Chemistry-12th

One Day Formula

Multiple Choice Questions

S.	Question	A	B	C	D
1	Who gave the law of Triads in 1829?	**Dobereiner ✓**	Mosely	Newland	Mendeleev
2	Zn, Cd, Hg in Mendleev's periodic table were placed with:	Noble metals	**Alkaline earth metals ✓**	Inner transition metals	Coinsage metals
3	The basis of modern periodic table is:	Electron affinity	Atomic mass	Ionization energy	**Atomic number ✓**
4	Which of the following are alkaline earth metals?	**Be, Mg, Ca ✓**	Li, Na, K	Fe, Co, Ni	B, Al, Ga
5	Select the two normal elements which are present in fourth period:	**K, Ca ✓**	Rb, Sr	Cs, Ba	Fr, Ra
6	Correct order according to atomic size in the following is:	$Na > K$	$Be > Mg$	$O > N$	$Cl > F$ ✓
7	Group VI-B of transition elements contains:	Zn, Cd, Hg	**Cr, Mo, W ✓**	Fe, Ru, Os	Mn, Te, Re
8	The hydrides of Group IA are:	**Ionic ✓**	Covalent	Metallic	Interstitial
9	Mark the correct statement:	**Na^+ is smaller than Na atom ✓**	Na^+ is larger than Na atom	Cl^- is smaller than Cl atom	Cl^- ion and Cl atom are equal in size
10	Which statement is incorrect?	All the metals are good conductors of electricity	All the metals are good conductors of heat.	**All the metals form acidic oxides ✓**	All the metals form positive ions.
11	Which statement is correct?	**Hydrogen resembles properties with I-A, IV-A elements ✓**	Hydrogen resembles in properties with III-A, IV-A and V-A elements.	Hydrogen resembles in properties with II-A, IV-A and VI-A elements.	Hydrogen resembles in properties with II-A, III-A and VII-A elements.
12	Mark the correct statement:	**Covalent character of metal halides increase from left to right in a period. ✓**	Boiling points of group IV-A hydrides decrease down the group.	Ionic character of hydrides increases from left to right in a period.	The basicity of group II-A oxides decreases on descending the group.
13	The word alkali is derived from which language?	**Arabic ✓**	Greek	French	German
14	Formula of epsom salt is:	$MgSO_4 \cdot 7H_2O$ ✓	$MgSO_4$	$MgCO_3$	$CaMg_3SiO_3$

15	Most of the elements of group-I A are:	Crystalloids	**Metals ✓**	Metalloids	Non-metals
16	The milk of magnesia is used for the treatment of:	Basicity	Rancidity	**Acidity ✓**	Jaundance
17	Which hydroxide gets decomposed on heating?	**LiOH ✓**	NaOH	KOH	RbOH
18	In Down's cell $CaCl_2$ is added to NaCl to:	Increase solubility	Increase the dissociation	Increase conductivity	**Lower its melting point ✓**
19	Down's cell is used to prepare:	Sodium carbonate	**Sodium metal ✓**	Sodium bicarbonate	Sodium hydroxide
20	Nelson's cell is used to prepare:	**NaOH ✓**	Na_2CO_3	Na metal	NaCl
21	Which element is deposited at the cathode during the electrolysis of brine in diaphragm cell?	H_2 ✓	Ba	Ra	Rn
22	When gypsum $CaSO_4 \cdot 2H_2O$ is heated too strongly, it gives:	Plaster of Paris	**Dead burnt ✓**	Does not affect	SO_2 gas
23	Which of the following sulphates is not soluble in water?	Sodium sulphate	Potassium sulphate	Zinc sulphate	**Barium sulphate ✓**
24	The ore $CaSO_4 \cdot 2H_2O$ has the general name:	**Gypsum ✓**	Dolomite	Calcite	Epsom salt
25	Down's cell is used to prepare:	Sodium carbonate	Sodium bicarbonate	**Sodium metal ✓**	Sodium hydroxide
26	The chief ore of aluminum is:	Na_3AlF_6	$Al_2O_3 \cdot 2H_2O$ ✓	Al_2O_3	$Al_2O_3 \cdot H_2O$
27	Tincal is a mineral of:	Al	C	Si	**B ✓**
28	Chemical formula of colemanite is:	$Ca_2B_6O_{11} \cdot 5H_2O$ ✓	$CaB_4O_7 \cdot 4H_2O$	$Na_2B_4O_7 \cdot 4H_2O$	$CaNaBO_2$
29	Which is used in the leather industry?	**Borax ✓**	Boric acid	Boric oxide	Tetra Boric acid
30	Boric acid cannot be used:	As antiseptic in medicine	For washing eyes	**In soda bottles ✓**	For Enamals and Glazes
31	Choose the gas which obtained by the reaction of ethyl alcohol with conc. H_2SO_4:	CO	CO_2	C_2H_2	C_2H_4 ✓
32	Aluminium oxide is:	Acidic oxide	Baric oxide	**Amphoteric oxide ✓**	None of these
33	_____element forms an ion with charge 3 +:	Beryllium	**Aluminum ✓**	Carbon	Silicon
34	Elements of group IV-A also called:	Halogens	**Chalogens ✓**	Chalite	Halite
35	Which one of following is used in cosmetics?	**Talc ✓**	Asbestos	Sodium sulphate	Aluminum Sulphate
36	Chemical composition of colemanite is:	$Ca_2B_6O_{11} \cdot 5H_2O$ ✓	$CaB_4O_7 \cdot 4H_2O$	$Na_2B_4O_7 \cdot 4H_2O$	$CaNaB_5O_9 \cdot 8H_2O$
37	Which element among the following belongs to group IV-A of the periodic table?	Barium	Iodine	**Lead ✓**	Oxygen
38	Chemical formula of litharge is:	Pb_2O	SiO_2	**PbO ✓**	Pb_3O_4
39	The lowest ionization energy is possessed by:	P	N	**Sb ✓**	As
40	Pick the element having least ionization energy value:	Nitrogen	**Oxygen ✓**	Fluorine	Neon

