple food reserve in egg-white
    (b) Blood proteins thrombin and fibrinogen are involved in blood clotting
    (c) Denaturation makes protein more active
    (d) Insulin maintains the sugar level of in the human body

    Ans: (c) Denaturation makes protein more active

20. Glucose is an aldose. Which one of the following reactions is not expected with glucose? ***(PTA MQ)***
    (a) It does not form oxime
    (b) It does not react with Grignard reagent

(c) It does not form osazones

(d) It does not reduce tollens reagent

Ans: (b) It does not react with Grignard reagent

21. If one strand of the DNA has the sequence 'ATGCTTGA', then the sequence of complementary strand would be

(a) TACGAACT (b) TCCGAACT

(c) TACGTACT (d) TACGRAGT

Ans: (a) TACGAACT

22. Insulin, a hormone chemically is

(a) Fat (b) Steroid (c) Protein (d) Carbohydrates

Ans: (c) Protein

23. α-D (+) Glucose and β-D(+) glucose are

(a) Epimers (b) Anomers

(c) Enantiomers (d) Conformational isomers

Ans: (b) Anomers

24. Which of the following are epimers?

(a) D (+)-Glucose and D (+)-Galactose

(b) D (+)-Glucose and D (+)-Mannose

(c) Neither (a) nor (b) (d) Both (a) and (b)

Ans: (d) Both (a) and (b)

25. Which of the following amino acids are achiral?

(a) Alanine (b) Leucine (c) Proline (d) Glycine

Ans: (d) Glycine

UNIT - 15: CHEMISTRY IN EVERYDAY LIFE

EVALUATION

Choose the Best Answer

1. Which of the following is an analgesic?

(a) Streptomycin (b) Chloromycetin (c) Asprin (d) Penicillin

Ans: (c) Asprin

2. Antiseptics and disinfectants either kill or prevent growth of microorganism. Identify which of the following statement is not true.
   (a) dilute solutions of boric acid and hydrogen peroxide are strong antiseptics
   (b) disinfectants harm the living tissues.
   (c) A 0.2% solution of phenol is an antiseptic while 1% solution acts as a disinfectant.
   (d) Chlorine and iodine are used as strong disinfectants.

Ans: (a) dilute solutions of boric acid and hydrogen peroxide are strong antiseptics

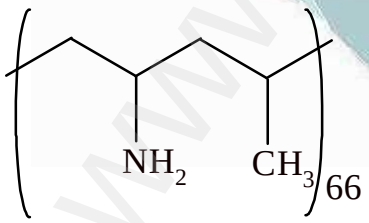
3. Drugs that bind to the receptor site and inhibit its natural function are called
   (a) antagonists (b) agonists (c) enzymes (d) molecular targets

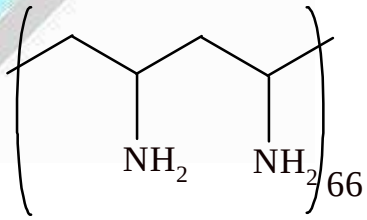
Ans: (a) antagonists

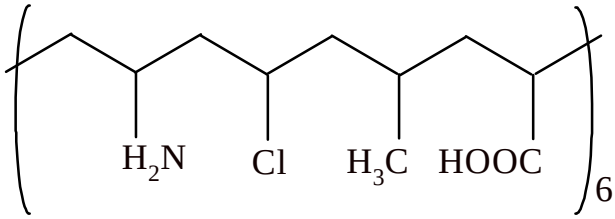
4. Aspirin is a/an
   (a) acetylsalicylic acid (b) benzoylsalicylic acid
   (c) chlorobenzoic acid (d) anthranilic acid

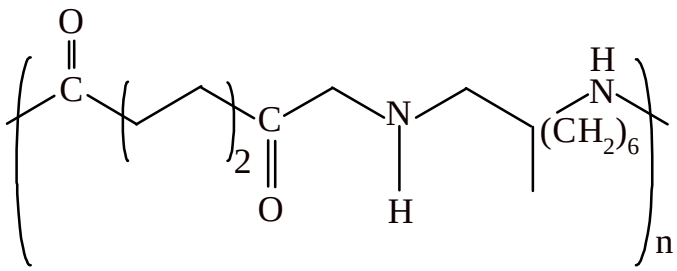
Ans: (a) acetylsalicylic acid

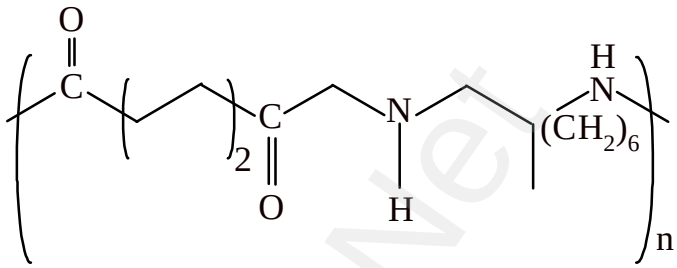
5. Which one of the following structures represents nylon 6,6 polymer?

(a) 

(b) 

(c) 

(d) 

Ans: (d) 

6. Natural rubber has
   (a) alternate cis- and trans- configuration
   (b) random cis- and trans-configuration
   (c) all cis-configuration (d) all trans-configuration

   Ans: (c) all cis-configuration

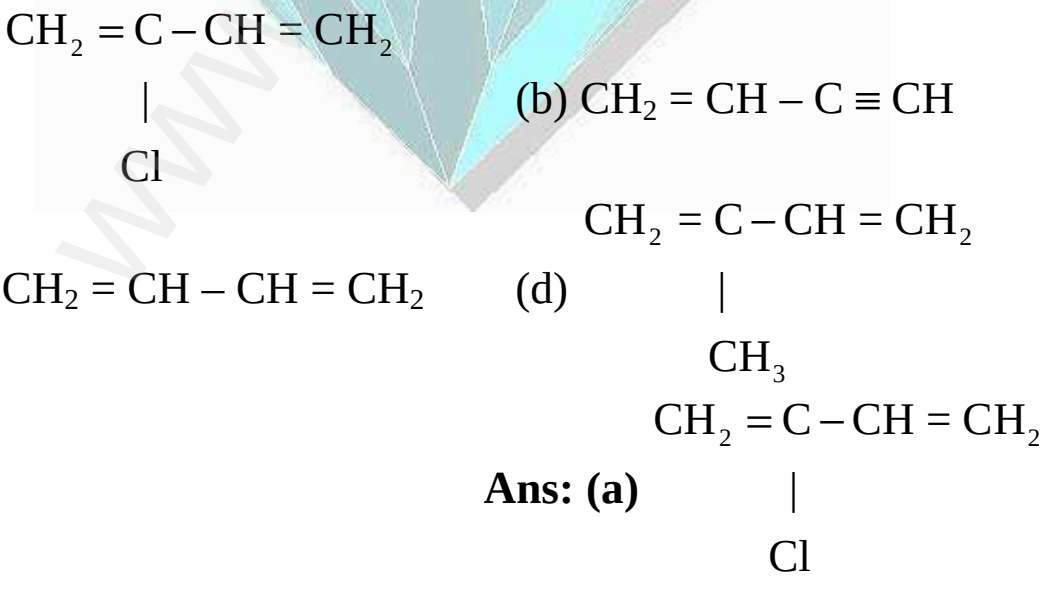
7. Nylon is an example of
   (a) polyamide (b) polythene (c) polyester (d) poly saccharine

   Ans: (a) polyamide

8. Terylene is an example of
   (a) polyamide (b) polythene (c) polyester (d) polysaccharide

   Ans: (c) polyester

9. Which is the monomer of neoprene in the following?

   (a) $CH_2 = C - CH = CH_2$ with Cl on the central C
   (b) $CH_2 = CH - C \equiv CH$
   (c) $CH_2 = CH - CH = CH_2$
   (d) $CH_2 = C - CH = CH_2$ with CH_3 on the central C

   Ans: (a) $CH_2 = C - CH = CH_2$ with Cl on the central C

10. Which one of the following is a bio-degradable polymer?
(a) HDPE (b) PVC (c) Nylone 6 (d) PHBV
Ans: (d) PHBV

11. Non stick cook wares generally have a coating of a polymer, whose monomer is
(a) ethane (b) prop-2-enenitrile
(c) chloroethene (d) 1,1,2,2-tetrafluoroethane
Ans: (d) 1,1,2,2-tetrafluoroethane

12. **Assertion :** 2-methyl-1,3-butadiene is the monomer of natural rubber.
Reason : Natural rubber is formed through anionic addition polymerisation.
(a) If both assertion and reason are true and reason is the correct explanation of assertion.
(b) If both assertion and reason are true and reason is the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.
Ans: (c) Assertion is true but reason is false

13. Which of the following is co-polymer?
(a) orlon (b) PVC (c) Teflon (d) PHBV
Ans: (d) PHBV

14. The polymer used in making blankets (artificial wool) is
(a) polystyrene (b) PAN (c) polyester (d) polythene
Ans: (b) PAN

15. Regarding cross-linked or network polymers which of the following statement is incorrect?
(a) Examples are Bakelite and melamine
(b) They are formed from bi and tri-functional monomers
(c) They contain covalent bonds between various linear polymer chains
(d) They contain strong covalent bonds in their polymer chain
Ans: (d) They contain strong covalent bonds in their polymer chain

2. DIFFERENCE - QUESTION AND ANSWERS (BOOK BACK)

1.1.1. What is the difference between minerals and ores?

(Sep-20)

Mineral	Ore
1. Naturally occurring substance contains metals in free state or in the form of compounds like oxide, sulphide	Mineral from which the metal extracted conveniently and economically are called ores.
2. All mineral are not ores (E.g) China clay is mineral of aluminum.	All ores are minerals (E.g) Bauxite is ore of aluminium.

4.15.2. Compare lanthanides and actinides.

(PTA MQ)

S. No.	Lanthanoids	Actinoids
1.	Differentiating electron enters in 4f orbital	Differentiating electron enters in 5f orbital
2.	Binding energy of 4f orbitals are higher	Binding energy of 5f orbitals are lower
3.	They show less tendency to form complexes	They show greater tendency to form complexes
4.	Most of the lanthanoids are colourless	Most of the actionoids are coloured. For example. U^{3+} (red), U^{4+} (green), UO_2^{2+}
5.	They do not form oxo cations	They do form oxo cations such as UO_2^{2+}, NpO_2^{2+} etc.
6.	Besides +3 Oxidation state lanthanoid show +2 and +4 oxidation states in few cases.	Besides +3 oxidation states actionoids show higher oxidation states such as +4, +5, +6 and +7

5.13.3. Give the difference between double salts and coordination compounds. *(Corona-20)*

Double salt	Co-Ordination compounds
1. It gives the test of all constituents ions in solution.	It does not give the test for individual ions present in co-ordination sphere
2. It loose their identity	It doesn't loose its identity
(E.g) Mohr salt	(E.g) $K_4[Fe(CN)_6]$

6.3.4. Differentiate crystalline solids and amorphous solids. *(PTA MQ) Corona-20*

S. No.	Crystalline solids	Amorphous solids
1.	Long range orderly arrangement of constituents.	Short range, random arrangement of constituents.
2.	Definite shape	Irregular shape
3.	Generally crystalline solids are anisotropic in nature	They are isotropic like liquids
4.	They are true solids	They are considered as pseudo solids (or) super cooled liquids
5.	Definite Heat of fusion	Heat of fusion is not definite
6.	They have sharp melting points	Gradually soften over a range of temperature and so can be moulded.
7.	Examples: NaCl, diamond etc.,	Examples: Rubber, plastics, glass etc.,

6.6.5. Distinguish between hexagonal close packing and cubic close packing.

S. No.	HCP	CCP
1.	Primitives are not same $a = b \neq c$	Primitives are same $a = b = c$
2.	Crystallographic angle $\alpha = \beta = 90°; \gamma = 120°$	Crystallographic angles $\alpha = \beta = \gamma = 90$
3.	This type is found in metals like Mg, Zn	This type is found in metals like Cu, Ag
4.	The unit cell of hcp has 6 spheres	The unit cell of CCP is 4 spheres
5.	The repeating unit of hcp has two layers of spheres	The repeating unit of CCP has three layers of spheres

6.7.6. Distinguish tetrahedral and octahedral voids.

S. No.	Tetrahedral voids	Octahedral voids
1.	The sphere of second layer is above the void of first layer, a tetrahedral void is formed	The triangular voids in the second layer are above the triangular voids in the first layer and the triangular voids do not overlap
2.	The co-ordination number is 4.	The co-ordination number is 6.

7.5.7. What is an elementary reaction? Give the difference between order and molecularity of a reaction. *(PTA MQ)*

Each and every single step in a reaction mechanism is called an elementary reaction.

S. No.	Order of a reaction	Molecularity of a reaction
1.	It is the sum of the powers of concentration terms involved in the experimentally determined rate law.	It is the total number of reactant species that are involved in an elementary step.
2.	It can be zero (or) fractional (or) integer	It is always a whole number, cannot be zero or a fractional number.
3.	It is assigned for a overall reaction.	It is assigned for each elementary step of mechanism.

10.2.8. Differentiate physisorption and chemisorption. *(PTA MQ)*

S. No.	Chemical adsorption or Chemisorption or Activated adsorption	Physical adsoption or van der waals adsorption or Physisorption
1.	It is very slow	It is instantaneous
2.	It is very specific depends on nature of adsorbent and adsorbent	It is non-specific
3.	Chemical adsorption is fast with increase of pressure, it cannot alter the amount.	In Physisorption, when pressure increases the extent of adsorption increases.
4.	When temperature is raised chemisoption first increases and then decreases.	Physisorption decreases with increases with increases in temperature

S. No.	Chemical adsorption or Chemisorption or Activated adsorption	Physical adsoption or van der waals adsorption or Physisorption
5.	Chemisorption involves transfer of electrons between the adsorbent and adsorbate.	No transfer of electrons
6.	Heat of adsorption high i.e., from 40-400kJ/mole.	Heat of adsorption is low in the order of 40kJ/mole.
7.	Monolayer of the adsorbate is formed.	Multilayer of the adsorbate is formed on the adsorbent.
8.	Adsorption occurs at fixed sites called active centres. It depends on surface area.	It occurs on all sides.
9.	Chemisorption involves the formation of activated complex with appreciable activation energy.	Activation energy is insignificant.

10.8.9. What is the difference between a sol and a gel?

S. No.	Sol	Gel
1.	Dispersion medium - liquid Dispersed phase - solid	Dispersion medium - solid Dispersed phase - liquid
2.	Highly stable	Less stable
3.	(E.g) Ink, paint	Butter, cheese

10.23.10. What is the difference between homogeneous and hetrogenous catalysis?

S. No.	Homogeneous catalysis	Heterogeneous catalysis
1.	Reactants and catalyst are in same phase	Reactants and catalysts are in different phases
2.	Intermediate compound is formed	Activated complex is formed

13.7.11. How will you distinguish between primary secondary and tertiary alphatic amines.

S. No.	Reagent	Primary amine	Secondary amine	Tertiary amine
1.	With Nitrous acid (HNO_2)	Forms alcohol	Forms N-nitroso amine	Forms salt
2.	With $CHCl_3$/KOH	Forms carbylamine	No reaction	No reaction
3.	With acetyl chloride	Forms N-alkyl acetamide	Forms N,N-dialkyl acetamide	No reaction
4.	With $CS_2/HgCl_2$	Alkyl isothiocyanate is formed	No reaction	No reaction
5.	With diethyl oxalate	Forms dialkyl oxamide	Forms N,N-dialkyl oxamic ester	No reaction
6.	With alkylhalide	With three molecules of alkyl halides quarternary ammonium salt crystalline compound is formed	With two molecules of alkyl halides quarternary ammonium salt is formed	With one molecule of alkyl halide quarternary ammonium salt is formed

14.2.12. Give the differences between primary and secondary structure of proteins.

S. No.	Primary structure of proteins	Secondary structure of proteins
1.	Proteins are polypeptide chain made up of amino acids connected through peptide bonds	The amino acids in the polypeptide chain forms highly regular shapes through hydrogen between carbonyl oxygen and amine hydrogen.
2.	The relative arrangement of amino acids in the polypeptide chain is called primary structure of protein	α-helix and β-strands are two most common sub-structures formed by proteins

14.5.13. Give any three difference between DNA and RNA. ***(PTA MQ)***

S. No.	DNA	RNA
1.	It is mainly present in nucleus, mitochondria and chloroplast	It is mainly present in cytoplasm, nucleolus and ribosomes
2.	It contains deoxyribose sugar	It contains ribose sugar
3.	Base pair A = Tand G ≡ C	Base pair A = U and C ≡ G
4.	Double stranded molecules	Single stranded molecules
5.	It's life time is high	It is short lived

S. No.	DNA	RNA
6.	It is stable and not hydrolysed easily by alkalis	It is unstable and hydrolyzed easily by alkalis
7.	It can replicate itself	It cannot replicate itself. It is formed from DNA.

14.7.14. Give two difference between Hormones and vitamins.

S. No.	Hormones	Vitamins
1.	Hormones are secreted by one tissue enters in to blood stream.	vitamins cannot be synthesised by our body
2.	Ductless endocrine glands synthesis hormones	It is supplied through diet
3.	Maintenance of blood pressure, hunger, embryogenesis are some of their function	Vitamins deficiency or excess cause disease

2. DIFFERENCE - QUESTION AND ANSWERS (ADDITIONAL)

7.1.15. Write the difference between Rate and Rate constant of a reaction. *(PTA MQ)*

S. No.	Rate of a reaction	Rate constant of a reaction
1.	It represents the speed at which the reactants are converted into products at any instant.	It is a proportionality constant

S. No.	Rate of a reaction	Rate constant of a reaction
2.	It is measured at decrease in the concentration of the reactants or increase in the concentration of products.	It is equal to the rate of reaction, when the concentration of each of the reactants in unity
3.	It depends on the initial concentration of reactants	It does not depend on the initial concentration of reactants.

8.1.16. Distinguish Lewis acids and Lewis bases.

S. No.	Lewis acids	Lewis bases
1.	Electron deficient molecules such as BF_3, $AlCl_3$, BeF_2 etc....	Molecules with one (or) more lone pairs of electrons. NH_3, H_2O, R-O-H, R-O-R, R–NH_2
2.	All metal ions (or) atoms Examples: Fe^{2+}, Fe^{3+}, Cr^{3+}, Cu^{2+} etc.	All anions F^-, Cl^-, CN^-, SCN^-, SO_4^{2-} etc...
3.	Molecules that contain a polar double bond Examples: SO_2, CO_2, SO_3 etc.	Molecules that contain carbon – carbon multiple bond Examples: $CH_2 = CH_2$, $CH \equiv CH$ etc...
4.	Molecules in which the central atom can expand its octet due to the availability of empty d-orbitals Example: SiF_4, SF_4, $FeCl_3$ etc..	All metal oxides CaO, MgO, Na_2O etc....
5.	Carbonium ion $(CH_3)_3\ C^+$	Carbanion CH_3^-

11.35.17. Write the test to differentiate alcohol and phenols.

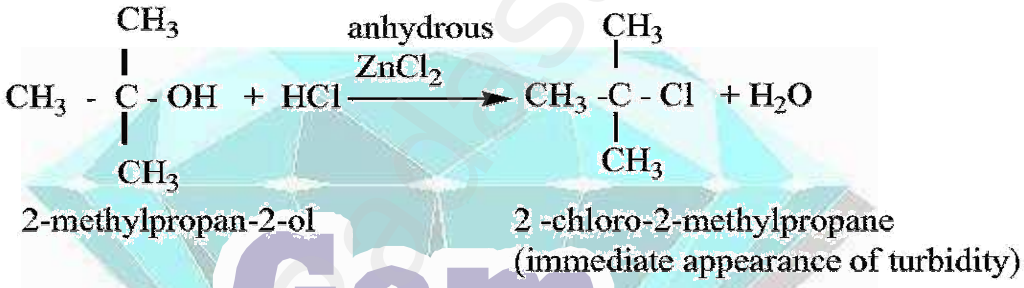
(PTA MQ)

S. No.		Phenol	alcohol
(i)	With benzene diazonium chloride	Red orange dye	No reaction
(ii)	With Neutral $FeCl_3$	Purple colour	No reaction
(iii)	With NaOH	Sodium phenoxide	No reaction

11.1.18. Write the Lucas test to distinguish 1°, 2°, 3° alcohols

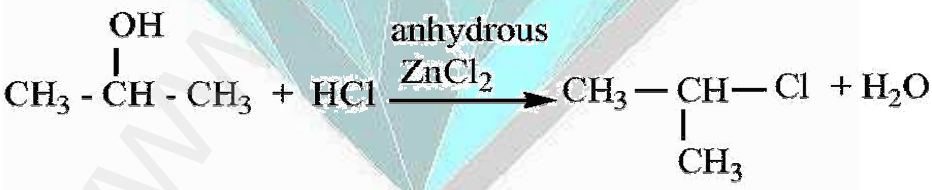
Lucas reagent ⇒ con. HCl + anhydrous $ZnCl_2$

3° alcohol



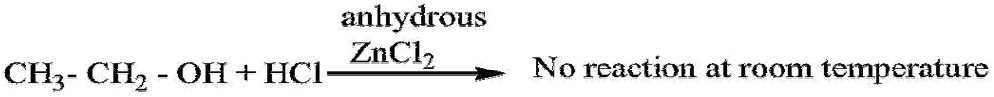
2-methylpropan-2-ol — 2 -chloro-2-methylpropane (immediate appearance of turbidity)

2° alcohol



propan-2-ol — 2 -chloropropane (slow appearance of turbidity)

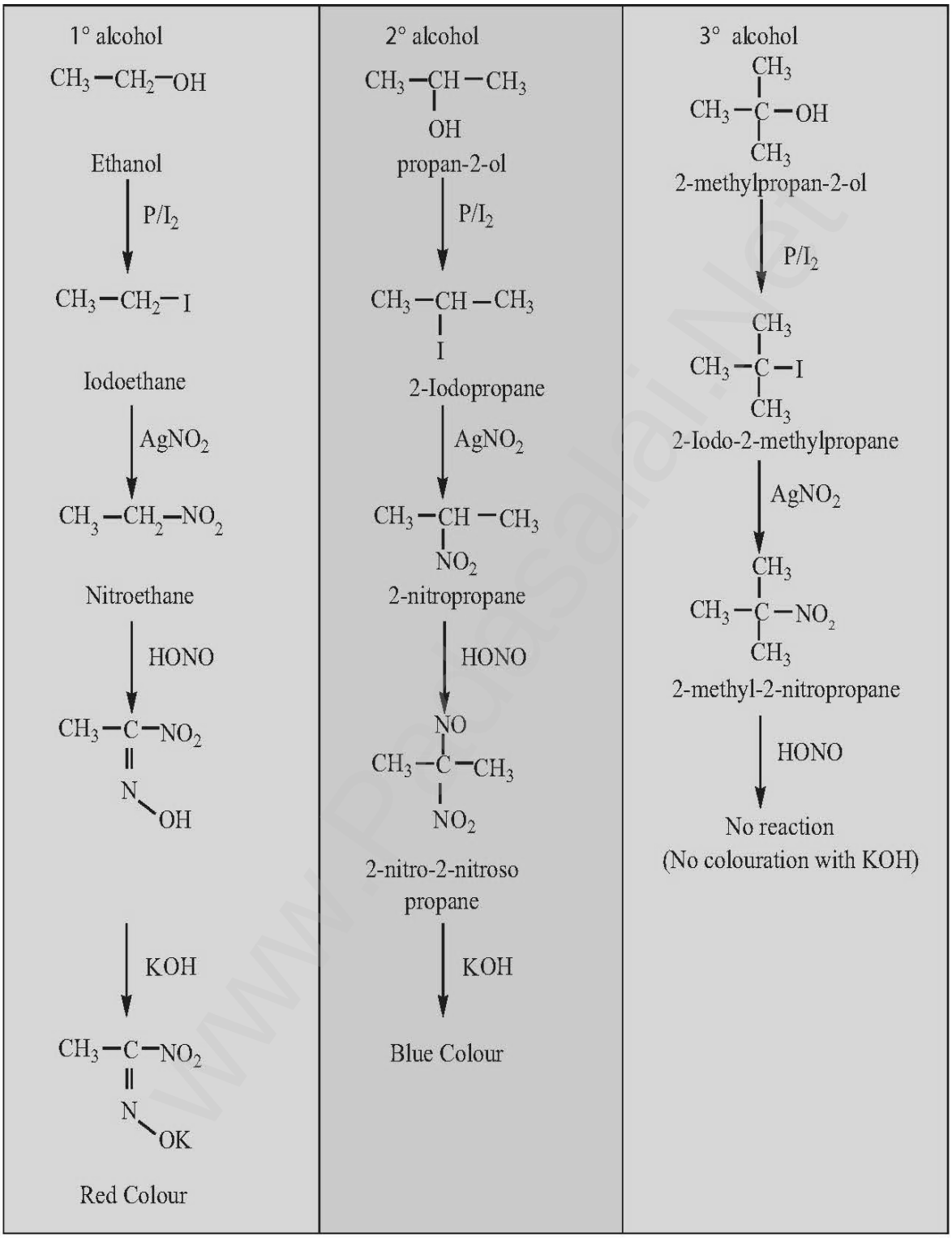
1° alcohol



ethanol — (Turbidity appears only on heating)

11.2.19. Write the victor mayer Test for 1°, 2°, 3° alcohols.

(Corona-20)



13.1.20. Distinguish – Nitro form and Aci form.

S. No.	Nitro form	Aci – form
1.	Less acidic	More acidic and also called pseudoacids (or) nitronic acids
2.	Dissolves in NaOH slowly	Dissolves in NaOH instantly
3.	Decolourises $FeCl_3$ solution	With $FeCl_3$ gives reddish brown colour
4.	Electrical conductivity is low	Electrical conductivity is high

14.28.21. What is the difference between fibrous protein and globular protein?

S. No.	Fibrous protein	Globular protein
1.	Linear molecule	spherical shape
2.	Insoluble in water	soluble in water
3.	structural proteins	many functions including catalysis
4.	(E.g) Keratin, collagen	(E.g) insulin

15.33.22. How do antiseptics differ from disinfectants?

(Sep 20)

Antiseptics	Disinfectants
Stop or slow down the growth of microorganisms when applied to living tissue	stop or slow down the growth of microorganism when applied in inanimate objects
(E.g) Hydrogen peroxide	Hydrogen peroxide

3. CLASSIFICATION - QUESTION AND ANSWERS (BOOK BACK)

6.4.1. Classify the following solids

(a) P_4 (b) Brass (c) diamond (d) NaCl (e) Iodine

a) P_4	Molecular solid
b) Brass	Metallic solid
c) diamond	Covalent solid
d) NaCl	Ionic solid
e) Iodine	Molecular solid

14.12.2. How are vitamins classified?

(i) Fat soluble vitamins

Vitamin A, D, E and K

(ii) Water soluble vitamins

Vitamin B and C

14.17.3 What are different types of RNA which are found in cell?

i) Ribosome RNA (rRNA)

ii) Messenger RNA (mRNA)

iii) Transfer RNA (tRNA)

2. CLASSIFICATION - QUESTION AND ANSWERS (ADDITIONAL)

6.2.3. Write the classification of crystal defects.

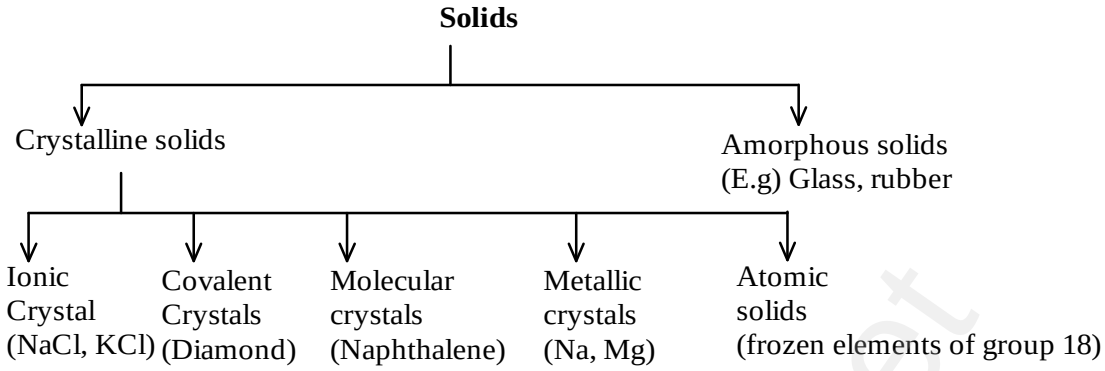
1) Point defects

2) Line defects

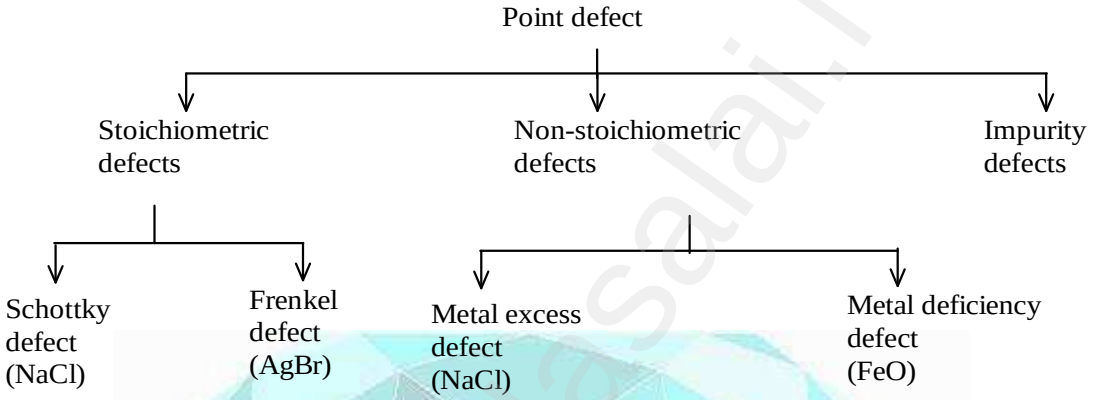
3) Interfacial defects

4) Volume defects

6.3.5. Write the classification of solids.



6.3.6. Explain the classification of point defect with example.



10.3.7. Classify the colloids based on the physical state of dispersed phase and dispersion medium.

S. No.	Dispersion medium	Dispersed phase	Name of the colloid	Examples
1.	Gas	Liquid	Liquid Aerosol	Fog Aerosol spray
2.	Gas	Solid	Solid Aerosol	Smoke, Air pollutants like fumes, dust.
3.	Liquid	Gas	Foam	Whipped cream, Shaving cream, Soda water, Froth

S. No.	Dispersion medium	Dispersed phase	Name of the colloid	Examples
4.	Liquid	Liquid	Emulsion	Milk, Cream, Mayonnaise
5.	Liquid	Solid	Sol	Inks, Paints, Colloidal gold.
6.	Solid	Gas	Solid foam	Pumice stone, Foam rubber bread.
7.	Solid	Liquid	Gel	Butter, cheese
8.	Solid	Solid	Solid sol	Pearls, opals coloured glass alloys colloidal dispersed eutelics.

10.15.8. Write the classification of colloid based on dispersion medium.

(1) **Hydrosols or aquasols:** In this colloid, the dispersion medium is water.

(2) **Alcosol:** In this colloid, the dispersion medium is alcohol.

(3) **Benzosol:** In this colloid, the dispersion medium is benzene.

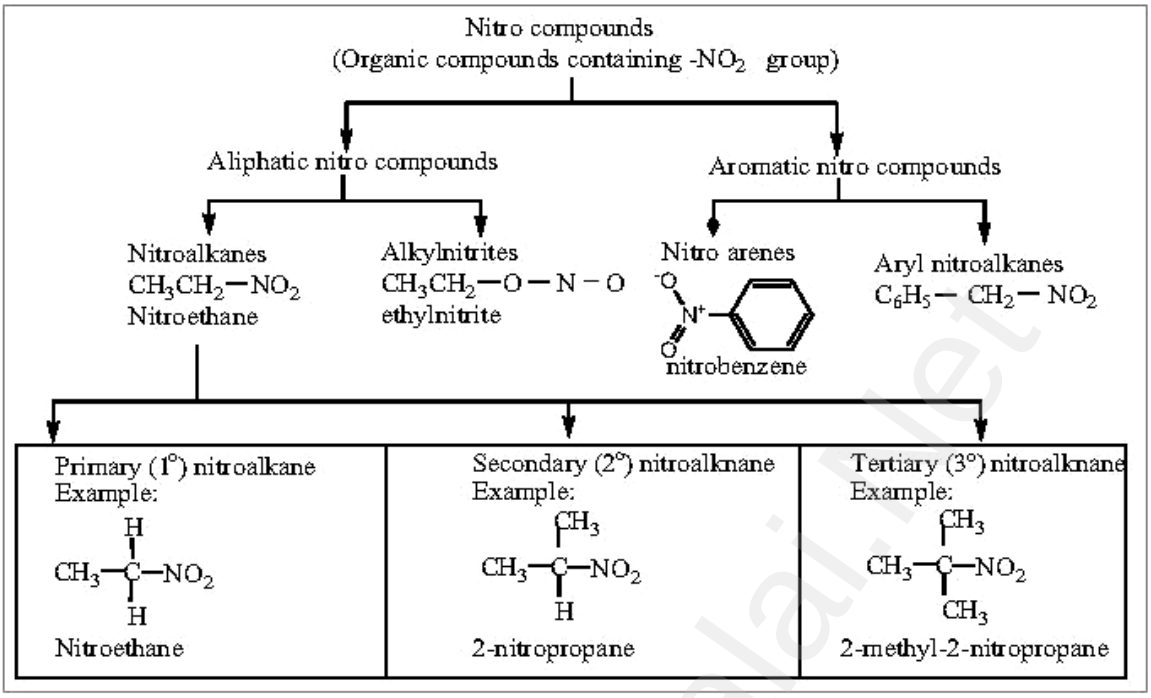
11.37.9. Write the classification of ethers.

Ethers

Simple ethers
CH_3-O-CH_3
C_6H_5-O-C_6H_5

Mixed ethers
$CH_3 – O – CH_2CH_3$
C_6H_5-O-CH_3

13.1.10. Write the classification of Nitro compounds.



14.16.11. Write the classification of amino acids.

The amino acids are classified on the nature of 'R' groups commonly known as side chain.

They are classified as acidic, basic and neutral amino acids.

They are classified as polar and Non-Polar amino acids.

They are classified as essential and non-essential amino acids.

The amino acids that can be synthesised by us are called Non-essential amino aids.

(E.g) Glycine, Alanine.

The amino acids that are supplied by food are essential amino acids.

(E.g) Valein, Ileucin, Hisditine.

Those amino acids present in the cells are called non-protein amino acids.

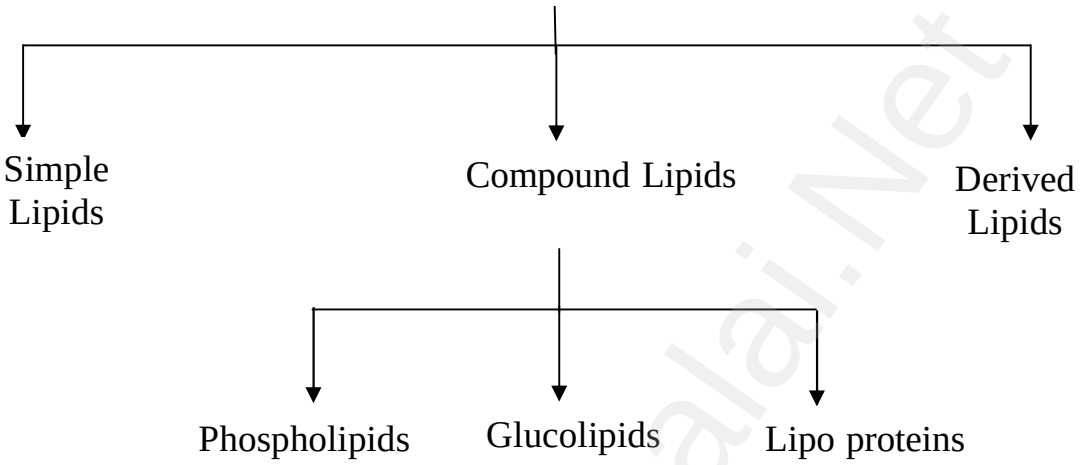
(E.g) Orinithine and Citralline

14.18.12. What are the type of proteins?

1) Fibrous proteins
2) Globular proteins

14.23.13. Write the classification of lipids.

Lipids



15.31.14. How polymers are classified on the basis of structure and molecular forces, give examples of each one. ***(PTA MQ)***

Polymers

Structure

(a) Linear Polymers
(E.g) HDPE, PVC

(b) Branched polymers
(E.g)Polypropylene, LDPE

(c) Cross linked polymers
(e.g)Bakelite, melamine formaldehyde

Molecular forces

(a) Elastomers
(e.g) Neoprene, buna – S, buna – N

(b) Fibrous Polymer
(e.g) Terelene, Nylon 66

(c) Thermoplastic
(e.g) Polythene, PVC, polystryne

(d) Thermosetting polymer
(e.g)bakellite, melamine formaldehyde

4. LAW & DEFINITION - QUESTION AND ANSWERS (BOOK BACK)

6.1.1. Define unit cell. ***(PTA MQ)***

A basic repeating structural unit of a crystalline solid is called a unit cell.

7.1.2. Define average rate and instantaneous rate.

$$\text{Average rate} = \frac{-\Delta[\text{concentration of reactant at regular interval}]}{\Delta(\text{time})}$$

$$\text{Instaneous rate} = \frac{-d\,[\text{concentration of reactant}]}{\text{time change}}$$

7.2.3. Define rate law and rate constant.

The mathematical relation of rate, rate constant and concentration of reactant is known as Rate law.

$xA + yB \longrightarrow$ Products

Rate law $\quad$ Rate = $k\,[A]^x\,[B]^y$

Rate constant is the proportionality constant equal to the rate of the reaction when concentration of each reactants is unity.

Rate = $k\,[A]^x\,[B]^y$

$\because [A] = [B] = 1$

Rate = k

The above equation is known as rate constant.

7.4.4. Define half life of a reaction. Show that for a first order reaction half life is independent of initial concentration. (Or) Derive an equation for half life period of First order equation. ***(PTA MQ)***

The half life of a reaction is defined as the time required for the reactant concentration to reach one half its initial value.

$$k_1 = \frac{2.303}{t} \log \frac{[A_o]}{[A]}$$

$$\text{at } t = t_{1/2} \; ; \; [A] = \frac{[A_o]}{2}$$

$$k_1 = \frac{2.303}{t_{1/2}} \log \frac{[A_o]}{\frac{[A_o]}{2}}$$

$$k_1 = \frac{2.303}{t_{1/2}} \log 2$$

$$t_{1/2} = \frac{2.303 \times 0.3010}{k_1}$$

$$t_{1/2} = \frac{0.6932}{k_1}$$

From the above equation, for a first order reaction half life is independent of initial concentration.

8.9.5. Define solubility product. ***(PTA MQ)***

The solubility product of a compound is defined as the product of the molar concentration of the constituent ions, each raised to the power of its stoichiometric co-efficient in a balanced equilibrium equation.

8.10.6. Define ionic product of water. Give its value at room temperature. ***(PTA MQ) Sep-20***

Ionic product of water K_W $= [H_3O^+] [OH^-]$

$= (1 \times 10^{-7}) (1 \times 10^{-7})$

The value of Ionic product of water

$K_W = 1 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$

8.13.7. Define pH.

pH of a solution is defined as the negative logarithm of base 10 of the molar concentration of the hydronium ions present in the solution.

$$pH = -\log_{10}\left[H_3O^+\right]$$

9.1.8. Define anode and cathode.

Anode: The electrode at which oxidation occurs is called the anode.

Cathode: The electrode at which reduction occurs is called the cathode.

9.3.9. State Kohlrausch Law. How is it useful to determine the molar conductivity of weak electrolyte at infinite dilution? ***(PTA MQ) Corona-20***

Kohlrausch Law: At infinite dilution, the limiting molar conductivity of an electrolyte is equal to the sum of the limiting molar conductivities of its constituent ions.

$$\left(\Lambda^\circ_m\right)_{NaCl} = \left(\lambda^\circ_m\right)_{Na^+} + \left(\lambda^\circ_m\right)_{Cl^-}$$

By using Kohlrausch law, the molar conductivity of weak electrolyte can be calculated.

For e.g., the molar conductance of CH_3COOH, is calculated using the experimentally determined molar conductivities of strong electrolyte HCl, NaCl, CH_3COONa

$$\Lambda^o_{CH_3COONa} = \lambda^\circ_{Na^+} + \lambda^\circ_{CH_3Coo^-} \quad \ldots (1)$$

$$\Lambda^o_{HCl} = \lambda^\circ_{H^+} + \lambda^\circ_{Cl^-} \quad \ldots (2)$$

$$\Lambda^\circ_{NaCl} = \lambda^\circ_{Na^+} + \lambda^\circ_{Cl^+} \quad \ldots (3)$$

$(1) + (2) - (3) \Rightarrow$

$$\Lambda^\circ_{CH_3COONa} + \Lambda^\circ_{HCl} - \Lambda^\circ_{NaCl} = \lambda^\circ_{H^+} + \lambda^\circ_{CH_3COO^-}$$

9.5.10. State Faraday's Laws of electrolysis. ***(PTA MQ)***

The mass of the substance (m) liberated at an electrode during electrolysis is directly proportional to the quantity of charge (Q) passed through the cell.