67	The colour of transition metal complexes:	**d-d transitions of electrons ✓**	Paramagnetic nature of transition elements	Ionization	Loss of s-electrons
68	The strength of binding energy of transition elements depends upon:	Number of electron pairs	**Number of unpaired electron ✓**	Number of neutrons	Number of protons
69	Maximum number of unpaired electrons are in cation:	Ni^{2+}	Co^{2+}	Mn^{2+} ✓	Fe^{2+}
70	Co-ordination number of Pt in $[PtClNO_2NH_3{}_4]$ is:	2-	4	1	**6 ✓**
71	Co-ordination number of Cu in $[CuNH_3{}_4]SO_4$ is:	Zero	Two	**Four ✓**	Six
72	What is coordination number of Fe in $K_4[FeCN{}_6]$?	4	**6 ✓**	2	3
73	Which is not an ore of iron?	Haematite	Magnetite	Limonite	**Cassiterite ✓**
74	Mild steel contains carbon percentage:	**0.1 – 0.2 % ✓**	0.3 – 0.7 %	0.7 – 1.5 %	1.6 – 2.0 %
75	f-block elements are also called:	non typical transition elements	outer transition elements	normal transition elements	**inner transitioin elements ✓**
76	Which is the formula of tetra-ammine Chloro-nitro platinum IV sulphate?	$[PtNH_3{}_4NO_2]S$	$[PtNO_2ClNH_3$	$[PtClNO_2NH_3$ ✓	$[PtNH_3{}_4NO_2C$
77	The chemist who synthesized urea from ammonium cyanate was:	Berzelius	Kolbe	**Wohler ✓**	Lavoisier
78	Formula of marsh gas is:	CH_4 ✓	C_2H_6	C_3H_6	C_4H_{10}
79	The process used to improve quality of gasoline is called:	Thermal Cracking	**Reforming ✓**	Combination	Steam Cracking
80	Tetra Ethyl lead T.E.L is used as:	Pain Killer	**Petroleum Additive ✓**	Fire extinguisher	Moth Repellent
81	Which one of the following is an amide?	$(NH_2{}_2CO$ ✓	$NH_2 \cdot CH_3$	$C_6H_5NH_2$	$NCH_3{}_3$
82	Select from the following the one which is alcohol:	CH_3CH_2OH ✓	CH_3OCH_3	CH_3COOH	CH_3CH_2Br
83	Which one is the heterocyclic compound of oxygen?	Pyridine	Pyrrole	**Furan ✓**	Thiophene
84	–SH Functional group is called:	Cyano	**Mercapto ✓**	Nitro	Carboxyl
85	A double bond consists of:	Two sigma bonds	**One sigma and one pi bond ✓**	One sigma and two Pi-bonds	Two Pi-bonds
86	In t-butyl alcohol, the tertiary carbon is bonded to:	Two hydrogen atoms	Three hydrogen atoms	One hydrogen atom	**No hydrogen atom ✓**
87	Linear shape is associated with which set of hybrid orbitals?	sp ✓	sp^2	sp^3	dsp^2
88	Number of possible chain isomers of an alkane C_5H_{12} are:	2	**3 ✓**	4	5
89	The catalytic oxidation of methane produces:	$CO + H_2O$	$CO_2 + H_2O$	$C_2 + H_2O$	$H_3C - OH$ ✓
90	The general formula for Alkanes is:	C_nH_{2n-1}	C_nH_{2n}	C_nH_{2n-2}	C_nH_{2n+2} ✓
91	Formula of chloroform is:	CH_3Cl	CCl_4	CH_2Cl_2	$CHCl_3$ ✓
92	Conversion of unsaturated hydrocarbons to saturated hydrocarbons in the presence of catalyst is called as:	Halogenation	**Hydrogenation ✓**	Hydroxylation	Dehydrogenation
93	The general formula for Alkene having one double bond is:	C_nH_{2n+1}	C_nH_{2n} ✓	C_nH_{2n-2}	C_nH_{2n+2}