$m \propto Q$

$m \propto It$

$m = Z\,It$

Faraday's second Law

When the same quantity of charge is passed through the solution of different electrolytes, the amount of substances liberated at the respective electrodes are directly proportional to their chemical equivalents.

$M \propto Z$

14.15.11. Define enzymes.

There are many biochemical reactions that occurs in our living cells. All these reaction are catalysed by special proteins called enzymes.

4. LAW & DEFINITION - QUESTION AND ANSWERS (ADDITIONAL)

4.4.12. Define: Standard electrode potential of transition metals.

The value of standard emf of a cell in which molecular hydrogen under 1 atm pressure and 273K temperature is oxidised to solvated protons at the electrode is known as standard electrode potential.

5.5.13. Define stability constant. ***(PTA MQ)***

The stability of co-ordination complex is a measure of its resistance to the replacement of one ligand by another.

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

$$\text{Stability constant } \beta = \frac{[Cu(NH_3)_4]^{2+}}{[Cu^{2+}][NH_3]^4}$$

6.1.14. Define: Isotrophy, anisotrophy.

In solid state, isotropy means having identical values of physical properties such as refractive index, electrical conductance in all direction.

In solid state, anisotropy means having different values of physical properties such as refractive index, electrical conductance in different direction.

6.12.15. Define packing fraction or packing efficiency.

Paking fraction (or) efficiency =

$$\left\{\frac{\text{Total volume occupied by spheres in a unit cell}}{\text{volume of unit cell}}\right\}\times 100$$

6.13.16. Define crystal lattice.

Crystalline solid is characterised by a definite orientation of atoms, ions or molecules, relative to one another in a three dimensional pattern. The regular arrangement of these species through out the crystal is called a crystal lattice.

8.5.17. Define pOH.

pOH of a solution is defined as the negative logarithm of base 10 of the molar concentration of hydroxyl ions present in the solution.

$pOH = - \log_{10}[OH^-]$.

8.6.18. Define Buffer capacity and buffer index. ***(PTA MQ)***

Buffer capacity is defined as the number of gram equivalents of acid or base added to 1 litre of buffer solution to change its pH by unity.

$$\text{Buffer index } \beta = \frac{dB}{d(pH)}$$

d(B) = number of gram equivalents of acid / base added to one litre of buffer solution.

d(pH) = The change in the pH after the addition of acid / base.

8.12.19. Define – Buffer action. ***(Corona-20)***

Buffer solution resists drastic changes in its pH upon addition of a small quantities of acid or bases and this ability is called buffer action.

9.1.20. Define Ohm's law.

At a constant temperature, the current flowing through the cell is directly proportional to the voltage across the cell.

$V \propto I$

$V = IR$

V = Potential difference

C = Current

R = Resistance

9.2.21. Define Specific Resistance (or) Define Resistivity.

Resistivity is defined as the resistance of an electrolyte confined between two electrodes having unit cross sectional area and are separated by a unit distance.

Unit: ohm metre (or) Ω m

$$R \propto \frac{l}{a}$$

$$R = \rho \frac{l}{a}$$

$$\rho = R \frac{a}{l}$$

9.3.22. Define – Conductance.

The reciprocal of resistance is called conductance.

SI unit = Siemen $\qquad C = \frac{1}{R}$

9.4.23. Define specific conductance (or) Conductivity. ***(PTA MQ)***

The reciprocal of specific resistance is called specific conductance (or) conductivity.

(or)

The specific conductance is defined as the conductance of a cube of an electrolytic solution of unit dimensions.

$$K = \frac{1}{\rho}.\frac{l}{a}$$

Unit: $ohm^{-1}.m^{-1}$ (or) $mho.m^{-1}$ (or) Sm^{-1}

9.5.24. Define molar conductance. ***(PTA MQ)***

Molar conductance is defined as the conductance of Vm^3 of electrolytic solution which contains one mole of electrolyte.

$$\Lambda_m = K \times V$$

$$\Lambda_m = \frac{K \times 10^{-3}}{m}$$

Unit: $Sm^2\ mol^{-1}$

9.6.25. Define equivalent conductance.

Equivalent conductance is defined as the conductance of 'V' m^3 of electrolytic solution containing one gram equivalent of electrolyte in a conductivity cell in which the electrodes are one metre apart.

$$\Lambda = \frac{K \times 10^{-3}}{N}$$

Unit: Sm^2 gram $equivalent^{-1}$

9.11.26. Define one joule of energy in a cell.

When there is one volt difference in electrical potential between the anode and cathode, one joule of energy is released for each column of charge that moves between them

$1J = 1C \times 1V$

9.13.27. Define electrode potential (E).

Electromotive force of a cell in which the electrode on the left is a standard hydrogen electrode and the electrode on the right with unknown cell.

9.14.28. Define standard electrode potential (E°).

The value of the standard emf of a cell in which molecular hydrogen under standard pressure is oxidised to solvated protons at the left hand electrode.

9.15.29. Define electrochemical equivalent.

Electrochemical equivalent is defined as the amount of substance deposited or liberated at the electrode by a charge of 1 coulomb.

$m = z$

10.7.30. Define catalyst. (or) Catalysis.

Catalyst is defined as a substance which alters the rate of chemical reaction without itself undergoing chemical change. The phenomenon of action of catalyst is known as catalysis.

10.8.31. Define positive and negative catalysis.

In positive catalysis, the rate of reaction is increased in presence of catalyst.

In negative catalysis, the rate of reaction is decreased in presence of catalyst.

10.11.32. Define – Auto catalysis.

In certain reactions, one of the products formed acts as a catalyst is known as auto catalysis.

$$2AsH_3 \longrightarrow 2As + 3H_2$$

Auto catalyst: Arsenic (As)

10.12.33. Define Negative Catalysis.

In certain reactions, presence of certain substances, decreases the rate of reaction is known as negative catalysis.

$$2H_2O_2 \xrightarrow{\text{Glycerol}} 2H_2O + O_2$$

Negative catalyst: Glycerol

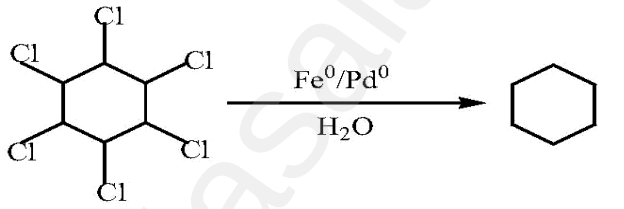
10.13.34. Write a note on Nano catalysis. ***(PTA MQ)***

Nano materials such as metallic nano particles, metal oxides are used as catalyst in many chemical reaction.

Nano catalysts give 100% selective transformations, excellent yield and high activity.

Nanocatalysts are actually soluble heterogenous catalysts.

(i)



Lindane cyclohexane

Fe^0/Pd^0 : Nanobimetallic catalyst (Zerovalent state)

10.14.35. Define – Dispersion medium and dispersion phase.

In a colloid, the substance present in larger amount is called dispersion medium.

In a colloid, the substance present in less amount is called dispersed phase.

10.23.36 What is called as flocculation value?

The precipitation power of electrolyte is determined by finding the minimum concentration required to cause precipitation of a sol in 2 hours.

This value is known as flocculation value.

The smaller the flocculation value greater is the precipitation.

10.25.37. Define gold number.

Gold number is defined as the number of miligrams of hydrophilic colloid that will just prevent the precipitation of 10 ml of gold sol on the addition of 1 ml of 10% NaCl solution.

15.2.38. Define – Therapeutic index. ***(PTA MQ)***

Therapeutic index is defined as the ratio between the maximum tolerated dose of a drug and the minimum creative dose.

15.16.39. Define - Total fatty matter (TFM). ***(PTA MQ)***

TFM is defined as the total amount of fatty matter that can be separated from a sample after splitting with mineral acids.

Higher the TFM value better its quality.

5. WHAT IS.....? - QUESTION AND ANSWERS (BOOK BACK)

3.1.1. What is inert pair effect?

In heavier post-transition metals, the outer 's' electrons (ns) have a tendency to remain inert and show reluctance to take part in the bonding is known as inert pair effect.

3.5.2. What are interhalogen compounds? Give examples.

(PTA MQ)

Each halogen combines with other halogens to form a series of compounds are called inter halogen compounds.

(E.g) IF, IF_3, IF_5, IF_7

4.1.3. What are transition metals? Give four examples.

(PTA MQ)

In modern periodic table, the element present in between highly reactive s-block elements and less reactive p-block elements are known as transition elements.

(Eg.) Gold, Silver, Platinum, Copper

4.3.4. What are inner transition elements?

In modern periodic table, in the sixth period after lanthanum, the electrons are preferentially filled in inner 4f sub shell and these fourteen elements called Lanthanoids.

In the seventh period after actinium, the electron are preferentially filled in inner 5f sub shell and these fourteen elements called Actinoids.

4.5.5. What are actinides? Give three examples.

The fourteen elements following actinium (i.e. from thorium to lawrencium) are called actionoids.

E.g. thorium, lawrencium, uranium

4.7.6. What is lanthanide contraction and what are the effects of lanthanide contraction? (or) *(PTA MQ)*

What is Lanthanides contraction? Explain its consequences.

As me move across 4f series, the atomic and ionic radii of lanthanoids show gradual decrease with increase in atomic number.

This decrease in ionic size is called lanthanoid contraction.

Effect of Lanthanoid contraction

1) Basicity

As we move from Ce^{3+} to Lu^{3+}, the basic character of Ln^{3+} ions decreases.

Due to decreases in size of Ln^{3+} ions, the ionic character of Ln-OH bond decreases which results in decrease in basicity.

2) Similarities among lanthanoids

In the complete f-series, very small change in radii of lanthanoids, the chemical properties are quite similar.

The elements of second and third transition series resemble each other more closely than the elements of first and second transition series.

4.9.7. What are interstitial compounds? *(PTA MQ) Sep-20*

An interstitial compound or alloy is formed, when small atoms like hydrogen, boron, carbon or nitrogen are trapped in interstitial holes in a metal lattice.

They are usually non-stoichiometric compounds.

(E.g) TiC, Mn_4N

5.11.8. What is linkage isomerism? Explain with an example.

When an ambidentate ligand is bonded to central metal or ion through either of its two different donor atoms.

(E.g) $[Co(NH_3)_5(NO_2)]^{2+}$ $[Co(NH_3)_5(ONO)]^{2+}$

Nitrite ligand (N is bound) Nitrite (O is bound)

5.17.9. What are hydrate isomers? Explain with an example. (or) Write any two hydrate isomers of the complex with the molecular formula $CrCl_3.6H_2O$. ***(PTA MQ, MAR 20)***

The exchange of free water molecules in the crystal lattice with a ligand in the co ordination sphere will give different isomers. This type of isomers are called as hydrate isomers.

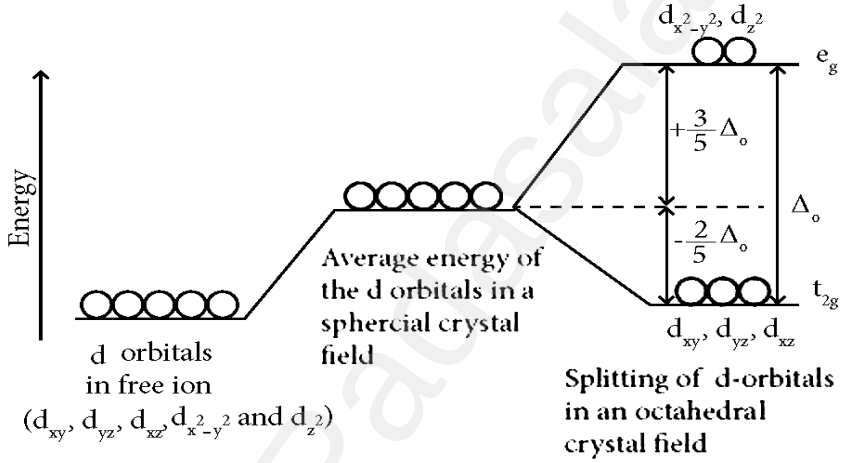
(Eg) $CrCl_3.\ 6H_2O$ – three hydrate isomers are possible

$[Cr\ (H_2O)_6]Cl_3$, $[Cr.(H_2O)_5Cl]Cl_2.H_2O$,

$[Cr(H_2O)_4Cl_2]\ Cl.2H_2O$

5.18.10. What is crystal field splitting energy?

Crystal field splitting in octahedral complexes.



In octahedral field, in order to maintain the average energy of the orbitals constant, the energy of e_g orbitals will increase by $\frac{3}{5}\Delta_o$ and the energy of t_{2g} orbitals will decrease by $2/5\Delta_o$.

Δ_o = crystal field splitting energy in octahedral field.

The energy of t_{2g} orbitals increases by $2/5\ \Delta_t$ and the energy of e_g orbitals decreases by $3/5\ \Delta_t$

Δ_t = crystal field splitting energy in tetrahedral field.

Crystal field splitting energy and nature of ligands

The magnitude of CFSE not only depend upon on ligand field.

It also depends upon the nature of the ligand, the nature of central metal atom or ion and the charge on it. The energy associated with the absorbed wavelength of light (λ)

$\Delta = h\upsilon = \frac{hc}{\lambda} = hc\upsilon$

h = Planks constant, C = Velocity of light

υ = Wave number of absorption maximum.

5.19.11. What is crystal field stabilization energy (CFSE)?

(PTA MQ)

CFSE is defined as the energy difference of electronic configurations in the ligand field (E_{LF}) and the isotropic field or barycentre (E_{iso})

CFSE (ΔE_o) = E_{LF} - E_{iso}

$= \{[nt_{2g}(-0.4)+n_{eg}(0.6)]\ \Delta_o + n_pP\}-\{n'_pP\}$

$n_{t_{2g}}$ = Number of electrons in t_{2g} orbitals.

n_{eg} = Number of electrons in e_g orbitals

n_p = Number of electron pairs in the ligand field

n'_p = Number of electron pairs in the isotropic field.

6.8.12. What are point defects?

If the deviation occurs due to missing atoms, displaced atoms or extra atoms, the imperfection is named as point defect.

6.16.13. What is meant by the term "Coordination number"? What is the coordination number of atoms in a bcc structure?

The number of spheres directly surrounding a single sphere in a crystal is called co-ordination number. Sphere may be molecule, atoms or ions.

The co-ordination number of atoms in bcc structure is 8.

8.1.14. What are Lewis acids and bases? Give two example for each. ***(PTA MQ)***

Lewis Acid: Lewis acid is a positive ion or an electron deficient molecule.

(E.g) Fe^{2+}, Fe^{3+}, BF_3

Lewis base: Lewis Base is an anion or neutral molecule with atleast one lone pair of electrons

(E.g) NH_3, F^-

15.1.15. What are antibiotics?

The medicines that have the ability to kill the pathogenic bacteria are called an antibiotics (e.g) Amoxicillin.

15.6.16. What are drugs? How are they classified?

Drug is a substance used to modify or explore physiological systems or pathological states for the benefit of the recipient.

Classification of drugs

a) Based on chemical structure

Drugs with a common chemical skeleton are classified into single group.

(e.g) Ampicillin, Amoxicillin, penicillin G,

b) Based on pharmacological effect

The drugs are grouped based on their biological effect that they produce on their recipient. (e.g) amoxicillin, ampicillin, tetracycline.

c) Based on drug action

The drugs are grouped based on biological system, that they target in the recipient.

Streptomycin – inhibits the protein synthesis in bacteria

Erythromycin – prevents the incorporation of new amino acids to the protein.

d) Based on side of action

Drug molecule interacts with biomolecules such as enzymes, receptors.

15.11.17. What are narcotic and non-narcotic drugs? Give examples.

Norcotic drugs: Relieve pain and produce sleep

(e.g) Morphine, codeine

Non-narcotic Drugs: Reduce the pain without causing any loss of consciousness.

(e.g.) Ibuprofen, Aspirin

15.14.18. What are bio degradable polymers? Give examples. ***(PTA MQ)***

Materials decomposed by Microorganisms in the environment are called biodegradable polymers.

(e.g) Polyhydroxy butyrate, Polyglycolic acid (PGA).

15.9.19. What are tetracyclines? Give its uses and e.g.

Inhibit the bacterial protein synthesis through interaction with the 30s subunit of the bacterial ribosome.

It is used in the treatment of peptic ulcer disease, infections of the respiratory tract, cholera and acne vulgaris.

(e.g) Doxycyline, Minocycline.

15.10.20. What are antifertility drugs? Give e.g. and use.

These synthetic hormones that suppresses ovulation or fertilisation.

It is used in birth control pills

(e.g) synthetic oestreogen (menstranol)

Synthetic progestorne (Norethin drone)

15.8.21. What are antacids? Give its use and e.g.

Neutralise the acid in the stomach that causes acidity.

Use: To relieve burning sensation in the chest or throat area.

(E.g) Milk of magnesia, aluminium hydroxide, Ranitidine, omeprazole.

5. WHAT IS.....? - QUESTION AND ANSWERS (ADDITIONAL)

1.1.22. What is Gangue? ***(PTA MQ)***

The ore are associated with non metallic impurities, rocky materials and siliceous matter are known as gangue.

1.4.23. What is Alkali Leaching? Give e.g.

In this method, the Bauxite ore is treated with aqueous alkali to form soluble complex.

The impurities iron oxide and titatinium oxide are left behind.

$$Al_2O_3 + 2NaOH + 3H_2O \xrightarrow[35atm]{470\text{-}520K} 2Na[Al(OH)_4]$$

This solution is diluted and neutralized by passing CO_2 gas, to form hydrated Al_2O_3 precipitate.

$$2Na[Al(OH)_3] + CO_2 \longrightarrow Al_2O_3.xH_2O + 2NaHCO_3$$

The precipitate is filtered off and heated around 1670K to get pure alumina.

1.6.24. What is roasting? ***(PTA MQ)***

The concentrated ore is oxidised by the heating it with excess of oxygen below the melting point of metal.

$$2ZnS + 3O_2 \xrightarrow{\Delta} 2\,ZnO + 2SO_2$$

1.7.25. Define calcination. ***(PTA MQ)***

The heating of concentrated ore in 'absence of air is known as calcination.

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$$

1.8.26. What is smelting?

A flux is added to concentrated ore and the mixture is melted by heating an elevated temperature in a furnace is known as smelting.

$Fe_2O_{3(s)} + 3CO_{(g)} \longrightarrow 2Fe_{(s)} + 3CO_{2(g)}$

1.9.27. What is auto reduction? Give e.g.

Simple roasting of some of the ores give the crude metal.
(E.g). Mercury is obtained by roasting of its ore cinnabar.

$HgS + O_2 \longrightarrow Hg + SO_2$

1.10.28. What is Ellingham Diagram?

The graphical representations of variation of standard Gibbs free energy of reaction for the formation of various metal oxides with temperature is called Ellingham diagram.

$Y = mx + C$

$\Delta G = - T\Delta S + \Delta H$

A Straight line is obtained by plotting the temperature in 'X'-axis and the standard free energies for the formation of metal oxide in y-axis.

ΔS as slope and ΔH as y-intercept.

1.13.29. Explain liquation with an example.

This method is employed to remove the impurities with high melting points from metals having relative low melting points.

The crude metal is heated to form fusible liquid and allowed to flow on a sloping surface. The molten metal flows down and the impurities are left behind.

(E.g) Tin, Lead

2.22.30. What is Burnt alum? How is it prepared?

Potash alum melts on heating at 365K.

Further heating at 457K, loses water of hydration and swells up.

The swollen mass is known as burnt alum

$$K_2SO_4.Al_2(SO_4)_3.24H_2O \xrightarrow{475K} K_2SO_4.Al_2(SO_4)_3 + 24H_2O$$

Burnt alum

2.25.31. What are carbon nanotubes?

1. It is an allotrope of carbon.
2. It has graphite like tubes with fullerene ends.
3. The nonotubes are stronger than steel and conduct electricity.
4. It is used in nanoscale electronics, catalysis, polymers and medicine.

2.26.32. What is producer gas?

It is mixture of carbon monoxide and Nitrogen.

2.27.33. What is water gas (or) Synthetic gas?

It is mixture of carbon monoxide and hydrogen.

2.28.34. What is phosgene? How is it prepared?

Carbonyl chloride is known as phosgene

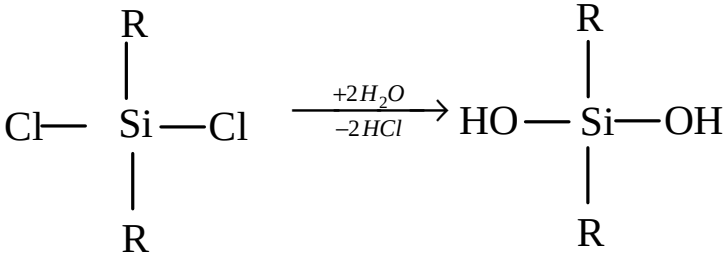
When carbon monoxide is treated with chlorine in presence of light or charcoal, phosgene is obtained.

$$CO + Cl_2 \xrightarrow{\text{light}} COCl_2$$

2.32.35. What are silicones? How is it prepared?

Silicones or poly siloxanes are organo silicon polymers.