94	Which one is not property or use of mustard gas?	Used in 1st world war	Powerful vesicant	High boiling liquid	**High boiling gas ✓**
95	When 1-chloropropane is reacted with alcoholic KOH, the product obtained is:	Propane	**Propene ✓**	Propyne	Butane
96	$H_2C = CH - C \equiv H$ and conc. HCl on reaction give:	Polyacetylene	Benzene	**Chloroprene ✓**	Divinyl acetylene
97	Vinyl acetylene reach with HCl to form:	Polyacetylene	Benzene	**Chloroprene ✓**	Divinylacetylene
98	Which gas is used for artificial ripening of fruits?	**Ethene ✓**	Methane	Propane	Ethyne
99	Preparation of vegetable ghee involves:	Halogenation	**Hydrogenation ✓**	Hydroxylation	Dehydrogenation
100	Structural formula of vinyl chloride is:	$HC \equiv C - Cl$	$H_2C = CH - Cl$ ✓	$H_3C - CHCl_2$	$H_2C = CH_2$

101	Aromatic hydrocarbons are the derivatives of:	Normal series of paraffins	Alkene	**Benzene ✓**	Cyclohexane
102	The resonating contributing structures of Benzene are:	2	3	**5 ✓**	7
103	The structure of Benzene is:	Hexagonal irregular	Tetrahedral	Trigonal planner	**Hexagonal planner ✓**
104	The conversion of n – hexane into Benzene by heating in the presence of Pt is called:	Isomerization	**Aromatization ✓**	Dealkylation	Rearrangement
105	During Nitration of Benzene, the active nitrating agent is:	NO_3	NO_2^+ ✓	NO_2^-	HNO_3
106	Which of the following is Ortho and Para directing group?	$-I$ ✓	$-CHO$	$-COOH$	$-NR_3$
107	Benzene cannot undergo:	Substitution Reactions	Addition Reactions	Oxidation Reactions	**Elimination Reactions ✓**
108	m-chloronitrobenzene is prepared by:	Nitration of chlorobenzene	Nitration of Benzene	**Chlorination of Nitrobenzene ✓**	Nitration of m-chlorobenzene
109	Which one is not a meta directing group:	$-COOH$	$-CHO$	$-COR$	$-NH_2$ ✓
110	The benzene molecule contains:	Three double bonds	Two double bonds	One double bond	**delocalized π-electron cloud ✓**
111	Which of the following acid can be used as a catalyst in Friedel Craft's reactions?	$AlCl_3$ ✓	HNO_3	$BeCl_2$	$NaCl$
112	The electrophile in aromatic sulphonation is:	H_2SO_4	HSO_4^-	SO_3 ✓	SO_3^+
113	Aromatic compounds burn with sooty flame because:	They have high percentage of hydrogen	They have a ring structure	**They have high percentage of carbon ✓**	They resist reaction with air
114	The conversion of n-hexane into benzene by heating in the presence of Pt is called:	Isomerization	**Aromatization ✓**	Dealkylation	Rearrangement
115	Which compound is the most reactive?	Benzene	**Ethene ✓**	Ethane	Ethyne
116	In primary alkyl halides, the halogen atom is attached to a carbon which is further attached to how many carbon atoms?	Two	Three	**One ✓**	Four

117	Choose the gas which is obtained by the reaction of phosphorus with thionyl chloride:	SO_2 ✓	PH_3	CO_2	C_2H_2
118	The most reactive Alkyl halide is:	**Alkyl Iodine ✓**	Alkyl Bromide	Alkyl Fluoride	Alkyl Chloride
119	S_N2 mechanism involves.	1st order kinetics	**2nd order kinetics ✓**	3rd order kinetics	Zero order kinetics
120	Which is not a nucleophile?	H_2O	H_2S	BF_3 ✓	NH_3
121	The rate of $E1$ reaction depends upon:	The have high percentage of hydrogen	The concentration of nucleophile	The concentration of substrate as will as nucleophile	**The concentration of eliminated group ✓**
122	The geometry of carbonium ion formed in S_N1 mechanism is:	Tetra hedral	Square planar	**Triangular planar ✓**	Hexagonal
123	During S_N1 reaction, the fast step involves:	Breakage of covalent bond	Formation of carbocation	Transition state	**Attack of nucleophile ✓**
124	The removal of two atoms or groups from adjacent carbon atoms in the presence of a base is called:	Subsititution reaction	**Elimination reaction ✓**	Hydrolatic reaction	Decomposition reaction
125	Cyanogen chloride reacts with ethyl magnesium bromide to give:	CH_3CH_2Cl	CH_3CH_2Br	CH_3CH_2Mg	CH_3CH_2CN ✓
126	Which compound is formed, when CH_3OH react with $CH_3-Mg-Br$?	Ethane	**Methane ✓**	Ethanol	Acetone
127	When CO_2 is made to react with ethyl magnesium iodide, followed by acid hydrolysis, the product formed is:	Propane	**Propanoic acid ✓**	Propanal	Propanol
128	Alkyl halides are considered to be very reactive compounds towards nucleophile because:	They have an electrophilic carbon	**They have an electrophilic carbon and a good leaving group ✓**	They have an electrophilic carbon and a bad leaving group	They have a nucleophilic carbon and a good leaving group
129	When cyanogen chloride $Cl-CN$ is made to react with ethyl magnesium bromide the product formed is:	CH_3-CN	CH_3-CH_2-CN ✓	$CH_3-CH_2-CH_2-CN$	$CH_2=CH-CN$
130	The carbon atom of carbonyl group is hybridized:	sp	sp^2 ✓	sp^3	dsp^2
131	Which of the following has highest boiling point?	Methanal	Ethanal	Propanal	**2- hexanone ✓**
132	Formalin is a 40% solution of:	CH_3CHO	CH_3OH	$HCHO$ ✓	CH_3OCH_3
133	40% aqueous solution of formaldehyde is called as:	**formalin ✓**	Tollen's reagent	paraldehyde	wood spirit
134	Which of the following reagent will react with both aldehydes and ketones?	**Grignard reaction ✓**	Tollen's reaction	Fehling reaction	Benedict's reaction
135	Which reagent will react with both aldehyde and ketones?	**Girgnard reagent ✓**	Tollen's reagent	Fehling's reagent	Benedict's reagent
136	Aldehyde react with hydroxylamine in acidic solution to give:	**An oxime ✓**	Aldol	Polymer	Acetic acid
137	Which reaction is disproportionation reaction?	Aldol Condensation	**Canizzaro's reaction ✓**	Haloform reactions	Acid-Catalyzed reactions
138	Percentage of water in Formalin is:	**52% ✓**	8%	40%	60%
139	The colour of precipitate of aldehyde with Fehling's solution is:	Black	White	Blue	**Brick red ✓**