The hydrolysis of dialkylchloro silanes gives silicones



2.34.36. What is water gas equilibrium? ***(PTA MQ)***

The equilibrium involved in the reaction between carbon dioxide and hydrogen, is called water gas equilibrium.

$$CO_2 + H_2 \rightleftharpoons CO + H_2O$$

5.2.37. What are metal carbonyls?

Metal carbonyls are the transition metal complexes of carbon monoxide, containing metal-carbon bond, 'CO' molecule act as ligand.

(e-g) $[Ni(CO)_4]$

6.3.38. What are covalent solids?

In covalent solids, the atoms are bound together in a three dimensional network entity by covalent bonds.

(E.g) Diamond

6.4.39. What are Non-polar molecular solids?

In this solids, constituent molecule are held together by weak dispersion forces or London forces.

(E.g) naphthalene

6.5.40. What are polar molecular solids?

In this solids, constituent molecules are held together by polar covalent bonds.

(E.g) Solid CO_2

6.6.41. What is primitive unit cell?

A unit cell that contain only one lattice point is called primitive unit cell.

6.7.42. What is non-primitive unit cell?

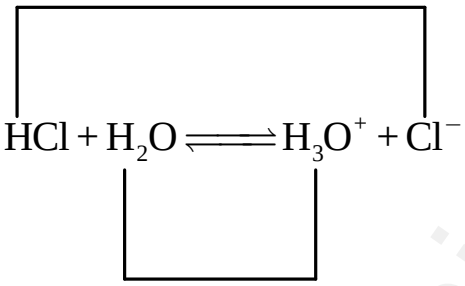
In this type, there are additional lattice points, either on a face of the unit cell or within the cell.

8.3.43. What are called conjugate acid-base pairs? ***(PTA MQ)***

The species that remains after the donation of a proton is called conjugate base of Bronsted acid.

Chemical species that differ only by a proton are called conjugate acid base pairs.

Conjugate acid base pairs



8.3.44. What is buffer solution? Explain buffer action. ***(PTA MQ)***

Buffer is solution having a mixture of a weak acid and its conjugate base (or) a weak base and its conjugate acid.

1. Acid buffer solution

(e.g) acetic acid + sodium acetate

2. Basic buffer solution

(e.g) Ammonium hydroxide + Ammonium chloride

Buffer Action

To resist changes in its pH on the addition of an acid (or) a base is known as buffer action.

Acid buffer action

$$CH_3COOH_{(aq)} \rightleftharpoons CH_3COO^-_{(aq)} + H_3O^+_{(aq)}$$

$$CH_3COONa \xrightarrow{H_2O(R)} CH_3COO^-_{(aq)} + Na^+_{(aq)}$$

Addition of acid

If an acid is added to this mixture, it will be consumed by the conjugate base CH_3COO^- to form undissociated weak acid. The increase in the concentration of H^+ does not reduce the pH significantly.

$$CH_3COO^- + H^+ \longrightarrow CH_3COOH$$

Addition of base

If a base is added, it will be neutralized by H_3O^+ and the acetic acid is dissociated to maintain the equilibrium. Hence the pH is not significantly altered.

$$OH^-_{(aq)} + H_3O^+_{(aq)} \longrightarrow 2H_2O_{(l)}$$

$$CH_3COOH_{(aq)} \overset{H_2O_{(l)}}{\rightleftharpoons} CH_3COO^-_{(aq)} + H_3O^+_{(aq)}$$

$$OH^-_{(aq)} + CH_3COOH_{(aq)} \longrightarrow CH_3COO^-_{(aq)} + H_2O_{(l)}$$

9.10.45. What is emf of a cell? (or) What is cell potential?

The force that pushes the electrons away from the anode and pulls them towards cathode is called electromotive force or emf or cell potential.

SI unit: Volt

9.18. 46. Define corrosion.

The redox process which causes the deterioration of metal is called corrosion.

9.19.47. Define electrochemical series. ***(PTA MQ)***

The standard aqueous electrode potential at 298 K for various metal-metal ion electrodes are arranged in the decreasing order of their standard reduction potential value is known as electrochemical series.

9.22.48. What is intercalation?

In chemistry, intercalation is the reversible or insertion of a molecule (or ion) into materials with layered structures.

(E.g) Graphite

10.1.49. What is adsorbent and adsorbate?

Adsorbent: Adsorbent is the material on which adsorption takes place.

Adsorbate: Adsorbed substance is called adsorbate.

10.2.50. What is called as desorption?

The process of removing adsorbed substance from the surface is called desorption.

10.10.51. What are promotors? Give e.g.

Substances which increase the activity of catalyst are known as promotors.

$$N_2 + 3H_2 \xrightarrow[Mo]{Fe} 2NH_3$$

Fe $\Rightarrow$ Catalyst

Mo $\Rightarrow$ Promotor

10.17.52. What is Tyndall effect? (or) Write optical property of colloidal solution. ***(Corona-20)***

When light passes through colloidal solution, it is scattered in all directions. This is called as Tyndall effect. The colloidal particles absorbs a portion of light and the remaining portion is scattered from the surface of the colloid. Hence the path of light is clear.

10.18.53. What is Brownian moment? (or) Write the Kinetic property of colloid.

The colloidal sol particles are continuously bombard with the molecules of the dispersion medium.

Sol particles follow a zigzag, random, continuous movement is known as Brownian moment

10.26.54. What are emulsions? Write the types of emulsions.

Emulsion are colloidal solution in which a liquid is dispersed in an another liquid.

(i) Oil in water (O/w)

(ii) Water in Oil (W/O)

10.29.55. What is deemulsification? Write the Various methods of deemulsification techniques. ***(PTA MQ)***

The process of separating emulsion into two separate layers is known as deemulsification.

Deemulsification techniques

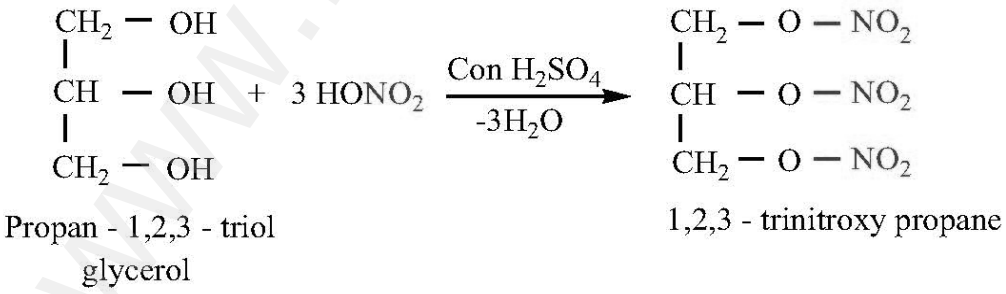
1. Distilling of one component
2. Adding an electrolyte to destroy the charge
3. Destroying the emulsifier using chemical methods
4. Using solvent extraction to remove one component
5. By freezing one of the component
6. By applying centrifugal force.
7. Adding dehydrating agents for water in oil type.
8. Using the ultrasonic waves
9. Heating at high pressure

10.31.56. What are active centers? ***(PTA MQ)***

The surface of catalyst is not smooth. It bears steps, cracks and corners. Hence the atoms on such locations of the surface are co-ordinatively unsaturated. So they have much residual force of attraction. Such sites are called active centres.

11.17.57. What is TNG? How it is Prepared?

Trinitroglycerine is called as TNG. Glycerol reacts with nitric acid to form TNG.

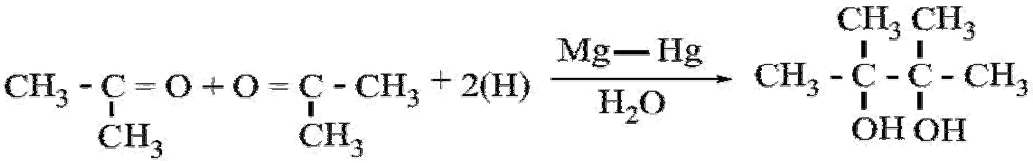


Propan - 1,2,3 - triol
glycerol

1,2,3 - trinitroxy propane

12.19.58. What is Pinacol? How it is Prepared?

Symmetrical diols are called as Pinacol. Ketones on reduction with magnesium amalgam and water gives pinacol.



Acetone Acetone 2,3dimethyl butane-2,3-diol (pinacol)

12.28.59. What is Tollens Reagent and Fehlings solution?

1) **Tollen's reagent:** Ammonical silver nitrate solution.
2) **Fehlings solution:** Equal volumes of Fehlings solutions 'A' containing aqueous copper sulphate and Fehling's solution 'B' Containing alkaline solution of sodium potassium tartarate.

12.29.60. What is Benedicts solution and schiff's reagent?

1) **Benedict solution:** Mixture of Copper sulphate + Sodium citrate + Sodium Hydroxide.
2) **Schiff's reagent:** Rosaniline hydrochloride dissolved in water and its red colour decolourised by passing SO_2.

12.30.61. What is Fomalin? Write its use. ***(MAR 20)***

40% aqueous solution of formaldehyde is called formalin.

Use: Preserving biological specimens.

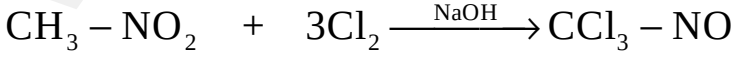
12.35.62. What is vinegar and glacial acetic acid?

Vinegar: 6 to 8% solution of acetic acid in water.

Glacial acetic acid: Pure acetic acid.

13.5.63. What is chloropicrin? How it is Prepared? ***(Mar 20)***

Chloropicrin: Trichloro Nitro methane $CCl_3\ NO_2$



Nitro Methane Chloropicrin

14.2.64. What are anomers?

The conversion of the achiral aldehyde carbon into chiral one leading the possibility of two isomers. These

isomers differ only in the configuration of C_1 carbon are called anomers.

14.3.65. What is mutarotation?

When pure form of anyone α-(D) glucose or β-D-Glucose dissolved in water, slow interconversion of α-D glucose and β-D-glucose via open chain form until equilibrium established giving constant specific rotation of +53°.
This phenomenon is called mutarotation.

14.4.66. Explain epimers and epimerisation. Give e.g.

Sugar differing in configuration at an asymmetric centre is known as epimers.
The process by which one epimer is converted into other is called epimerisation by using an enzyme epimerase.

14.6.67. What is invert sugar?

During hydrolysis of sucrose, the optical rotation of the reaction mixture changes from dextro to leavo. So sucrose is called as invert sugar.

14.8.68. What is glycosidic linkage? ***(Mar 20)***

Anomeric carbon of one monosaccharide reacts with a hydroxyl group of another monosaccharide. This linkage is called glycosidic linkage or oxide linkage.

14.17.69. What is isoelectric point of Amino acid?

At a specific pH value, the net charge of an amino acid is neutral is called isoelectric point.

14.19.70. What are fibrous proteins?

Fibrous proteins are linear molecules similar to fibres. These are generally insoluble in water and are held togelther by disulphide bridges and weak intermolecular hydrogen bonds.
(E.g) Keratin, Collagen.

14.20.71. What are globular proteins?

Globular proteins have an overall spherical shape. The polypeptide chain is folded into a spherical shape.

These proteins are usually soluble in water and have many functions including catalysis.

14.22.72. What are Lipids?

Lipids are organic molecules that are soluble in organic solvents such as chloroform and methanol. Lipids are insoluble in water.

These are the principle components of cell membranes including cell walls.

They act as energy source for living system.

Lipids provide 2-3 fold higher energy compared to carbohydrates or proteins.

14.24.73. What are Nucleic acids?

Nucleic acids are biopolymers of nucleotides.

They are the molecular repositories that carry genetic information in every organism.

14.25.74. What is nucleoside, Nucleotide and Polynucleotide?

Sugar + base $\longrightarrow$ Nucleoside

Nucleoside + Phosphate $\longrightarrow$ Nucleotide

'n' nucleotide $\longrightarrow$ Polynucleotide (Nucleic acid)

15.1.75. What is chemotherapy?

The specific treatment of a disease using medicine is known as chemotherapy.

15.3.76. What are antibiotics? Give e.g.

The medicine that have the ability to kill the pathogenic bacteria are grouped as antibiotics.

15.4.77. What are enzymes?

Protein which act as biological catalysts are called as enzymes.

15.5.78. What are called allosteric inhibitiors?

In certain enzymes, the inhibitor molecule binds to a different binding site, and causes a change in its active site geometry.

As a result, the substrate cannot bind to the enzyme. This type of inhibitors are called allosteric inhibitors.

15.6.79. What are antipyretics? Give e.g.

The drugs which are reduces fever and preventing platelet coagulation are called antipyretics.

(e.g) Aspirin

15.8.80. What are antacids? Give its use and e.g.

Neutralise the acid in the stomach that causes acidity.

Use: To relieve burning sensation in the chest or throat area.

(E.g) Milk of magnesia, aluminium hydroxide, Ranitidine, omeprazole.

15.9.81. What are tetracyclines? Give its uses and e.g.

Inhibit the bacterial protein synthesis through interaction with the 30s subunit of the bacterial ribosome.

It is used in the treatment of peptic ulcer disease, infections of the respiratory tract, cholera and acne vulgaris.

(e.g) Doxycyline, Minocycline.

15.10.82. What are antifertility drugs? Give e.g. and use.

These synthetic hormones that suppresses ovulation or fertilisation.

It is used in birth control pills
(e.g) synthetic oestreogen (menstranol)
Synthetic progestorne (Norethin drone)

15.12.83. What are antioxidants? Give e.g. ***(PTA MQ) Corona-20***

Antioxidants are substances which refined the oxidative detoriation of food.
(E.g) BHT (butyl hydroxy toluene)
BHA (Butylated hydroxy anisole)

15.13.84. What are sugar substituents? Give e.g.

Those compounds that are used like sugars for sweetening, but are metabolised without the influence of insulin are called sugar substituents.

15.14.85. What are artificial sweetening agents? Give e.g.

Synthetic compounds which imprint a sweet sensation and possess no or negligible nutritional value are called artificial sweetners.
(E.g) Saccharin, Sucralose.

15.15.86. What are cleansing agents? Write the chemical composition.

Soap: sodium or potassium salt of higher fatty acids.
Detergent: Sodium salt of alkyl hydrogen sulphates or alkyl benzene sulphonic acids.

15.17.87. What is known as termination in polymerization reaction?

The chain reaction can be stopped by the supply of monomer or by compiling two chains of reaction with an impurity such as oxygen.

6. USES - QUESTION AND ANSWERS (BOOK BACK)

1.8.1. Give the uses of Zinc. ***(PTA MQ)***

1. It is used to galvanise iron and steel structures.
2. It is used to produce die-castings in the automobiles, electrical and hardware industries.
3. Zinc oxide is used in the manufacture of paints, rubber, cosmetics.

Zinc sulphide is used in making Luminous paints, fluorescent light and X-ray screen.

2.3.2. Give the uses of Borax.

Uses of Borax:

1. Borax is used for the identification of coloured metal ions.
2. In the manufacture of optical and borosilicate glass, enamels and glaze for pottery.
3. It is also used as a flux in metallurgy and also acts as a good preservative.

2.7.3. Give the uses of silicones.

1. Silicones are used for low temperature lubrication and in vacuum pump.
2. It is used in high temperature oil bath.
3. They are used for making water proofing clothes.
4. They are used as insulating material in electrical motor and other appliances.
5. They are mixed with paints and enamels to make them resistant towards high temperature, sun light, dampness and chemicals.

3.7.4. Give the uses of helium.

1. Helium and oxygen mixture is used by divers in place of air oxygen mixture. This prevents the painful dangerous condition called bends.

2. Helium is used to provide inert atmosphere in electric arc welding of metals.
3. Helium has lowest boiling point hence used in cryogenics.
4. It is used for filling air balloons.

3.11.5. Give the uses of sulphuric acid.

1. Sulphuric acid is used in manufacture of fertilizers, ammonium sulphate, super phosphate, HCl, HNO_3.
2. It is used as drying agent.
3. It is used for preparation of pigment, explosives etc.

3.15.6. Give the uses of argon. ***(PTA MQ)***

Argon prevents the oxidation of hot filament and prolongs the life in filament bulbs.

6. USES - QUESTION AND ANSWERS (ADDITIONAL)

1.14.7. Write the applications of aluminium.

1) Cooking vessels are made of aluminium.
2) Used as packing materials for food items.
3) Alloys of aluminium are used to design of aeroplanes and other forms of transport.
4) It is used in chemical reactors, medical equipments, refrigeration units and gas pipelines
5) Used in electrical overhead electric cable with steel core for strength.

1.15.8. Write the applications of Iron.

1) Iron and its alloys are used in bridges, cutting tools and rifle barrels.
2) Cast iron is used to make pipes, valves

3) It is used to make magnets
4) Stainless steel is used in architecture, bearings, cutlery, surgical instruments and jewellery.
5) Chrome steel are used for cutting tools.

1.16.9. Write the uses of copper.

1) Used for making coins and ornaments.
2) Copper and its alloys used for making wires, water pipes and other electrical parts.

1.17.10. Write the applications of gold.

1) It is used for coinage and ornaments
2) Used for electroplating of other metals
3) Gold Nano particles are used for increasing the efficiency of solar cells and catalyst.

2.6.11. Write the uses of boron.

1. Isotope of Boron $\left({}^{10}B_5\right)$ is used as moderator in nuclear reactors.
2. Amorphous Boron is used as rocket fuel igniter.
3. Boron is essential for the cell walls of plants.
4. Compounds of boron such as boric acid and borax are used in eye drops, antiseptics, and washing powders.

2.13.12. Write the uses of Boric acid.

1) It is used in the manufacture of pottery glazes, glass, enamels and pigments.
2) It is used as antiseptic and eye lotion.
3) Used as food preservative.

2.16.13. Write the uses of Diborane?

1) used as a high energy fuel for propellant.
2) used as reducing agent in organic chemistry.
3) used in welding torches.

2.18.14. Give the uses of boron trifluoride.

1) used for preparing catalyst HBF_4
2) used as fluorinating agent

2.20.15. Write the uses of aluminium chloride.

1) Anhydrous aluminium chloride is used as catalyst in Friedal-crafts reaction.
2) Used for manufacture of petrol by cracking the mineral oils.
3) Used as catalyst for manufacture of dye, drugs and perfumes.

2.23.16. Write the uses of alum.

1) Used for purification of water
2) Used for water proofing and textiles
3) Used in dyeing, and leather tanning industries
4) Used as a styptic agent to arrest bleeding

2.29.17. Write the uses of carbon monoxide.

1) Water gas ($CO+H_2$) and producer gas ($CO + N_2$) are important industrial fuels.
2) Used as good reducing agent.
3) It is an important ligand.

2.31.18. Write the uses of silicon tetra chloride.

1) Used in the production of semiconducting silicon.
2) Used as a starting material in the synthesis of silica gel, silicic esters.

3.2.19. Write the uses of Nitrogen.

1) Used for manufacture of ammonia, nitric acid and calcium cyanamide.
2) Used for producing low temperature in cryosurgery and biological preservation

3.10.20. Write the use of Nitric acid.

1. Used as an oxidising agent.
2. Used for preparation of aqua regia.
3. Salts of nitric acid $AgNO_3$ used in photography and gunpowder ($NaNO_3$) for fire arms.

3.15.21. Write the uses of phosphorus.

1. Red phosphorus is used in match boxes.
2. Used for production of alloys (e.g) phosphor bronze.

3.17.22. Write the uses of phosphine.

1. Used for producing smoke screen.
2. In Holmes signal (calcium carbide + calcium phosphide), liberated phosphine catches fire. It serves as signal for approaching ships.

3.19.23. Write the uses of PCl_3 and PCl_5.

PCl_3:

1. Used as chlorinating agent
2. Used for preparation of H_3PO_3

PCl_5:

1. Used as chlorinating agent.
2. Used for replacing –OH group by chlorine in organic compounds.

3.24.24. Write the uses of oxygen.

1. Oxygen is essential for survival of living organisms.
2. Used in welding.
3. Liquid oxygen is used as fuel in rocket.

3.27.25. Write the uses of sulphur dioxide.

1. Used in bleaching hair, silk and wool.
2. Used for disinfecting crops and plants in agriculture.

3.32.26. Write the use of chlorine.

1. Purification of drinking water.
2. Bleaching of cotton textiles, paper and nylon.
3. Used in the extraction of gold and platinum.

3.38.27. Write the uses of krypton.

1. It is used in fluorescent bulbs, flash bulbs.
2. Lamps filled with krypton are used in airports as approaching light.

3.39.28. Write the uses of xenon.

1. Xenon is used in fluorescent bulbs, flash bulbs and lasers.
2. Xenon is used in high speed electronic flash bulbs used by photographers.

3.40.29. Write the uses of Radon.

1. Radon is a source of gamma rays
2. Radon is implanted in the body to destroy cancer growth.

4.12.30. Write the uses of potassium dichromate.

1. Used as strong oxidising agent
2. Used in dyeing and printing
3. For chrome tanning
4. In qualitative analysis for estimation of iron compounds and iodides.

4.2.31. Write the uses of potassium permanganate.

1. Used as a strong oxidising agent.
2. Used for treatment of skin infections and fungal infection.
3. Used in water treatment industries to remove iron and hydrogen sulphide.
4. Used as bayer's reagent for the detection of unsaturation in organic compound.

5. In quantitative analysis, for estimation of ferrous salts, oxalates, hydrogen peroxides and iodides.

5.9.32. Mention the metal complexes and its metal ions are used in biological system. ***(Sep 20)***

S. No.	Metal complex in Biological system	Metal ions
1.	Red blood corpuscles (RBC)	Fe^{2+}
2.	Chlorophyll	Mg^{2+}
3.	Vitamin B_{12}	Co^{+}
4.	Carboxy peptidase	Zn^{2+}

5.9.33. Write the applications of co-ordination complexes.

1. **Phthalo blue** – used in printing ink and in packaging industry.
2. Purification of nickel by Mond's process.
3. **EDTA** – separation of lanthanides in softening of hard water and remove lead poisoning.
4. For the extraction of gold and silver.
5. Many of the complexes are used as catalyst. Wilkins's catalyst – $[(PPh)_3\ Rh\ Cl]$.
6. **Cis–platin** – used as anti tumour dung in cancer treatment.
7. Hypo used is photography.
8. Chlorophyll, RBC, vitamin B_6 and many enzymes are biological co-ordination compares.

10.6.34. Write the applications of adsorption.

1. Activated charcoal is one of the best adsorbent used in world war I.
2. Activated charcoal is used to create high vaccum in vessels.

3. Alumina and Silica are used for dehydration and purification of gases like CO_2, N_2, Cl_2, O_2 and He.
4. Silica gel is used for drying air in blast furnace.
5. Adsorption is used in softening of hard water. Permuidit is used as adsorbent for adsorption of Ca^{2+} and Mg^{2+} ions.
6. Ion exchange resins are used to demineralise water.
7. Fullers earth and Silica gel are used for petroleum refining process.
8. Animal charcoal is employed to remove coloured impurities from sugar.

10.19.35. Write the application of Brownian moment. ***(PTA MQ)***

1. To calculate Avagadro number.
2. To confirm Kinetic theory which considers the ceaseless rapid moment of molecules that increases with increase in temperature.
3. To understand the stability of colloids.

10.33.36. Write medicinal applications of colloids.

1. Antibodies such as penicillin and streptomycin are produced in colloidal form.
2. Colloidal gold and colloidal calcium are used as tonics.
3. Milk of magnesia is used for stomach troubles
4. Silver sol known as argyrols is used as eye lotion.

11.19.37. Write the uses of Methanol.

1. Methanol is used as a solvent for paints, varnishes
2. In the manufacture of dyes, drugs, perfumes and formaldehyde.

11.20.38. Write the uses of Ethanol.

1. Ethanol is used as beverage
2. It is used in the preparation of paints and varnishes.
3. As a substitute for petrol in the name of power alcohol.
4. Used as preservative for biological specimens.

11.21.39. Write the uses of ethylene glycol.

1. It is used as an antifreeze in automobile radiator.
2. For the preparation of explosive TNG.

11.22.40. Write the uses of glycerol.

1. It is used as a sweetening agent.
2. Used in the manufacture of cosmetics and transparent soaps.
3. Used in making printing inks, stamp pad inks and lub ricants.
4. Used in the manufacture of explosive like dynamite and cordite.

11.36.41. Write the uses of phenol.

1. Used for making phenol formaldehyde resin.
2. Used as an antiseptic - carbolic lotion and carbolic soaps.
3. It is used as a starting material for the preparation of phenancetin, phenolphthalein and explosives.

11.41.42. Write the uses of diethyl ether. ***(PTA MQ)***

1. It is used as a surgical anesthetic agent in surgery.
2. It is a good solvent for organic reactions and extraction.
3. Used as a volatile starting fluid for diesel and gasoline engines.
4. Used as refrigerant.

11.42.43. Write the uses of anisole.

1. Anisole is a precursor to the synthesis of perfumes and insecticide pheromones.
2. It is used as a pharmaceutical agent.

12.15.44. Write the uses of Urotropine.

1. Urotropine is used as a medicine to treat urinary infection.
2. Nitration of Urotropine under controlled condition gives an explosive RDX.

12.3.45. Write the uses of aldehyde or Ketones.

Formaldehyde:

(i) 40% aqueous solution of formaldehyde is called formalin. It is used for preserving biological specimes.

(ii) Formalin has hardening effect, hence it is used for tanning.

(iii) Formalin is used in the production of thermo setting plastic known as bakelite, which is obtained by heating phenol with formalin.

Acetaldehye:

(i) Acetaldehyde is used for silvering of mirrors

(ii) Paraldehyde is used in medicine as a hypnotic.

(iii) Acetaldehyde is used in the commercial preparation of number of organic compounds like acetic acid, ethyl acetate etc.,

Acetone:

(i) Acetone is used as a solvent, in the manufacture of smokeless powder (cordite)

(ii) It is used as a nail polish remover.

(iii) It is used in the preparation of sulphonal, a hypnotic.

(iv) It is used in the manufacture of thermosoftening plastic Perspex.

Benzaldehyde is used:

(i) as a flavouring agent
(ii) in perfumes
(iii) in dye intermediates
(iv) as starting material for the synthesis of several other organic compounds like cinnamaldehyde, cinnamic acid, benzoyl chloride etc.

Aromatic Ketones:

(i) Acetophenone has been used in perfumery and as a hypnotic under the name hyphone.
(ii) Benzophenone is used in perfumery and in the preparation of benzhydrol drop.

13.22.46. Write the uses of Nitro benzene.

1. Nitro benzene is used to produce lubricating oils in motors and machinery.
2. It is used in the manufacture of dyes, drugs, pesticides, syntheic rubber, aniline and explosives (TNB, TNT).

13.23.47. Write the uses of cyanides and isocyanides.

Alkyl cyanides are important intermediates in the organic synthesis of large number of compounds acids, amides, esters and amines.

13.2.48. Write the uses of Nitroalkanes. ***(PTA MQ)***

1. Nitro methane is used as fuel for car.
2. Chloropicrin is used an insecticide.
3. Nitroethane is used as a fuel additive.
4. Nitroelthane is used as a precursor to explosive ester, and good solvent for polymers, cellulose ester synthetic rubber and dyes.
5. 4% solution of ethyl nitrile in alcohol is known as sweet spirit of nitre used as diuretic.

7. DERIVATION AND EQUATION - QUESTION AND ANSWERS (BOOK BACK)

7.3.1. Derive integrated rate law for a zero order reaction A → product.

The rate of reaction is independent of concentration of the reactant over a wide range of concentration is called zero order reaction

$A \longrightarrow$ Product

The rate raw

Rate = $k[A]^{\circ}$

$$\frac{-d[A]}{dt} = k(1)$$

$$-d[A] = k.dt \quad \ldots (1)$$

Integrate equation (1) between $[A_\circ]$ and $[A]$

$$-\int_{[A_o]}^{[A]} d.(A) = k\int_{o}^{1} dt$$

$$-[A]_{[A_o]}^{[A]} = K(t)_0^1$$

$$A_o - A = kt$$

$$k = \frac{[A_o]-[A]}{t}$$

The above equation is known as Integrated rate law for zero order reaction.

7.4.2. Define half life of a reaction. Show that for a first order reaction half life is independent of initial concentration. (Or) Derive an equation for half life period of First order equation. ***(PTA MQ)***

The half life of a reaction is defined as the time required for the reactant concentration to reach one half its initial value.

$$k_1 = \frac{2.303}{t} \log \frac{[A_o]}{[A]}$$

$$\text{at } t = t_{1/2} \; ; \; [A] = \frac{[A_o]}{2}$$

$$k_1 = \frac{2.303}{t_{1/2}} \log \frac{[A_o]}{\frac{[A_o]}{2}}$$

$$k_1 = \frac{2.303}{t_{1/2}} \log 2$$

$$t_{1/2} = \frac{2.303 \times 0.3010}{k_1}$$

$$t_{1/2} = \frac{0.6932}{k_1}$$

From the above equation, for a first order reaction half life is independent of initial concentration.

7.14.3. Write Arrhenius equation and explains the terms involved.

Arrhenius equation

$K = Ae^{-Ea/RT}$

A = frequency factor

E_a = Activation energy

R = Gas constant

T = Absolute temperature (Kelvin)

8.12.4. Derive an expression for Ostwald's dilution law.

(PTA MQ) Corona-20

Ostwald's dilution law relates the dissociation constant of a weak acid (Ka) with its degree of dissociation (α) and the concentration (C).

$$\alpha = \frac{\text{Number of moles dissociated}}{\text{Total number of moles}}$$

$$CH_3COOH \rightleftharpoons H^+ + CH_3COO^-$$

$$K_a = \frac{[H^+][CH_3COO^-]}{[CH_3COOH]} \quad \ldots (1)$$

	CH_3COOH	H^+	CH_3COO^-
Initial number of moles	1	-	-
Degree of dissociation of CH_3COOH	α	-	-
Number of moles at equilibrium	$1-\alpha$	α	α
Equilibrium concentration	$(1-\alpha)C$	αC	αC

Substituting equilibrium concentration in Equation (1)

$$K_a = \frac{(\alpha C)(\alpha C)}{(1-\alpha)C}$$

$$K_a = \frac{\alpha^2 C}{(1-\alpha)}$$

For weak acid, α is so small. So $(1-\alpha) \simeq 1$

$$K_a = \alpha^2 C$$

$$\alpha^2 = \frac{K_a}{C}$$

$$\alpha = \sqrt{\frac{K_a}{C}} \quad \ldots (2)$$

When dilution increases, the degree of dissociation of weak electrolyte also increases. This statement is known as Ostwald's dilution Law.

$$[H^+] = \alpha C \quad \ldots (3)$$

Substituting Equation (2) in (3)

$$[H^+] = \sqrt{\frac{K_a}{C}}.C$$

$$[H^+] = \sqrt{\frac{K_a C^2}{C}}$$

$$[H^+] = \sqrt{K_a \times C}$$

Similarly for weak base

$$K_b = \alpha^2 C;\ \alpha = \sqrt{\frac{K_b}{C}}$$

$$[OH^-] = \sqrt{K_b \times C}$$

9.24.5. Derive an expression for Nernst equation. ***(Sep-20)***

Nernst equation relates the cell potential and the concentration of species involved in electrochemical reaction.

Consider the electrochemical cell overall redox reaction.

$$xA + yB \rightleftharpoons lC + mD$$

$$\text{Reaction quotient } Q = \frac{[C]^l[D]^m}{[A]^x[B]^y} \quad \ldots (1)$$

$$\Delta G = \Delta G^\circ + RT\ln Q \quad \ldots (2)$$

Relation between Gibbs free energy and emf.

$$\Delta G = -nFE \quad \ldots (3)$$

$$\Delta G^\circ = -nFE^\circ \quad \ldots (4)$$

Substitute equation (1), (3) & (4) in (2)

$$-nFE = -nFE^\circ + RT\ln\frac{[C]^l[D]^m}{[A]^x[B]^y} \quad \ldots (5)$$

Divide the equation (5) by (– nF)

$$E = E^\circ - \frac{RT}{nF}\ln\frac{[C]^l[D]^m}{[A]^x[B]^y}$$

$$E_{cell} = E^{\circ}_{cell} - \frac{2.303RT}{nF} \log \frac{[C]^l[D]^m}{[A]^x[B]^y}$$

The above equation is called Nernst equation.

The Nernst equation after substitute R, T and F values.

$$E_{cell} = E^{\circ}_{cell} - \frac{0.0591}{n} \log \frac{[C]^l[D]^m}{[A]^x[B]^y}$$

7. DERIVATION AND EQUATION - QUESTION AND ANSWERS (ADDITIONAL)

4.5.1. Explain Magnetic moment.

Magnetic moment $\mu = g\sqrt{s(s+1)}\mu_B$

where g = 2

s = total spin quantum number of unpaired electrons

μ_B = Bohr Magneton (or)

Magnetic moment $\mu = \sqrt{n(n+2)}\ \mu_B$

n = number of unpaired electrons

5.4.2. Write the relation between dissociation equilibrium constant and formation equilibrium constant.

The reciprocal of dissociation equilibrium constant is equals to formation equilibrium constant.

$$\beta = \frac{1}{\alpha}$$

β = Formation equilibrium constant.

α = dissociation equilibrium constant

6.10.3. Write Bragg equation and explain the term. ***(PTA MQ)***

$n\lambda = 2d \sin\theta$

n $\Rightarrow$ Order of reflection

$\lambda \Rightarrow$ Wave length of X-ray

d $\Rightarrow$ Inter planar distance

$\theta \Rightarrow$ angle of reflection

6.11.4. Write the formula for density of unit cell.

Density of unit cell (ρ) = $\frac{nm}{a^3 N_A}$

n = Number of atom in a unit cell

m = mass of a atom

a = edge length

N_A = Avagadro number

7.3.5. Derive the equation for half life period of zero order reaction. ***(PTA MQ)***

Rate constant $k = \frac{[A_o]-[A]}{t}$

If $t = t_{1/2}$, $[A] = [A_o]/2$

$$k = \frac{[A_o]-[A_o]/2}{t_{1/2}}$$

$$k = \frac{[A_0]}{2t_{1/2}}$$

$$t_{1/2} = \frac{[A_o]}{2k}$$

The half life period of zero order reaction is directly proportional to initial concentration of reactants.

7.7.6. Derive Arrhenius equation to calculate activation energy from the rate constant K_1 and K_2 at temperature T_1 and T_2 respectively.

$k = Ae^{(-Ea/RT)}$ ... (1)

Taking logarithm on both side of equation (1)

$\ln K = \ln A + \ln e^{-(Ea/RT)}$

$$\ln K = \ln A - \left(\frac{E_a}{RT}\right) \qquad (\because \ln e = 1)$$

At temperature $T = T_1$ and $K = K_1$

$$\ln K_1 = \ln A - \left(\frac{E_a}{RT_1}\right) \qquad \ldots (2)$$

At temperature $T = T_2$, and $K = K_2$

$$\ln K_2 = \ln A - \left(\frac{E_a}{RT_2}\right) \qquad \ldots (3)$$

(3) – (2)

$$\ln K_2 - \ln K_1 = -\left(\frac{E_a}{RT_2}\right) + \left(\frac{E_a}{RT_1}\right)$$

$$\ln\left(\frac{K_2}{K_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$2.303\log\left(\frac{K_2}{K_1}\right) = \frac{E_a}{R}\left(\frac{T_2 - T_1}{T_1T_2}\right)$$

$$\log\left(\frac{K_2}{K_1}\right) = \frac{E_a}{2.303R}\left(\frac{T_2 - T_1}{T_1T_2}\right)$$

The above equation is used to calculate Ea from rate constants K_1 and K_2 at temperature T_1 and T_2.

7.1.7. Derive integrated rate equation of first order reaction. $A \rightarrow$ product. *(PTA MQ, MAR 20)*

A reaction rate depends on the reactant concentration raised to the first power is called a first order reaction.

$A \longrightarrow$ products

rate $= k [A]'$

$$-\frac{d[A]}{dt} = k_1[A]'$$

$$-\frac{d[A]}{[A]} = k_1\, dt \qquad \ldots (1)$$

Integrate equation (1)

$$\int_{[A_o]}^{[A]} \frac{-d[A]}{[A]} = k\int_0^1 dt$$

$$(-\ln[A])_{[A_o]}^{[A]} = k(t)_0^1$$

$$-\ln[A] - (-\ln[A_0]) = k(t-0)$$

$$-\ln[A] + \ln[A_o] = kt$$

$$\ln \frac{[A_0]}{[A]} = kt \qquad \ldots (2)$$

$$2.303 \log \left(\frac{[A_0]}{[A]}\right) = kt$$

$$k = \frac{2.303}{t} \log\left(\frac{[A_0]}{[A]}\right)$$

$A_\circ$ = Initial concentration of reactant.

A = concentration of reactant after time 't'.

This equation is known as integrated equation for first order reaction.

8.2.8. Derive the relation between pH and pOH. *(PTA MQ)*

$$pH = -\log_{10}[H_3O^+] \qquad \ldots (1)$$

$$pOH = -\log_{10}[OH^-] \qquad \ldots (2)$$

(1) + (2)

$$pH + pOH = -\log_{10}[H_3O^+] - \log_{10}[OH^-]$$

$$= -\left\{\log_{10}[H_3O^+] + \log_{10}[OH^-]\right\}$$

$$pH + pOH = -\log_{10}[H_3O^+][OH^-] \qquad \ldots (3)$$

$$[H_3O^+][OH^-] = K_w \qquad \ldots (4)$$

Substitute equation (4) in (3)

$pH + pOH = -\log_{10} K_w$

$pH + pOH = pK_w$ $[\because pKw = -\log_{10} K_w]$ ... (5)

Ionic product of water $k_w = 1 \times 10^{-14}$

$pk_w = -\log_{10} 10^{-14}$

$= 14 \log_{10} 10$

$pk_w = 14$ ... (6)

Substitute (6) in (5)

$pH + pOH = 14$

8.4.9. Derive Henderson equation. (or) Derive an equation to find pH of buffer solution. ***(PTA MQ)***

$$CH_3COOH_{(aq)} \rightleftharpoons^{H_2O} CH_3COO^-_{(aq)} + H_3O^+_{(aq)}$$

$$CH_3COONa_{(aq)} \xrightarrow{H_2O} CH_3COO^-_{(aq)} + Na^+_{(aq)}$$

Dissociation constant of weak acid

$$k_a = \frac{[CH_3COO^-][H_3O^+]}{[CH_3COOH]}$$

$$[H_3O^+] = k_a \frac{[CH_3COOH]_{(aq)}}{[CH_3COO^-]}$$

$$[H_3O^+] = k_a \frac{[Acid]}{[Base]}$$

Due to common ion effect, the dissociation of weak acid is further suppressed

$[acid]_{aq}$ = initial concentration of the acid

$[conjugate\ base]_{aq}$ = initial concentration of the added salt.

$$[H_3O^+] = k_a \frac{[Acid]}{[Salt]}$$

Taking negative logarithm on both sides of the equation

$$-\log[H_3O^+] = -\log k_a - \log\frac{[Acid]}{[Salt]}$$

$pH = -\log[H_3O^+]$

$pk_a = -\log k_a$

Substitute the above value in equation

$$pH = pk_a - \log\frac{[Acid]}{[Salt]}$$

$$pH = pk_a + \log\frac{[Salt]}{[Acid]}$$

Similarly for a basic buffer, $pOH = pk_b + \log\frac{[Salt]}{[Base]}$

9.7.10. Explain Debye-Huckel and Onsagar equation. ***(PTA MQ)***

Each ion is surrounded by an ionic atmosphere of opposite charge.

Debye Huckel derived an expression relating the molar conductance of strong electrolytes with the concentration by assuming complete dissociation.

For a uni-univalent electrolyte the Debye Huckel and Onsagar equation is given below.

$$\Lambda_m = \Lambda_m^\circ - (A + B\Lambda_m^\circ)\sqrt{C}$$

$$A = \frac{82.4}{\sqrt{DT}\,\eta} \qquad B = \frac{8.20\times10^5}{\sqrt[3]{DT}}$$

D = Dielectric constant of the medium

η = viscosity of the medium

T = Temperature in Kelvin

9.5.11. Explain the thermodynamics of cell reactions.

In a galvanic cell, the chemical energy is converted into electrical energy.

The electrical energy produced by the cell is equal to the product of total charge of electrons and the emf of the cell.

Electrical energy = Charge of 'n' mole of electrons $\times E_{cell}$ ... (1)

Charge of 1 mole of electrons = 1 F

Charge of 'n' mole of electrons = n F ... (2)

Electrical energy = n F E_{cell} ... (3)

The energy is used to do electric work.

$(W_{max})_{cell} = -n\ F\ \ E_{cell}$ ... (4)

The (-) sign is introduced to indicate that the work is done by the system on the surroundings.

According to second law of thermodynamics,

$$W_{max} = \Delta G \quad \text{... (5)}$$

Compare equation (4) and (5)

$$\Delta G = -\ n\ F\ E_{cell} \quad \text{... (6)}$$

$$\Delta G^0 = -\ n\ F\ E^\circ_{cell} \quad \text{... (7)}$$

Standard free energy and equilibrium constant

$$\Delta G^0 = -\ RT \ln K_{eq} \quad \text{... (8)}$$

Compare equation (7) and (8)

$$nFE^\circ_{cell} = RT \ln K_{eq}$$

$$E^\circ_{cell} = \frac{2.303RT}{nF} \log K_{eq}$$

8. PREPARATION - QUESTION AND ANSWERS (BOOK BACK)

1.5.1. Describe a method for refining nickel. ***(PTA MQ)***

Mond's Process:

The impure nickel is heated with carbon monoxide at 350K. The nickel reacts with CO to form a highly volatile Nickel tetra carbonyl.