140	Which one will not give Silver Mirror Test?	Formaldehyde	Acetaldehyde	**Acetone ✓**	Propionaldehyde
141	Which one has yellow or orange crystalline ppt?	Acetone hydrazone	**2, 4-DNPH ✓**	Ethanaloxime	Bisulphite addition product
142	Formalin is:	10% solution of formaldehyde in water	20% solution of formaldehyde in water	**40% solution of formaldehyde in water ✓**	60% solution of formaldehyde in water
143	Ketones are prepared by the oxidation of:	Primary alcohol	**Secondary alcohol ✓**	Tertiary alcohol	None of these
144	The compound used in the processing of anti-polio vaccine is:	Acetadehyde	**Formaldehyde ✓**	Acetone	Ethylbromide
145	…….. is aromatic acid:	Propanoic acid	Ethanoic acid	Butanoic acid	**Phthalic acid ✓**
146	Which of these is the formula of Palmitic Acid:	$C_{15}H_{31}COOH$ ✓	$C_{16}H_{31}COOH$	$C_{17}H_{35}COOH$	$C_{18}H_{37}COOH$
147	Origin of Formic Acid is:	Milk	Butter	**Red Ants ✓**	Oil
148	Alkane nitriles can be converted into carboxylic acids by:	Hydration	**Acid hydrolysis ✓**	Hydrogenation	Oxidation
149	Among the aliphatic carboxylic acids the first four members are soluble in water due to:	London dispersion forces	**Hydrogen bonding ✓**	Ion-Dipole forces	Covalent bond
150	The flavor of amylacetate is:	Orange	Apricot	**Banana ✓**	Pineapple
151	Which of the following derivative is not directly prepared from acetic acid CH_3COOH?	Ethyl acetate	Acetyl chloride	Acetic anhydride	**Acetamide ✓**
152	Organic compound having fruity smell are:	Carboxylic acid	Alcohols	Ethers	**Esters ✓**
153	Which of the following ester gives apricot flavor?	Amyl acetate	Benzyl acetate	**Amyl butyrate ✓**	Octyl acetate
154	Acetic acid exists as _____ in benzene:	**A dimer ✓**	A trimer	A monomer	A tetramer
155	Which compound is used as coagulant for latex in rubber Industry:	Formic acid	**Acetic acid ✓**	Benzoic acid	Butanoic acid
156	The nature of lysine amino acid is:	Acidic	**Basic ✓**	Amphoteric	Neutral
157	Which of the following is not a fatty acid?	Propanoic acid	Acetic acid	**Phthalic acid ✓**	Butanoic acid
158	Amino acids reacts with ninhydrin to form intensely coloured _____ product.	Reddish green	**Bluish violet ✓**	Yellowish	Pinkish
159	A polymer is a large molecule built up by the repetition of small and simple chemical units known as:	**Monomers ✓**	Dimers	Tetrarmers	Trimers
160	The polymer which can be softened and hardened by heating and cooling is called:	**Thermoplastic ✓**	Thermosetting	Proteins	Fats
161	In which of these processes are small organic molecules made into macro molecules:	The cracking of petroleum fractions	The fractional distillation of crude oil	**The polymerization of ethene ✓**	The hydrolysis of proteins
162	Which of these polymers is a synthetic polymer?	Animal fat	Starch	Cellulose	**Polyester ✓**
163	Which of the following is an addition polymer?	Polyester	**Polystyrene ✓**	Nylon 6, 6	Terylene
164	The fiber which is made from acrylonitrile as monomer?	Acetic acid	Adipic acid	**Vinyl chloride ✓**	Acetyl chloride
165	PVC is polymer:	thermosetting	**thermoplastic ✓**	autosetting	wet setting

166	Select the one which is a copolymer:	Polythene	Polystyrene	Polyvinyl acetate	**Nylon-6, 6 ✓**
167	Select the Monomers of Nylon – 6, 6:	Adipic Acid and Ethylene Glycol	Acetic Acid and HexamethleneDl amine	**Adipic Acid and Hexamethylen eDiamine ✓**	Acetic Acid and Ethlene Glycol
168	Which one is a disaccharide?	Glucose	**Sucrose ✓**	Fructose	Cellulose
169	Which of the following nitrogenous base is not present in RNA?	Cytosine	Adenine	**Thymine ✓**	Uracil
170	A polymeric substance that is formed in the liquid state and then hardened to a rigid solid is called a:	Fibre	**Plastic ✓**	Varnish	Polyamide resin
171	Vegetable oils are:	Unsaturated fatty acids	**Glycerides of unsaturated fatty acids ✓**	Glycerides of saturated fatty acids	Essential oils obtained from plants
172	Which one of the following base is not present in DNA?	Adenine	**Uracil ✓**	Thymine	Cytosine
173	Which three elements are needed for healthy growth of Plants?	N,S,P	N,Ca,P	**N,P,K ✓**	N,K,C
174	The macronutrients are required in quantities ranging from:	4-40 kg per acre	10-100 kg per acre	5-100 kg per acre	**5-200 kg per acre ✓**
175	Micronutrients required for plant growth is in the range of per acre.	5g to 200g	**6g to 200g ✓**	6g to 250g	7g to 250g
176	Phosphorus helps the growth of:	Root	Leaf	Steam	**Seed ✓**
177	Which is the strongest oxidizing agent in the following:	I_2	Cl_2	F_2 ✓	Br_2
178	Select the percentage of nitrogen in urea:	82%	**46% ✓**	35%	100%
179	Diammonium phosphate fertilizer contains how much percentage of nitrogen?	48%	**16% ✓**	75%	46%
180	Which is not a calcarious material?	**Clay ✓**	Limestone	Marble	Chalk
181	One of following is argillaceous material:	Marble	**Clay ✓**	Lime	Marine Shell
182	During the manufacturing process of cement the temperature of decomposition zone goes up to:	600°C	**900°C ✓**	1000°C	120°C
183	The wood paper is derived from the name of which reedy plant:	Rose	Sun Flower	**Papyrus ✓**	Water
184	Which woody raw material is used for the manufacture of paper pulp?	Cotton	Biogases	Rice straw	**Poplar ✓**
185	The nitrogen present in some fertilizers helps plants?	To fight against diseases	To produce fat	To undergo photosynthesis	**To produce protein ✓**
186	How many zones through which the charge passes in a rotary kiln?	**4 ✓**	3	2	5
187	Ecosystem is smaller unit of:	Lithosphere	Hydrosphere	Atmosphere	**Biosphere ✓**
188	Thickness of atmosphere is about how much kilometer above the surface of earth?	100 km	**1000 km ✓**	10,000 km	unlimited
189	Which of following element is not abundantly present in earth's crust?	Silicon	Aluminum	**Sodium ✓**	Oxygen
190	The proportion of N_2 in atmosphere is:	**78% ✓**	21%	0.9%	0.0%
191	A single chloride free radical can destroy how many ozone molecules?	100	**100,000 ✓**	100,000	10
192	The pH of unpolluted rain water should be:	5.00	**5.60 ✓**	6.50	7.00

193	Which one of the following substance cause acid rain?	SO_2 ✓	Hydro carbons	Chloroflouroca rbons	O_3
194	Hard water contains:	**Ca and Mg salts ✓**	Carbonates of Na and K	Chorides of Na and K	Sulphate of Al
195	Disinfection of chlorine is:	**Inexpansive ✓**	Expansive	Rapid	Slow
196	The co-agulant used in raw water to precipitate suspened impurities is:	Cautic soda	Lime water	**Alum ✓**	Soda Ash
197	In water, the concentration of dissolved O_2 should be:	1-3 ppm	2-4 ppm	**4-8 ppm ✓**	8-12 ppm
198	The newspaper can be recycled again and again many times as:	**5 ✓**	3	4	2
199	Fungicides are the pesticides which:	**Control the growth of fungus ✓**	Kill insects	Kill plants	Kill herbs
200	The temperature in the incineration of industrial and hazardous waste process has a range:	900 to 1000°C	250 to 500°C	**950 to 1300°C ✓**	500 to 900°C

Short Questions NO.2

Question 1: Lanthanide contraction controls the atomic sizes of elements of 6th and 7th periods. Give reason.

Answer: The gradual reduction in the size of Lanthanides due to poor shielding effect of 'f' subshell electrons is called Lanthanide Contraction. This effect reduces the atomic radii of elements in the 6th and 7th periods, pulling electrons closer to the nucleus and counteracting the expected increase in size.