$Ni_{(s)} + 4\ CO_{(g)} \xrightarrow{350\,K} [Ni\ (CO)_4]_{(g)}$

On heating this compound at 460K, the complex decomposes to give pure metal.

$Ni(CO)_{4(g)} \xrightarrow{460\,K} Ni_{(s)} + 4CO_{(g)}$

1.6.2. Explain zone refining process with an example

(PTA MQ, MAR 20)

Principle: Fractional crystallization.

When an impure metal is melted and allowed to solidify, the impurities will prefer to be in the molten region.

Shape of impure metal: Rod shape

Atmosphere: Inert atmosphere

The type of heater: Induction heater

Process: One end of the rod is heated. When the heater is moved to the other end, pure metal crystallizes while the impurities will move on to the adjacent molten zone.

The process is repeated several times by moving the heater in the same direction again and again to achieve the desired purity level.

Eg. Germanium, Silicon, Galium

1.13.3. Explain the principle of electrolytic refining with an example. ***(PTA MQ)***

Anode: Impure Silver

Cathode: Pure Silver

Electrolyte: Acidified silver nitrate solution. During electrolysis pure metal deposits at cathode.

Reaction

Anode $Ag_{(g)} \longrightarrow Ag^{+} + 1e^{-}$

Cathode $Ag^{+} + 1e^{-} \longrightarrow Ag_{(s)}$

Anode mud: During electrolysis, the less electropositive impurities in the anode, settle down at the bottom and are removed as anode mud.

1.9.4. Explain the electrometallurgy of aluminium. ***(PTA MQ)***

Anode: Carbon rods

Cathode: Iron tank lined with carbon

Electrolyte: 20% Alumina + molten cryolite + 10% calcium chloride solution

Temperature: 1270K

Ionisation of Alumina: $Al_2O_3 \longrightarrow 2\ Al^{3+} + 3O^{2-}$

Cathode: $2Al^{3+} + 6e^{-} \longrightarrow 2\ Al$

Anode: $6O^{2-} \longrightarrow 3O_2 + 12e^{-}$

Since carbon acts as anode, the following reaction takes place

$C + O^{2-} \longrightarrow CO + 2e^{-}$

$C + 2O^{2-} \longrightarrow CO_2 + 4e^{-}$

The pure aluminium is formed at the cathode. The net electrolysis reaction.

$4Al^{3+} + 6O_2^{-} + 3C_{(s)} \longrightarrow 4\ Al_{(l)} + 3CO_{2(g)}$

2.5.5. Write a note on Fisher tropsch synthesis. ***(PTA MQ)***

The reaction of Carbon monoxide with hydrogen using metal catalysts at 500-700K and 50 atm gives saturated and unsaturated hydro carbons.

$$nCO + (2n+1)\,H_2 \longrightarrow C_nH_{2n+2} + nH_2O$$

$$nCO + 2nH_2 \longrightarrow C_nH_{2n} + nH_2O$$

Carbon monoxide forms numerous complex compounds with transition metals.

$[Ni(CO)_4]$

$$Ni + 4\,CO \xrightarrow{\Delta} [Ni\,(CO)_4]$$

3.10.6. How will you prepare chlorine in the laboratory? ***(PTA MQ)***

Chlorine is prepared by the action of conc. sulphuric acid on sodium chloride in presence of manganese dioxide.

$$4NaCl + MnO_2 + 4H_2SO_4 \longrightarrow Cl_2 + MnCl_2 + 4NaHSO_4 + 2H_2O$$

4.6.7. Describe the preparation of potassium dichromate. ***(PTA MQ)***

Ore: Chromate ore

Concentration: Gravitational process

Roasting: Ore + Sodium carbonate + Lime heated in a reverbratory furnace.

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \xrightarrow{900\text{-}1000^0\,C} 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

Sodium Chromite

The roasted mass is treated with water to separate soluble sodium chromate.

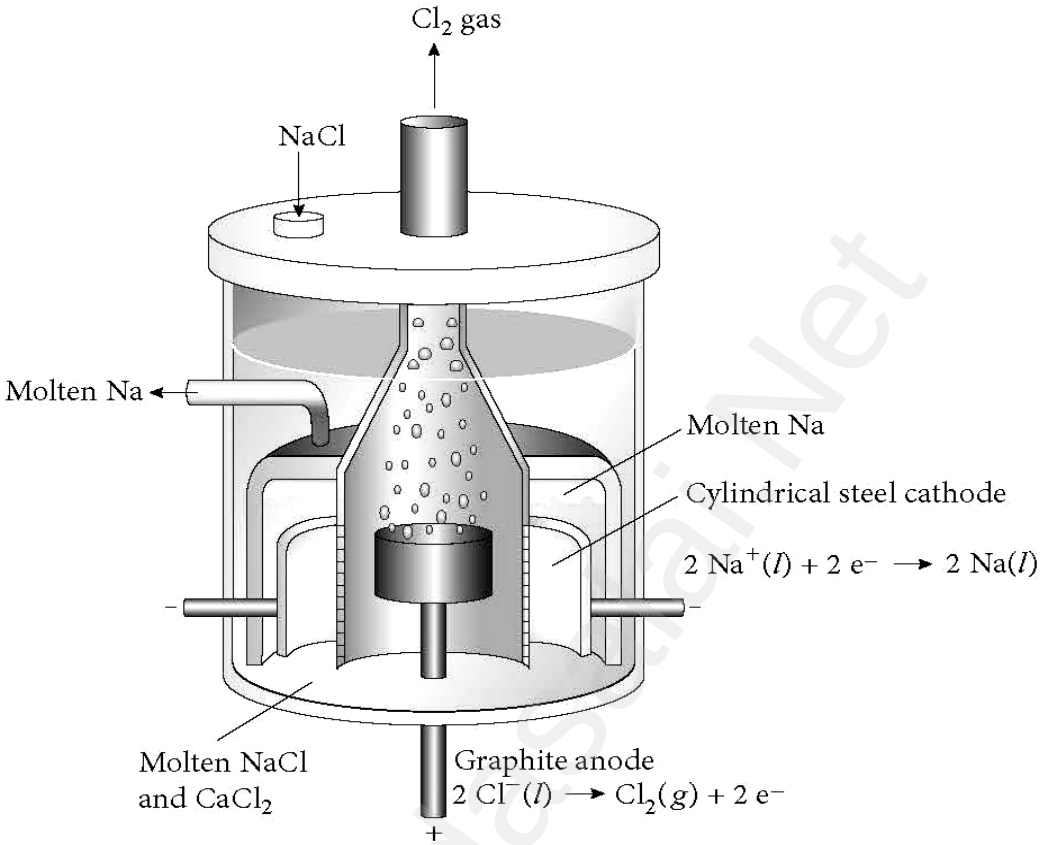
$$2Na_2CrO_4 + H_2SO_4 \longrightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$$

Sodium Chromate Sodium dichromate

The saturated solution of sodium dichromate in water is mixed with KC*l* to obtain $K_2Cr_2O_7$ Crystals.

$$Na_2Cr_2O_7 + 2KCl \longrightarrow K_2Cr_2O_7 + 2NaCl$$

4. Describe the electrolysis of molten NaCl using inert electrodes.



Anode: Iron rod attached to the positive end of power supply dipped in molten sodium chloride.

Cathode: Iron rod attached to the negative end of power supply dipped in molten sodium chloride.

Electrolyte: molten sodium chloride.

Cell reactions:

Cathode (reduction)

$Na^+_{(l)} + e^- \longrightarrow Na_{(l)}$ $\quad E^\circ = -2.71V$

Anode (oxidation)

$2Cl^-_{(l)} \longrightarrow Cl_{2(g)} + 2e^-$ $\quad E^\circ = -1.36V$

The overall reaction

$2Na^+_{(l)} + 2Cl^-_{(l)} \longrightarrow 2Na_{(l)} + Cl_{2(g)}$ $\quad E^\circ = -4.07V$

The negative E° value shows that reactions is non-spontaneous.

Hence, we have to supply a voltage greater than 4.07 to cause the electrolysis of NaCl.

12.15.8. How will you prepare

(i) Acetic anhydride from acetic acid ***(PTA MQ)***

(ii) Ethyl Acetate from methyl acetate

(iii) Acetamide from methyl cyanide

(iv) Lactic acid from ethanol

(v) Acetophenone from acetyl chloride

(vi) Ethane from sodium acetate

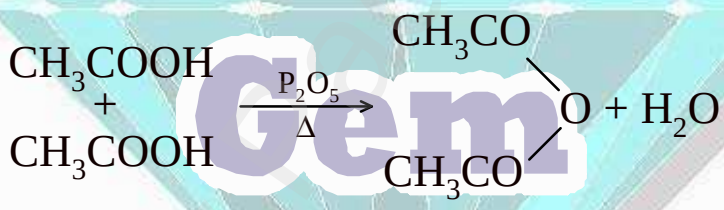
(vii) Benzoic acid from Tolune ***(PTA MQ)***

(viii) Malachite green from benzaldehyde ***(PTA MQ)***

(ix) Cinnamic acid from benzaldehyde

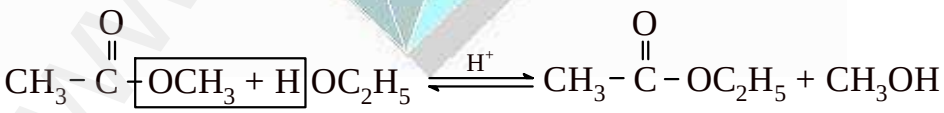
(x) Acetaldehyde from ethyne

(i)



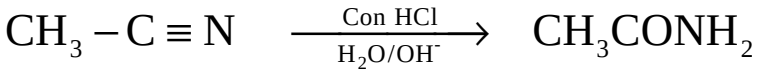
Acetic acid Acetic anhydride

(ii)



Methyl acetate Ethyl Acetate

(iii)

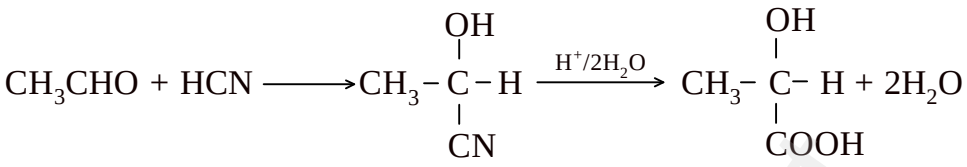


Methyl cyanide Acetamide

(iv)

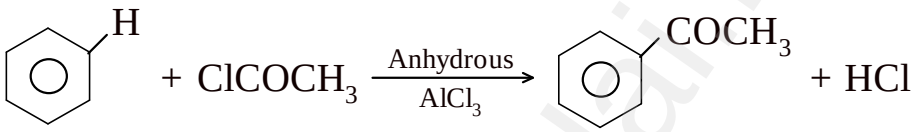
$$CH_3CH_2OH \xrightarrow[300°C]{Cu} CH_3CHO + H_2$$

Ethanol Ethanal



Acetaldehyde Cyano Hydrin — Lactic acid

(v) Friedal – craft reaction

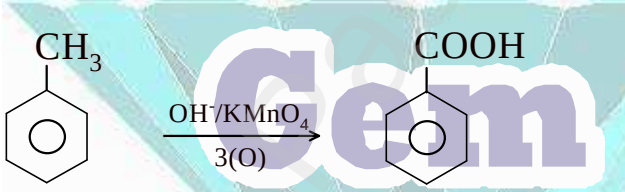


Benzene acetyl chloride — Acetophenone

(vi) $CH_3COONa + NaOH \xrightarrow{CaO/350°C} CH_3CH_3 + Na_2CO_3$

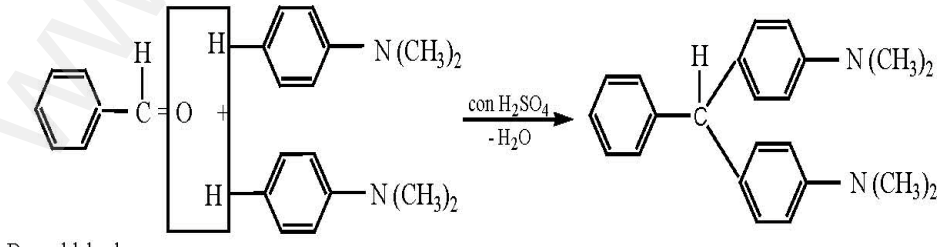
sodium acetate — Ethane

(vii)



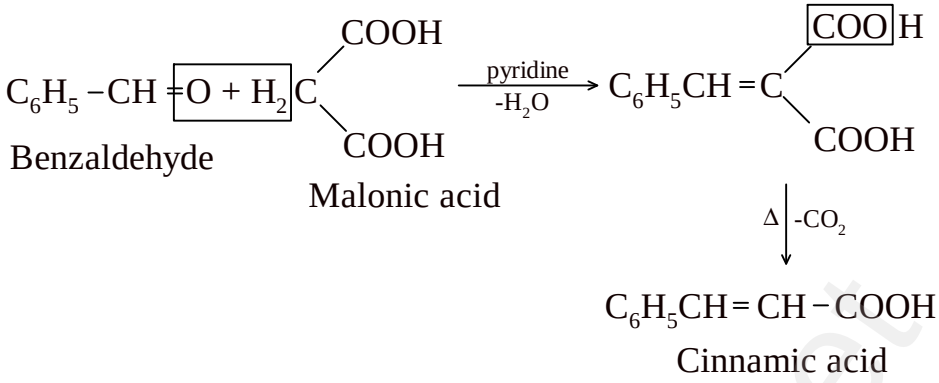
Toluene — Benzoic acid

(viii)

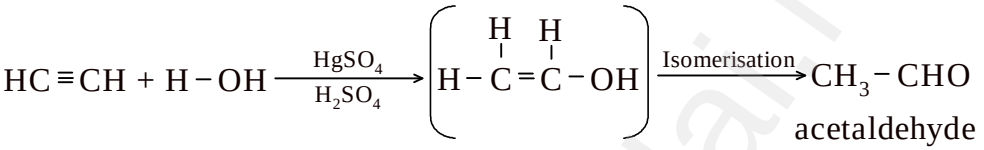


Benzaldehyde — N, N - Dimethyl aniline — Malachite green dye

(ix)

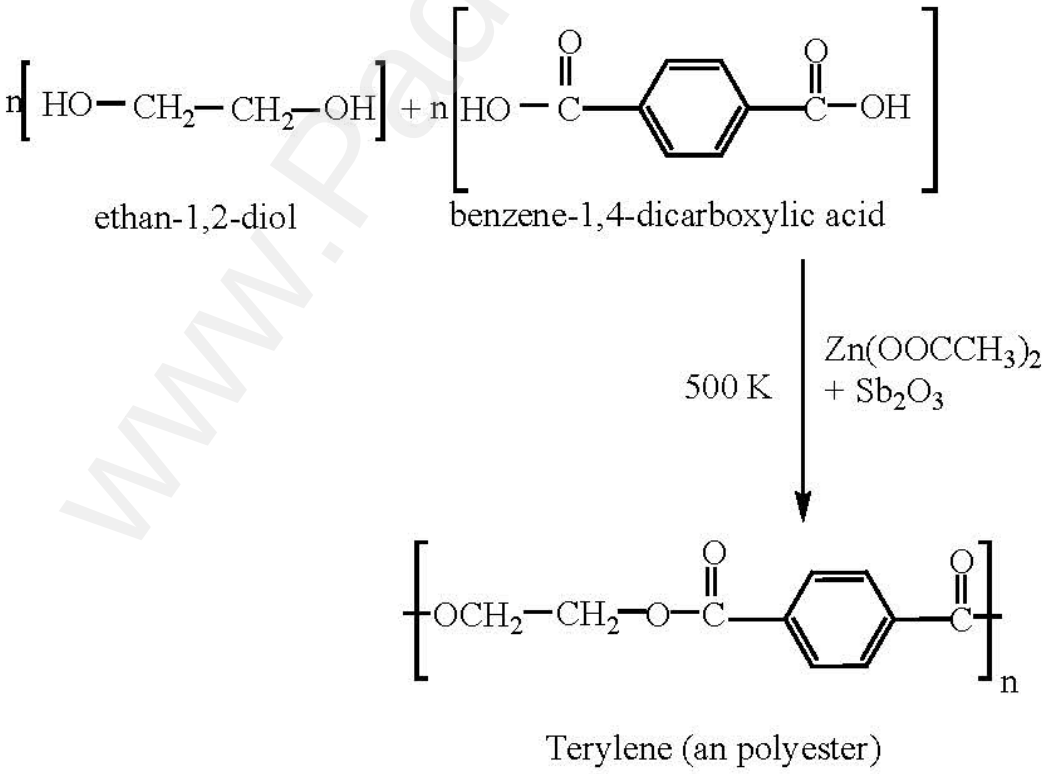


(x)



15.15.9. How is terylene prepared? *(PTA MQ)*

When ethylene glycol and terephathalic acid heated at 500K in presence of Zinc acetate and antimony trioxide catalyst, terelene is formed.



8. PREPARATION - QUESTION AND ANSWERS (ADDITIONAL)

1.2.10. Write a note on Gravity separation or Hydraulic wash.

Ore is crushed to a finely powdered form and treated with rapidly flowing running water. During this process, the lighter gangue particles are washed away by the running water.

(E.g) gold, haematite (Fe_2O_3), tinstone (SnO_2)

1.3.11. Write a note on Leaching with an example.

The crushed ore is allowed to dissolve in a suitable solvent. The metal present in the ore is converted to its soluble salt or complex. The gangue remains insoluble (E.g) Leaching of gold.

$$4Au + 8CN^- + O_2 + 2H_2O \longrightarrow 4[Au(CN)_2]^- + 4OH^-$$

1.4.12. What is Alkali Leaching? Give e.g.

In this method, the Bauxite ore is treated with aqueous alkali to form soluble complex.

The impurities iron oxide and titatinium oxide are left behind.

$$Al_2O_3 + 2NaOH + 3H_2O \xrightarrow[35atm]{470\text{-}520K} 2Na[Al(OH)_4]$$

This solution is diluted and neutralized by passing CO_2 gas, to form hydrated Al_2O_3 precipitate.

$$2Na[Al(OH)_3] + CO_2 \longrightarrow Al_2O_3.xH_2O + 2NaHCO_3$$

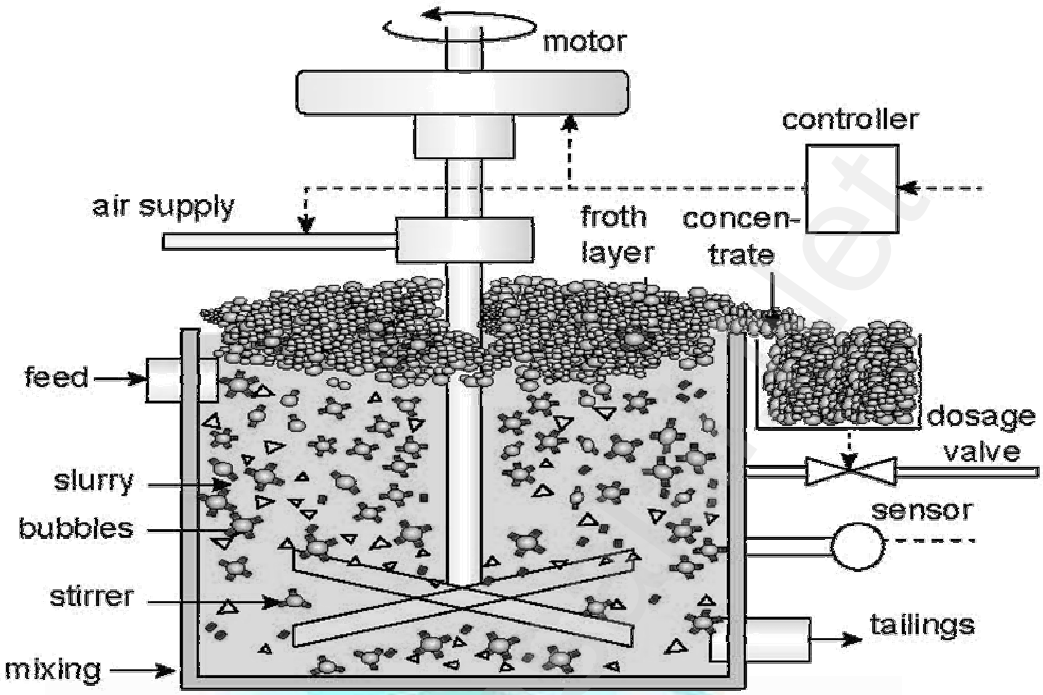
The precipitate is filtered off and heated around 1670K to get pure alumina.

1.1.13. Explain froth flotation process. ***(PTA MQ)***

This method is used to concentrate sulphide ore.