Question 2: Explain the variations in melting points along the short periods.

Answer: Across the short periods, melting and boiling points increase up to group IVA due to an increase in binding electrons, forming giant covalent structures. They decrease from group VA to VIIA as lighter elements exist as small covalent molecules with weak intermolecular forces.

Question 3: Why is the aqueous solution of Na2CO3 alkaline in nature?

Answer: Sodium carbonate (Na_2CO_3) dissolves in water and undergoes hydrolysis to form a strong base (NaOH) and a weak acid (H_2CO_3). The presence of the strongly ionized NaOH makes the overall solution alkaline.

Equation: $Na_2CO_3(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2CO_3(aq)$.

Question 4: What happens when LiOH is heated to red hot?

Answer: Lithium hydroxide is unique among alkali metals; when strongly heated to red hot, it decomposes to form lithium oxide and water. Other alkali metal hydroxides are stable to heat.

Equation: $2LiOH(s) \xrightarrow{\text{Red hot}} Li_2O(s) + H_2O(l)$.

Question 5: Give chemistry of borax-bead test.

Answer: When fused, borax decomposes into sodium metaborate and boric anhydride: $Na_2B_4O_7 \rightarrow 2NaBO_2 + B_2O_3$. The metallic oxide of the test substance combines with B_2O_3 to form colored metallic borates. For example, cupric oxide gives a blue bead: $CuO + B_2O_3 \rightarrow Cu(BO_2)_2$.

Question 6: How does boric acid react with Ethyl alcohol and Na2CO3?

Answer: Boric acid reacts with ethyl alcohol to form ethyl borate: $H_3BO_3 + 3C_2H_5OH \rightarrow (C_2H_5)_3BO_3 + 3H_2O$. It reacts with sodium carbonate (Na_2CO_3) to yield borax: $4H_3BO_3 + Na_2CO_3 \rightarrow Na_2B_4O_7 + 6H_2O + CO_2$.

Question 7: How will you convert boric acid into borax?

Answer: Boric acid can be converted into borax by partial neutralization with sodium hydroxide (NaOH) or sodium carbonate (Na_2CO_3).

Equation: $4H_3BO_3(aq) + 2NaOH(aq) \rightarrow Na_2B_4O_7(aq) + 7H_2O(l)$.

Question 8: How does orthoboric acid react with NaOH and C2H5OH?

Answer: Orthoboric acid is neutralized by NaOH to give borax: $4H_3BO_3 + 2NaOH \rightarrow Na_2B_4O_7 + 7H_2O$. It reacts with ethyl alcohol (C_2H_5OH) to form ethyl borate: $H_3BO_3 + 3C_2H_5OH \rightarrow (C_2H_5)_3BO_3 + 3H_2O$.

Question 9: Name the allotropes of phosphorus. How red phosphorus is prepared?

Answer: The main allotropes of phosphorus are white, red, and black phosphorus. Red phosphorus is prepared by heating white phosphorus in the presence of a little iodine or sulphur as a catalyst up to $250°C$ in a vacuum.

Question 10: Give the reaction of phosphorus with Thionyl chloride and Cl2(g).

Answer: With thionyl chloride ($SOCl_2$): $2P + 4SOCl_2 \rightarrow 2PCl_3 + 2SO_2 + S_2Cl_2$. With dry chlorine ($Cl_2$): $2P + 3Cl_2 \rightarrow 2PCl_3$ (limited supply) or $2P + 5Cl_2 \rightarrow 2PCl_5$ (excess supply).

Question 11: Give the effect of heat on H3PO4.

Answer: On heating, orthophosphoric acid (H_3PO_4) loses water and is converted into pyrophosphoric acid at $240°C$, and then to metaphosphoric acid (HPO_3) at $316°C$. $2H_3PO_4 \overset{240°C}{\rightarrow} H_4P_2O_7 + H_2O$ and $H_4P_2O_7 \overset{316°C}{\rightarrow} 2HPO_3 + H_2O$.

Question 12: Why HF is weaker acid than HCl?

Answer: HF is a weak acid due to its limited ionization in water. The strong hydrogen bonding between HF molecules and the small size of the fluorine atom create a very strong H-F bond, making it harder to release a proton compared to the weaker H-Cl bond.

Question 13: Which halogen is used as an antiseptic?

Answer: Iodine is widely used as an antiseptic and germicide in the pharmaceutical industry. Popular preparations include tincture of iodine and iodex.

Question 15: Give two uses of silicones.

Answer: 1) Liquid methyl silicones are used as lubricants, either incorporated in greases or oils, for bearings and gears. 2) Silicones are extensively used to treat various surfaces (like cloth, plastics, and glass) to make them strongly water-repellent.

Question 16: What is water glass? How is it prepared?

Answer: Water glass is sodium silicate (Na_2SiO_3), a water-soluble sodium salt of metasilicic acid. It is prepared by fusing sodium carbonate with pure sand (SiO_2) in a reverberatory furnace: $Na_2CO_3 + SiO_2 \rightarrow Na_2SiO_3 + CO_2$.

Question 17: Give the two reactions for the preparation of N2O.

Answer: 1. By the action of dil. HNO_3 on metallic zinc: $4Zn + 10HNO_3 \rightarrow 4Zn(NO_3)_2 + N_2O + 5H_2O$. 2. By carefully heating ammonium nitrate to about $200°C$: $NH_4NO_3 \overset{200°C}{\rightarrow} N_2O + 2H_2O$.

Question 18: What is laughing gas? How is it prepared?

Answer: Laughing gas is Dinitrogen Oxide (N_2O). It is typically prepared by heating ammonium nitrate to about $200°C$. To avoid explosion, a mixture of sodium nitrate and ammonium sulphate can be used instead. $NH_4NO_3 \rightarrow N_2O + 2H_2O$.

Question 19: Write down four uses of HNO3.

Answer: 1. As a laboratory reagent. 2. In the manufacture of nitrogen fertilizers. 3. In the manufacture of explosives like TNT. 4. For making varnishes and organic dyes.

Question 20: How does HNO3 react with Cu metal?

Answer: Copper reacts differently depending on the concentration: With dilute HNO_3: $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$. With concentrated HNO_3: $Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$.

Question 21: Give the reactions of H2SO4 with NaCl and KNO3.

Answer: With NaCl: $2NaCl(s) + H_2SO_4(conc.) \rightarrow Na_2SO_4(aq) + 2HCl(g)$. With KNO_3: $KNO_3(aq) + H_2SO_4(conc.) \overset{heat}{\rightarrow} KHSO_4(aq) + HNO_3(g)$.

Question 22: How does conc. H2SO4 reacts with C and S?

Answer: Concentrated H_2SO_4 acts as a strong oxidizing agent: With Carbon: $C + 2H_2SO_4 \rightarrow CO_2 + 2SO_2 + 2H_2O$. With Sulphur: $S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$.

Question 23: Briefly discuss the property of paramagnetism in transition elements compounds.

Answer: Paramagnetism in transition elements is due to the presence of unpaired electrons in their partially filled d-orbitals. These unpaired electrons align with an applied magnetic field, causing the substance to be weakly attracted by the magnetic field.

Question 24: Why does the compounds of transition elements are coloured?

Answer: Transition metal compounds are colored because they have partially filled d-orbitals. When visible light falls on them, an electron absorbs certain wavelengths and jumps to a higher energy d-orbital (d-d transition). The transmitted or reflected light corresponds to the complementary color.

Question 25: What are Interstitial compounds and Substitutional alloys?

Answer: Interstitial compounds are formed when small non-metal atoms (like H, C, or N) occupy the interstitial spaces in a transition metal lattice. Substitutional alloys are solid solutions formed when some atoms in the crystal lattice of a transition metal are replaced by atoms of another metal of similar size.

Question 26: What is meant by "central metal ion"? Explain with one example.

Answer: A central metal ion in a complex compound is a transition metal cation surrounded by and coordinately bonded to a number of electron-pair donating molecules or ions (ligands). Example: In $[Fe(CN)_6]^{4-}$, the Fe^{2+} ion acts as the central metal ion bonded to six cyanide ligands.

Question 27: Prove that ZnO is an amphoteric oxide.

Answer: Zinc oxide (ZnO) acts as both an acid and a base. It reacts with acids to form salts: $ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$. It also reacts with strong bases to form salts: $ZnO + 2NaOH + H_2O \rightarrow Na_2[Zn(OH)_4]$.

Question 28: What is milk of magnesia and where it is used?

Answer: Milk of magnesia is a suspension of magnesium hydroxide, $Mg(OH)_2$, in water. It is primarily used as an antacid for the treatment of acidity in the stomach.

Question 29: Write down the chemical formula of dolomite and asbestos. **Answer:** Dolomite: $MgCO_3.CaCO_3$ Asbestos: $CaMg_3(SiO_3)_4$

Question 30: Write down the chemical formula of Sylvite and Natron. **Answer:** Sylvite: KCl Natron: $Na_2CO_3.H_2O$

Question 31: What is lime mortar?

Answer: Ordinary mortar, also called lime mortar, is prepared by mixing freshly prepared slaked lime (1 volume) with sand (3-4 volumes) and water to form a thick paste. It is used as a building material to bind stones and bricks.

Question 32: Why are aluminium sheets said to be free from corrosion?

Answer: When exposed to moist air, an aluminium sheet quickly acquires a thin, continuous, and highly protective coating of aluminium oxide (Al_2O_3). This layer prevents further attack by atmospheric oxygen and water, making the metal corrosion-resistant.

Question 33: Give four uses of aluminium.

Answer: 1. Because of its light weight and high tensile strength, it is used in aircraft and transport industries. 2. It is used for making heavy-duty electrical cables. 3. Used to make cooking utensils and window frames. 4. Used as a heat reflector and for insulating buildings.

Question 34: Why does aqua regia dissolve platinum?