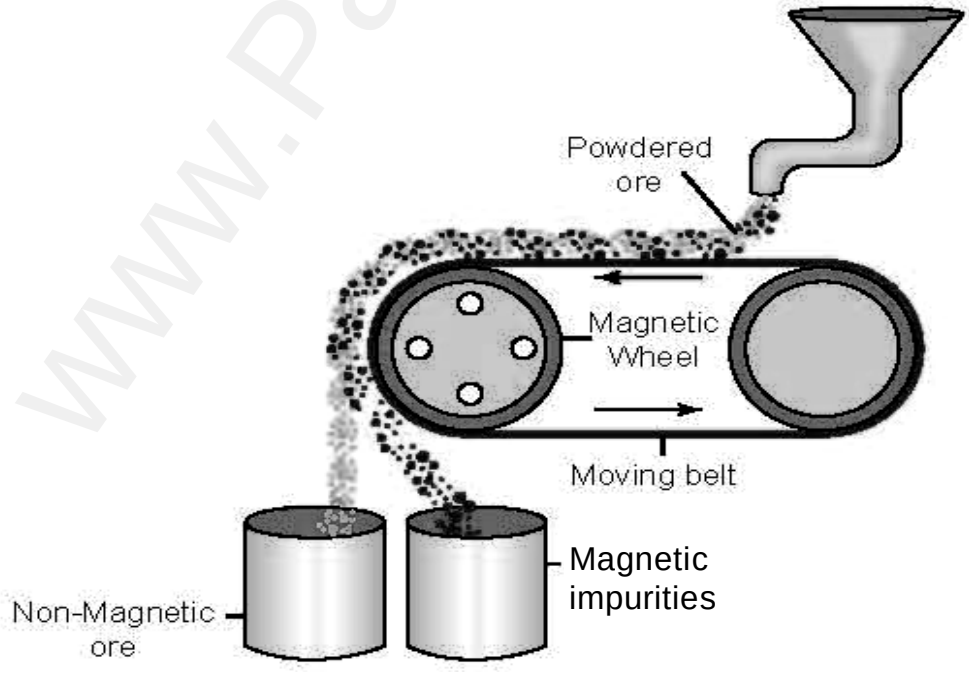
Crushed ore is mixed with water, pine oil, eucalyptus oil, and sodium ethyl xanthate.

A froth is generated by blowing air through this mixture. The ore is coming with froath and impurities settle down. (E.g) Zinc blende (Zns), Galena (Pbs)



Froth Flotation

1.1.14. Explain Magnetic Separation.



Magnetic separation

Ferromagnetic ores can be concentrated by this method.

The crushed ore is poured into an electro magnetic separator consisting of belt moving over two rollers. The one roller is magnetic.

The Magnetic part of ore is attracted towards the magnet and falls as a heap near the non-magnetic part of heap.

(E.g) Tin stone ore is separated from the magnetic impurities wolframite.

2.7.15. How borax is obtained from its ore?

Borax is obtained from colemanite ore by boiling with sodium carbonate.

$$2Ca_2B_6O_{11}+2Na_2CO_3+H_2O \xrightarrow{\Delta} 3Na_2B_4O_7 + 3CaCO_3 + Ca(OH)_2$$

2.10.16. Write preparation of Boric acid.

Boric acid is prepared by treating borax with sulphuric acid.

$$Na_2B_4O_7 + H_2SO_4 + 5H_2O \longrightarrow Na_2SO_4 + 4H_3BO_3$$

2.14.17. Write the industrial manufacture of diborane?

Diborane is obtained by reaction of sodium boro hydride with Iodine in diglyme.

$$2NaBH_4 + I_2 \longrightarrow \underset{\text{diborane}}{B_2H_6} + 2NaI + H_2$$

2.15.18. What is inorganic benzene? How is it produced?

(PTA MQ)

Borazole or borazine is known as inorganic benzene.

Diborane is treated with excess ammonia at high temperature gives borazole.

$$3B_2H_6 + 2NH_3 \xrightarrow[\text{Closed vessel}]{\text{High temperature}} \underset{\text{Borozole}}{B_3N_3H_6}+12H_2$$

2.17.19. Explain the preparation of boron trifluoride.

Calcium fluoride is treated with boron trioxide in presence of conc. sulphuric acid gives boron trifluoride.

$$B_2O_3 + 3CaF_2 + 3H_2SO_4 \xrightarrow{\Delta} 2BF_3 + 3CaSO_4 + 3H_2O$$

2.19.20. Explain McAfee process of preparation of Aluminium chloride.

By heating a mixture of alumina and coke in a current of chlorine gives aluminium chloride.

$$Al_2O_3 + 3C + 3Cl_2 \longrightarrow 2AlCl_3 + 3CO_2$$

2.21.21. Write the preparation of Alum (or) How is potash alum prepared? ***(PTA MQ Corona-20)***

When alum stone is treated with excess of sulphuric acid, the aluminium hydroxide is converted to aluminum sulphate.

On adding calculated quantity of potassium sulphate, potash alum is crystallised.

$$K_2SO_4.Al_2(SO_4)_3.4Al(OH)_3 + 6H_2SO_4 \longrightarrow$$
$$K_2SO_4 + 3Al_2(SO_4)_3 + 12H_2O$$
$$K_2SO_4 + Al_2(SO_4)_3 + 24H_2O \longrightarrow$$
$$K_2SO_4.Al_2(SO_4)_3.24H_2O$$

2.22.22. What is Burnt alum? How is it prepared?

Potash alum melts on heating at 365K.

Further heating at 457K, loses water of hydration and swells up.

The swollen mass is known as burnt alum

$$K_2SO_4.Al_2(SO_4)_3.24H_2O \xrightarrow{475K} K_2SO_4.Al_2(SO_4)_3 + 24H_2O$$

Burnt alum

2.29.23. What is phosgene? How is it prepared?

Carbonyl chloride is known as phosgene

When carbon monoxide is treated with chlorine in presence of light or charcoal, phosgene is obtained.

$CO + Cl_2 \xrightarrow{\text{light}} COCl_2$

2.30.24. How silicic esters are prepared?

Silicon tetra chloride is treated with alcohols gives silicic esters.

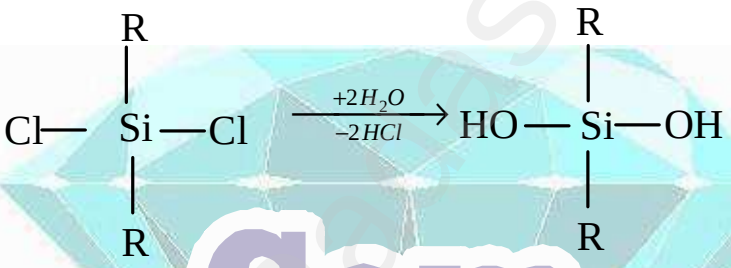
$SiCl_4 + 4C_2H_5OH \longrightarrow Si(OC_2H_5)_4 + 4HCl$

Tetra ethoxy silane

2.32.25. What are silicones? How is it prepared?

Silicones or poly siloxanes are organo silicon polymers.

The hydrolysis of dialkylchloro silanes gives silicones



3.3.26. Write the preparation of ammonia.

The hydrolysis of urea gives ammonia

$NH_2CONH_2 + H_2O \longrightarrow 2NH_3 + CO_2$

3.7.27. How nitric acid is prepared?

By heating potassium or sodium nitrate with concentrated sulphuric acid give nitric acid.

$KNO_3 + H_2SO_4 \longrightarrow KHSO_4 + HNO_3$

3.11.28. What is the oxidation number of nitrous oxide? Write its preparation.

The oxidation number of nitrogen in Nitrous oxide is +1.

Preparation

$$NH_4NO_3 \longrightarrow N_2O + 2H_2O$$

Ammonium Nitrate **Nitrous oxide**

3.14.29. Explain phosphorus is powerful reducing agent (or) Write the preparation of phosphine?

Yellow phosphorus react with alkali to give phosphine. Here phosphorus acts as reducing agent.

$$P_4 + 3NaOH + 3H_2O \longrightarrow \underset{\text{Sodium Hypo phosphite}}{3NaH_2PO_2} + \underset{\text{phosphine}}{PH_3}\uparrow$$

3.18.30. Write the preparation of phosphorus trichloride.

Chlorine is passed over phosphorus gives phosphorus trichloride.

$$P_4 + 6Cl_2 \longrightarrow 4PCl_3$$

3.20.31. Write the preparation of phosphorus penta chloride.

When PCl_3 is treated with excess chlorine gives PCl_5.

$$PCl_3 + Cl_2 \longrightarrow PCl_5$$

3.22.32. Explain the preparation of ortho phosphoric acid (H_3PO_4).

When phosphorus pentoxide is treated with water gives orthophosphoric acid.

$$P_4O_{10} + 6H_2O \longrightarrow 4H_3PO_4$$

3.30.33. Explain the preparation of chlorine.

When bleaching powder is treated with mineral acid, chlorine is obtained.

$$CaOCl_2 + 2HCl \longrightarrow CaCl_2 + H_2O + Cl_2$$

3.31.34. How bleaching powder is prepared? ***(MAR 20)***

By passing chlorine gas through dry slaked lime gives bleaching powder.

$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$

3.37.35. Write the preparation of xenon fluoride compounds.

$Xe + F_2 \xrightarrow[400^\circ C]{Ni} XeF_2$

$Xe + 2F_2 \xrightarrow[400^\circ C]{Ni/Acetone} XeF_4$

$Xe + 3F_2 \xrightarrow[400^\circ C]{Ni/200\ atm} XeF_6$

3.45.36. How is pure phosphine prepared from phosphorus acid? ***(PTA MQ)***

$4H_3PO_3 \xrightarrow{\Delta} 3H_3PO_4 + PH_3 \uparrow$

phosphorus acid — ortho phophoric acid — phosphine

3.1.37. Explain Ostwald's process of preparation of Nitric acid.

Ammonia is heated with air. The mixture is passed into catalyst chamber in contact with platinum gauze at 1275K. The nitrogen dioxide is produced.

$4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$

$2NO + O_2 \longrightarrow 2NO_2$

The nitrogen dioxide is treated with water to give nitric acid. This nitric acid is bleached by blowing air

$6NO_2 + 3H_2O \longrightarrow 4HNO_3 + 2NO + H_2O$

3.2.38. Explain the manufacture of sulphuric acid by contact process.

(i) Sulphur dioxide produced by burning sulphur in air

$S + O_2 \longrightarrow SO_2$

(ii) Sulphur dioxide is converted to sulphur tri oxide by air in presence of catalyst V_2O_5 or Platonized asbestos.

(iii) The sulphur trioxide is absorbed by concentrated sulphuric acid to produce oleum. The oleum is diluted with water to give sulphuric acid.

$$SO_3 + H_2SO_4 \longrightarrow \underset{\text{Oleum}}{H_2S_2O_7} \xrightarrow{H_2O} 2H_2SO_4$$

Temperature and pressure: 720K, 2 bar

Purity of sulphuric acid: 96%

3.3.39. Explain the manufacture of chlorine by Deacon's process.

Mixture of air and hydrochloric acid is passed to a chamber containing number of shelves. Hot gases at 723K is passed.

$$4HCl + O_2 \xrightarrow[Cu_2Cl_2]{400^oC} 2H_2O + 2Cl_2$$

The chlorine is obtained by this method is diluted for manufacture of bleaching powder. The following reaction also takes place.

$$2Cu_2Cl_2 + O_2 \longrightarrow 2Cu_2OCl_2$$

$$Cu_2OCl_2 + 2HCl \longrightarrow 2CuCl_2 + H_2O$$

$$2CuCl_2 \longrightarrow Cu_2Cl_2 + Cl_2$$

4.6.40. What is Zigler–Natta catalyst? How poly propylene polymer is obtained.

A mixture of titanium chloride and Trialkyl aluminum is known as Zigler – Natta Catalyst.

$$n\underset{\text{Propylene}}{CH_3\text{-}CH{=}CH_2} \xrightarrow{TiCl_4 + Al(C_2H_5)_3} -\left(\underset{\text{Poly propylene}}{\text{-}\overset{CH_3}{\overset{|}{C}}H\text{-}CH_2\text{-}}\right)_n -$$

4.13.41. Explain the preparation of potassium permanganate.

(i) Ore: Pyrolusite (MnO_2)

(ii) Conversion of MnO_2 to potassium manganate

Powdered ore is fused with KOH in presence of air gives green coloured potassium manganate.

$$2MnO_2 + 2KOH + O_2 \longrightarrow K_2MnO_4 + 2H_2O$$

(iii) Oxidation of potassium mangante to potassium per manganate

Potassium manganate oxidized to potassium permanganate by electrolytic oxidation.

Electrolysis is carried out in presence of alkali

$$K_2MnO_4 \rightleftharpoons 2K^+ + MnO_4^{2-}$$

$$H_2O \rightleftharpoons H^+ + OH^-$$

Anode: $MnO_4^{2-} \rightleftharpoons MnO_4^- + e^-$

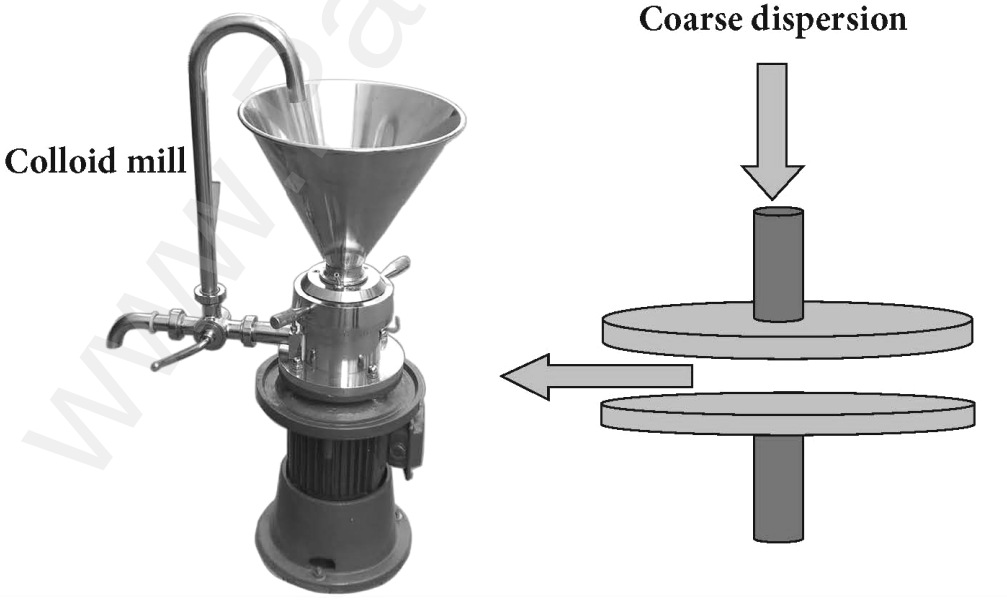
Green Blue

Cathode: $2H^+ + 2e^- \rightleftharpoons H_2$

The blue colour solution is cooled and potassium permanganate is crystallized.

10.4.42. Write the dispersion methods of preparation of colloids.

(1) Mechanical dispersion ***(PTA MQ)***



The colloidal mill consists of two metal plates rotating in opposite direction at very high speed.

The solid is ground to colloidal dimension using a colloidal mill.

The colloidal particles of required size is obtained by adjusting the distance between two plates.

(E.g) Solutions of ink and graphite

(2) Electro dispersion

An electrical arc is struck between electrodes dispersed in water surrounded by ice.

When a current is passed, an arc produced forms vapours of metal condensed to form colloidal solution.

Alkali hydroxide is added to colloidal solution as stabilising agent.

(Eg) Colloidal solution of copper, silver, gold.

(3) Ultransonic dispersion

Sound waves of frequency more than 20 kHz used to disperse course suspension to colloidal suspension.

The ultransonic vibration produced by generator spread the oil and transfer the vibration to the vessel with mercury in water.

(4) Peptisation

By addition of suitable electrolytes precipited particles changes to colloidal state.

This process is termed as peptisation and the electrolyte is added is known as peptising (or) dispersing agent

$$\underset{\text{Precipitate}}{AgCl} \xrightarrow{HCl} \underset{\text{Colloid}}{AgCl}$$

10.4.43. Explain the Preparation of colloids by condensation methods. ***(PTA MQ)***

1) Oxidation: Sols of some metals are prepared by this method.

(Eg) When hydroiodic acid is treated with iodic acid, I_2 sol is obtained.

$$HIO_3 + 5HI \longrightarrow 3H_2O + I_{2(sol)}$$

2) Reduction: Gold sol is prepared by reduction of auric chloride using formaldehyde.

$$2AuCl_3 + 3HCHO + 3H_2O \longrightarrow 2Au_{(sol)} + 6HCl + 3HCOOH$$

3) Hydrolysis: Sols of hydroxides of metals like chromium and aluminium produced by this method.

$$FeCl_3 + 3H_2O \longrightarrow Fe(OH)_3 + 3HCl$$

4) Double decomposition: When hydrogen sulphide gas is passed through a solution of arsenic oxide, a yellow colour arsenic sulphide is obtained.

$$As_2O_3 + H_2S \longrightarrow As_2S_3 + 3H_2O$$

Colloid (yellow)

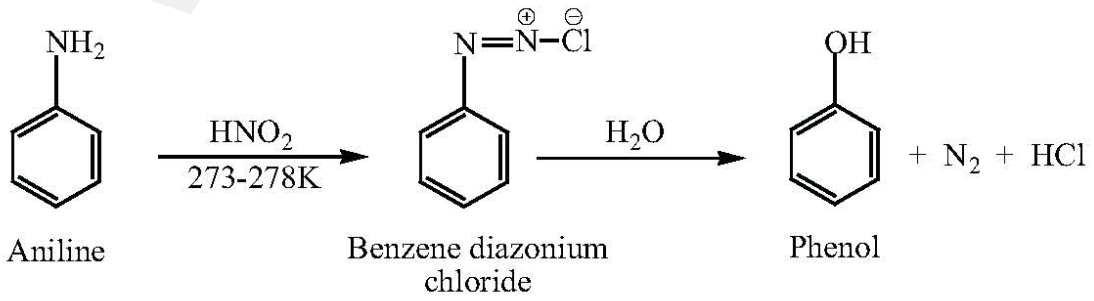
5) Decomposition: When acid is added to dilute solution of sodium thio sulphate, the insoluble free sulphur sol is produced.

$$S_2O_3^{2-} + 2H^+ \longrightarrow S + H_2O + SO_2$$

(Sol)

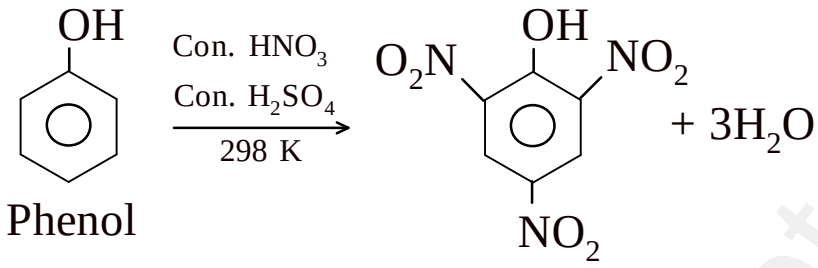
11.24.44. How phenol is prepared from Aniline?

Aniline is diazotised with nitrous acid at 273-278K to give benzene diazonium chloride. It is treated with hot water in presence of mineral acid gives phenol.



11.31.45. Write the preparation of Picric acid.

Nitration with con HNO_3 + Con H_2SO_4 gives picric acid.



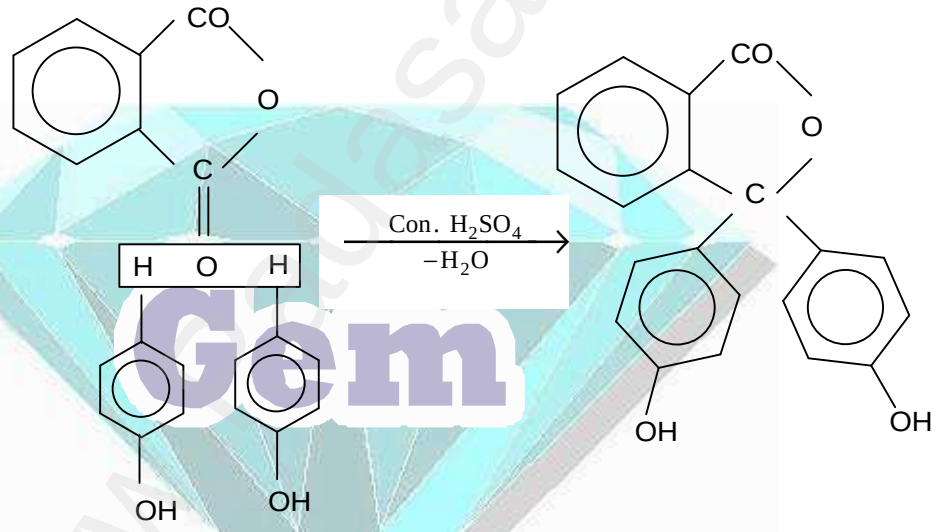
Phenol

2,4,6-trinitro phenol (picric acid)

11.33.46. How phenol is prepared from Phenolphthlein?

(PTA MQ)

On heating phenol with phtahalic anhydride in presence of Con H_2SO_4, Phenolphthalein is obtanined.



11.39.47. Write the preparation methods of ethers.

1. Intermolecular dehydration of alcohol

When ethanol is treated with con. H_2SO_4 at 443K, give diethylether.

$$2CH_3CH_2OH \xrightarrow[443K]{H_2SO_4} CH_3-CH_2-O-CH_2-CH_3$$

ethanol diethyl ehter

2. Williamsons synthesis

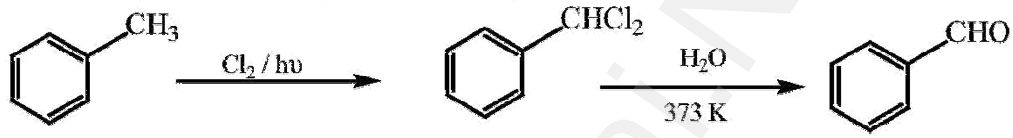
When an alkyl halide is heated with alcoholic solution of sodium alkoxide, the corresponding ether is obtained.

$$C_2H_5ONa + Br - C_2H_5 \xrightarrow{\Delta} C_2H_5 - O - C_2H_5 + NaBr$$

diethyl ether

12.8.48. Write the manufacture of benzaldehyde from toluene.

Side chain chlorination of toluene gives benzal chloride, which on hydrolyis gives benzaldehyde.



Tolune Benzal Chloride Benzaldehyde

12.13.49. What is Urotrophine? How it is prepared? (or) Write the reaction of formaldehyde with ammonia?

(Corona-20)

Urotropine: Hexa methylene tetramine

$$6HCHO + 4NH_3 \longrightarrow (CH_2)_6N_4 + 6H_2O$$

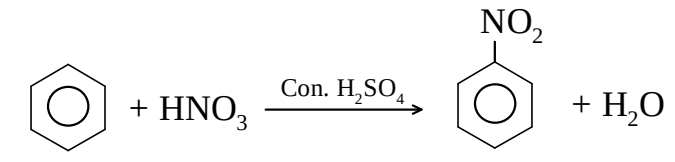
Formaldehyde Hexamethylene tetramine (Urotrophine)

12.51.50. Write the Preparation of acetamide from acetyl chloride.

$$CH_3CO\boxed{Cl + H}-NH_2 \longrightarrow CH_3CONH_2 + HCl$$

acetyl chloride acetamide

13.3.51. Write the Preparation of Nitro benzene (or) Mirbane oil.



Benzene Nitro benzene

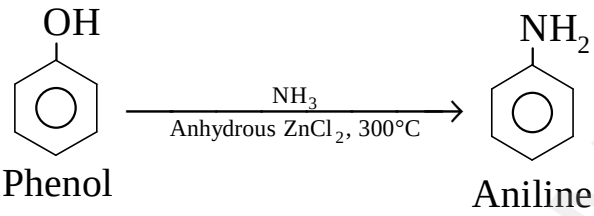
13.5.52. What is chloropicrin? How it is Prepared? *(MAR 20)*

Chloropicrin: Trichloro Nitro methane CCl_3NO_2

$$CH_3 - NO_2 + 3Cl_2 \xrightarrow{NaOH} CCl_3 - NO_2 + 3HCl$$

Nitro Methane — Chloropicrin

13.8.53. Write the preparation of aniline from Phenol.



Phenol — Aniline

14.1.54. How glucose is prepared?

When sucrose is boiled with dil. H_2SO_4 in alcoholic solution, gives glucose and fructose.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{H^+} C_6H_{12}O_6 + C_6H_{12}O_6$$

Sucrose — Glucose — Fructose

14.5.55. How fructose is manufactured?

By boiling sucrose with dil H_2SO_4 (or) using an enzyme invertase, fructose is prepared.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{(or) invert sugar}]{H^+} C_6H_{12}O_6 + C_6H_{12}O_6$$

Sucrose — Glucose — Fructose

15.18.56. Explain about High Density Polyethylene (HDPE) and Low density polyethylene (LDPE).

LDPE

It is formed by heating ethene at 200-300°C under oxygen as catalyst.

The peroxide formed from oxygen act as a free radical initiator.

$$CH_2 = CH_2 \xrightarrow[1000\ atm]{200\text{-}300^\circ C} \left\{CH_2 - CH_2\right\}_n$$

Ethene — Polythene

Use: Insulation of cables, making toys.

HDPE

It is formed by heating ethene at 373 K and 6 to 7 atm using Xeiglar – Natta Catalyst. [$TiCl_4 + (C_2H_5)_3 Al$]

15.19.57. Write the preparation of teflon (PTFE). Give its use.

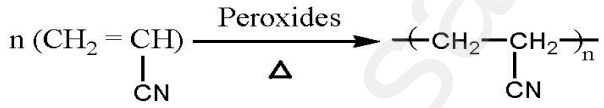
Tetrafluro ethylene is heated with oxygen (or) ammonium persulphate under high pressure, teflon is obtained.

$$nCF_2 = CF_2 \xrightarrow{\Delta} \left\{ CF_2 - CF_2 \right\}_n$$

Use : for coating articles and preparing non-stick utensils.

15.20.58. Write the preparation of orlon or polyacro nitile (PAN).

Addition polymerisation of vinyl cyanide using peroxide initiator gives orlon (or) PAN.

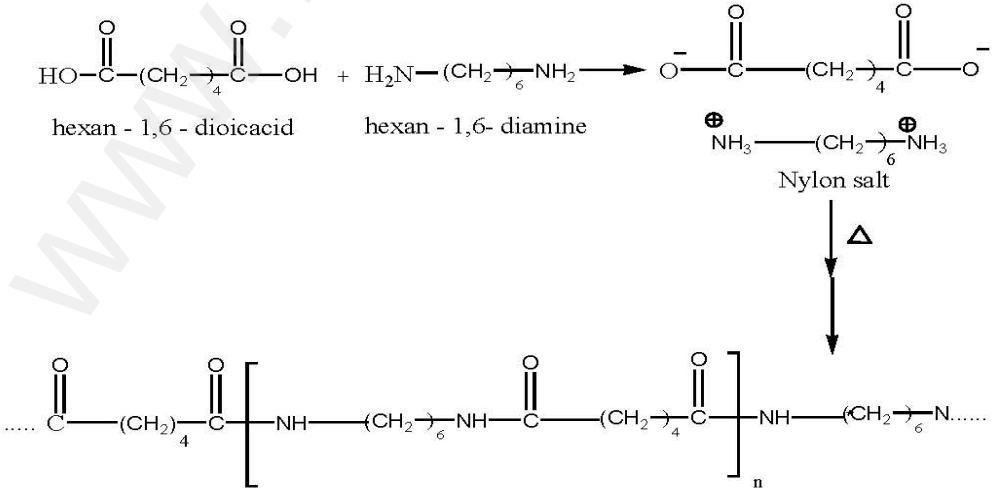


Prop - 2-enenitrile PAN

Use: used for making blankets, sweaters.

15.21.59. Write a note on Nylon 6,6. ***(PTA MQ)***

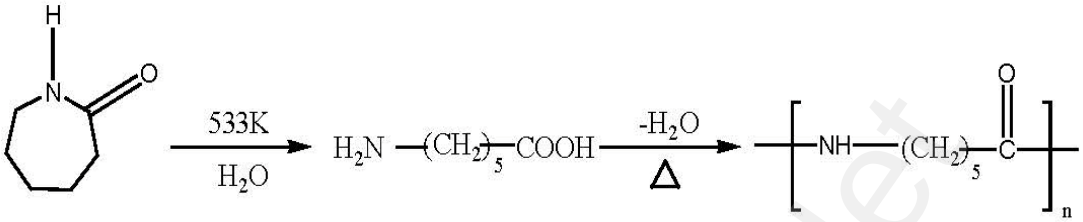
By mixing equimolar mixture of adipic acid and hexa methylene diamine to form nylon 6,6.



Poly (hexamethyleneadipamide)
Nylon 6,6

15.22.60. Write the preparation of nylon-6 and give its use.

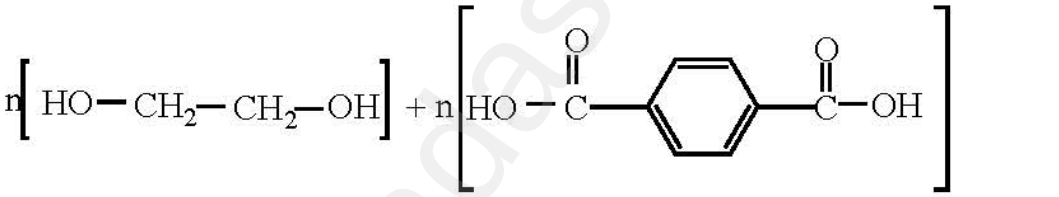
Caprolactum is heated at 533K in an inert atmosphere with traces of water gives E-amino caproic acid which polymerises to give nylon-6.



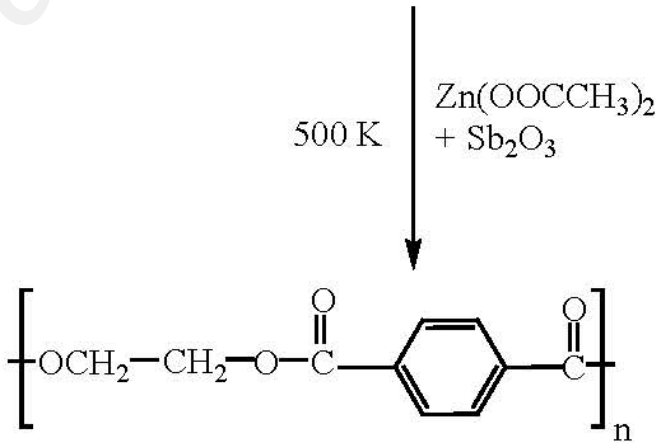
Nylon -6

15.23.61. Write a note on Terelene or Dacron.

Ethylene glycol and terephthalic acid are heated at 500 K in presence of zinc acetate and antimony trioxide catalyst, terelene is formed.



ethan-1,2-diol benzene-1,4-dicarboxylic acid

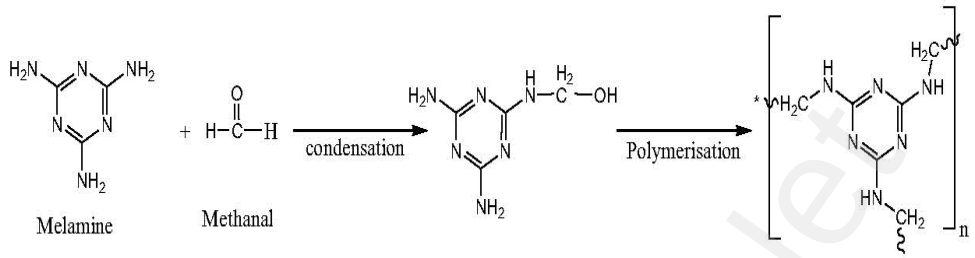


Terylene (an polyester)

Uses: Blending with cotton and fibres and as glass reinforcing materials in helmets.

15.24.62. Write the preparation of melamine or formaldehyde melamine. Give its use.

Melamine and formaldehyde undergo condensation polymerisation gives melamine – formaldehyde polymer.

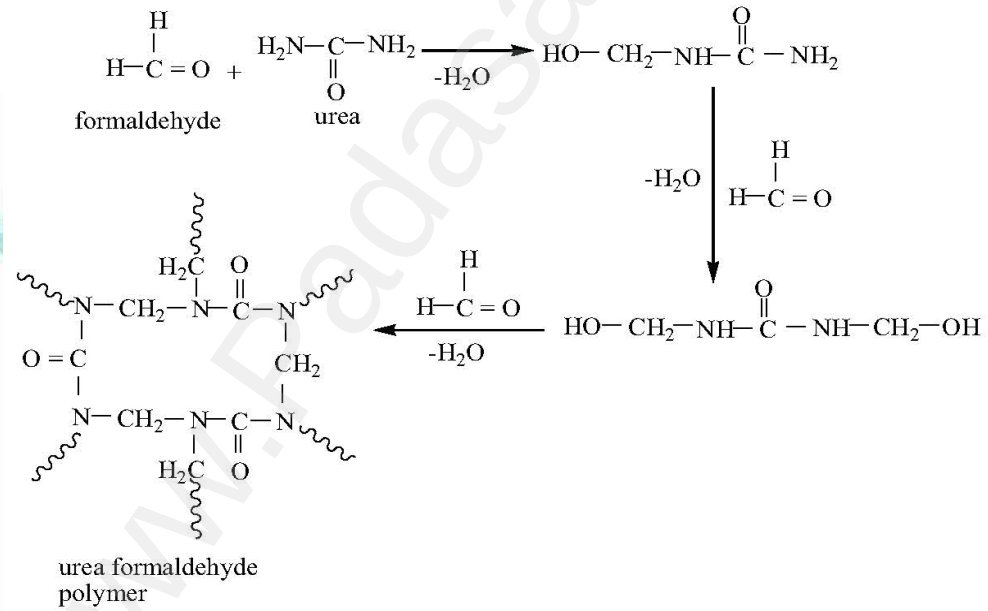


Uses: It is used for making unbreakable crockery

Melamine-formaldehyde polymer

15.25.63. Write the preparation of urea formaldehyde polymer.

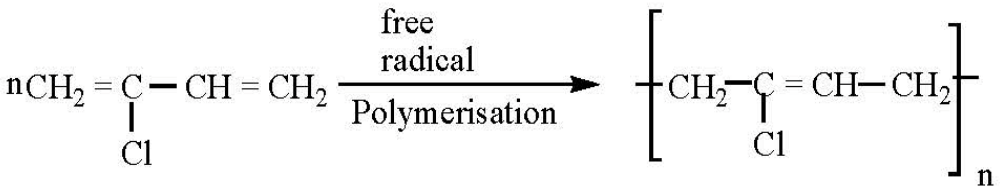
Condensation polymerisation of urea and formaldehyde gives urea formaldehyde polymer.



urea formaldehyde polymer

15.26.64. Write the manufacture of Neoprene. ***(Sep-20)***

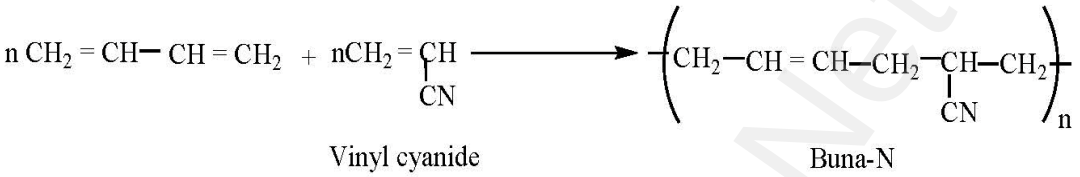
The free radical polymerisation of chloroprene gives neo prene.



Uses: It is used in the manufacture of chemical containers, conveyer belts.

15.27.65. Write the preparation of Buna-N and Buna-S (SBR) rubber and its uses. ***(PTA MQ)***

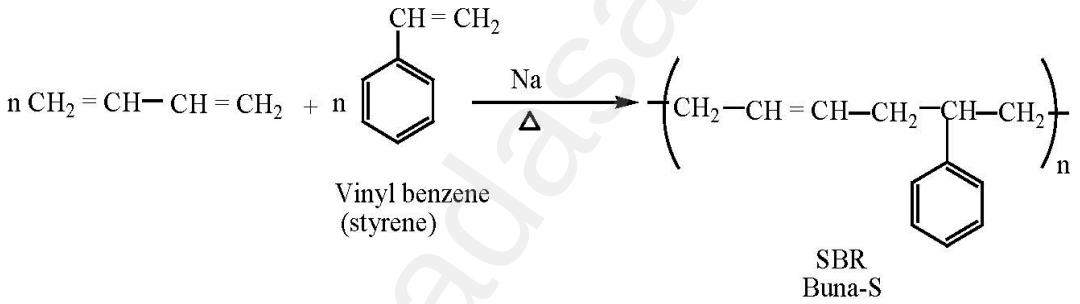
Buna-N: The polymerisation of acrylo nitrile and buta-1,3-diene gives Buna-N.



Vinyl cyanide Buna-N

Use: Manufacture of hoses and tank linings.

Buna-S: Plymerisation of buta-1,3-diene and styrene in presence of sodium gives Buna-S.



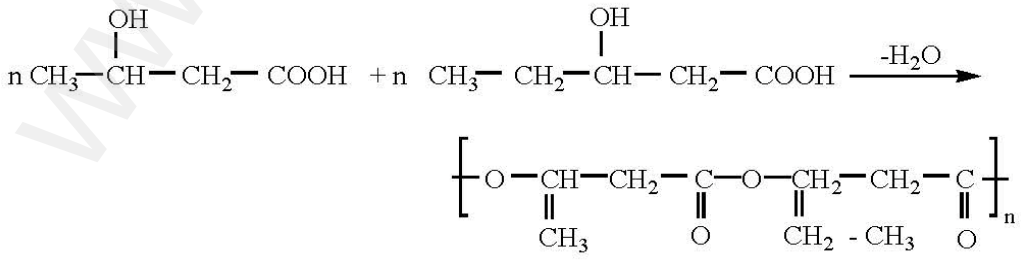
Vinyl benzene (styrene)

SBR Buna-S

Use: Tyres and tubes.

15.28.66. Write the preparation of PHBV and its uses.

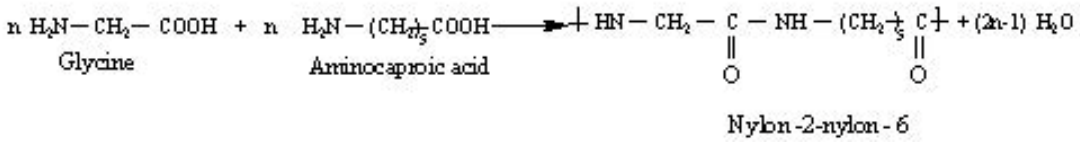
Polymerisation of 3-hydroxybutanoic acid and 3-hydroxy pentanoic aicd gives PHBV.



Use: It is used to orthopaedic devices, and in controlled release of drugs.

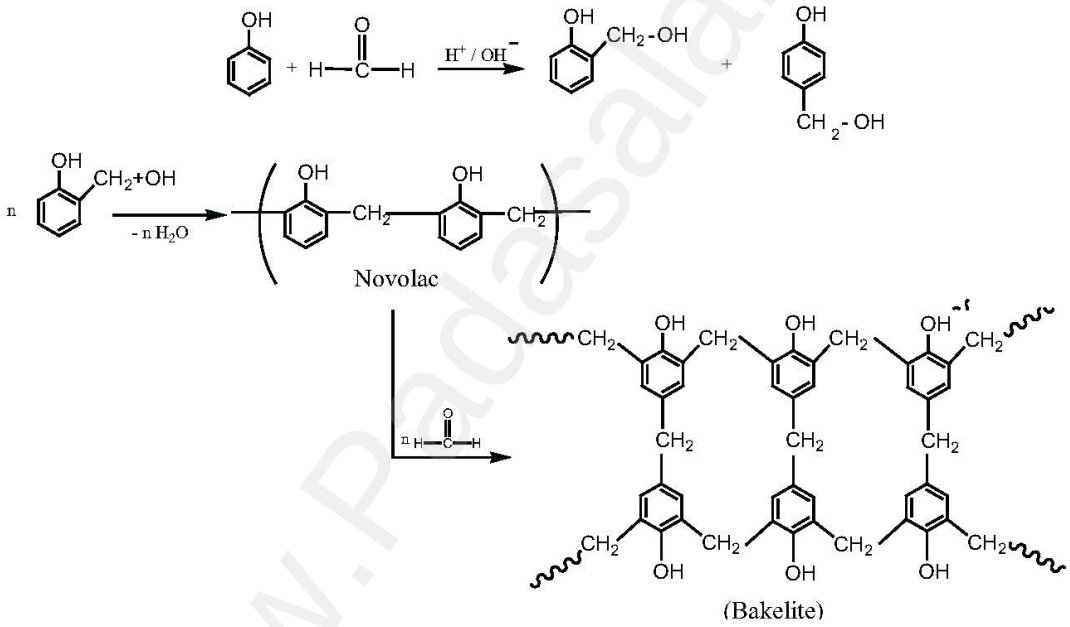
15.29.67. Write the manufacture of nylon-2-nylon-6.

Condensation polymerisation of glycine and E-amino caproic acid gives nylon-2-nylon-6.



15.2.68. Explain the preparation of Bakellite and give its uses.

Phenol reacts with formaldehyde give ortho or para hydroxy methylphenols. This on further reaction with phenol gives novalac. Novalac heated with formaldehyde gives bakallite.



Uses: Used in paints, making glue, combs, pens.