Answer: Aqua regia (3 parts conc. HCl and 1 part conc. HNO_3) produces nascent chlorine ($[Cl]$) and nitrosyl chloride (NOCl). The highly reactive liberated chlorine gas converts noble metals like platinum into their water-soluble chlorides, dissolving the metal.

Question 35: What is meant by the term "inert pair"?

Answer: The pair of outermost 's' orbital electrons that does not readily take part in chemical combination is termed as an inert pair. This effect is most marked in heavier elements of group IVA (like lead), where they preferentially show an oxidation state of +2 instead of +4.

Question 36: Give four common properties of group IVA elements.

Answer: 1. All elements show a valency of four. 2. They all form hydrides of the type MH_4. 3. They form covalent tetrachlorides of the type MCl_4. 4. They all form dioxides of the type MO_2.

Question 37: Why diamond is a non-conductor while graphite is conductor?

Answer: In diamond, carbon uses all four valence electrons in strong tetrahedral sp^3 covalent bonds, leaving no free electrons for conduction. In graphite, carbon uses only three valence electrons (sp^2 bonds) in its layers, leaving one delocalized π-electron per atom free to move, making it a good conductor.

Question 38: Why R-I is more reactive than R-F?

Answer: The reactivity of an alkyl halide (R-X) depends mainly on the C-X bond energy. The C-I bond has a much lower bond energy (228 kJ/mol) than the strong C-F bond (467 kJ/mol), making it much easier to break and thus far more reactive.

Question 39: What is vital force theory?

Answer: The vital force theory was an early hypothesis stating that organic compounds could only be synthesized by living organisms under the influence of a mysterious "vital force," and could not be prepared artificially from inorganic materials in a laboratory.

Question 40: Define functional group. Give one example.

Answer: An atom or a group of atoms, or a double/triple bond whose presence dictates the specific chemical properties of an organic compound is called a functional group. Example: The hydroxyl group (-OH) is the functional group for alcohols.

Question 41: Why is sigma bond inert?

Answer: A sigma (σ) bond is inert because the electron density is tightly held linearly between the two nuclei. The highly localized and strong nature of the σ bond makes it difficult for electrophiles or nucleophiles to attack, rendering alkanes chemically unreactive.

Question 42: What are alicyclic compounds? Give example.

Answer: Alicyclic compounds are homocyclic (carbocyclic) organic compounds that contain a ring of three or more carbon atoms and resemble aliphatic compounds in their properties. Example: Cyclohexane (C_6H_{12}).

Question 43: What are heterocyclic organic compounds? Give two examples.

Answer: Heterocyclic compounds are cyclic organic compounds whose rings consist of atoms of more than one kind; they contain one or more heteroatoms (like N, O, or S) in the ring. Examples: Pyridine and Furan.

Question 44: Name two main factors which govern reactivity of R-X bond in alkyl halides.

Answer: The reactivity of the R-X bond is governed by two main factors: 1) C-X Bond Energy (which dictates how easily the bond breaks), and 2) C-X Bond Polarity (which determines the partial positive charge on the carbon atom).

Question 45: Define nucleophile. Give two examples.

Answer: A nucleophile ("nucleus loving") is a species that has an unshared electron pair available for bonding. It may be negatively charged or neutral and attacks electrophilic centers. Examples: Hydroxide ion (OH^-) and Ammonia (NH_3).

Question 46: Define leaving group. Give some examples.

Answer: A leaving group is an atom or group of atoms that departs with an unshared pair of electrons during a nucleophilic substitution or elimination reaction. Examples: Chloride ion (Cl^-), Bromide ion (Br^-), and Iodide ion (I^-).

Question 47: What is Wurtz-Fittig reaction?

Answer: The Wurtz-Fittig reaction is a modification of the Wurtz reaction where a mixture of an alkyl halide and an aryl halide reacts with sodium metal in the presence of dry ether to form an alkylated aromatic hydrocarbon (e.g., forming toluene from bromobenzene and methyl bromide).

Question 48: What are polycyclic aromatic hydrocarbons? Give two examples.

Answer: Polycyclic aromatic hydrocarbons are organic compounds containing two or more fused or isolated benzene rings in their molecules. Examples: Naphthalene (fused rings) and Biphenyl (isolated rings).

Question 49: Convert benzene into glyoxal.

Answer: Benzene is converted into glyoxal via ozonolysis. Benzene reacts with ozone (O_3) to form benzene triozonide. This intermediate is then reduced with zinc dust and water to yield three molecules of glyoxal ($CHO-CHO$).

Question 50: Why is nitro group meta-directing?

Answer: The nitro group ($-NO_2$) is strongly electron-withdrawing. It withdraws electron density from the benzene ring via the inductive and resonance effects, deactivating the ortho and para positions mostly. Consequently, the meta position remains comparatively electron-rich, directing electrophilic attack there.

Question 51: How is ethyl benzene obtained from bromobenzene?

Answer: Ethyl benzene is obtained from bromobenzene via the Wurtz-Fittig reaction. Bromobenzene and ethyl bromide are reacted with sodium metal in the presence of dry ether: $C_6H_5Br + C_2H_5Br + 2Na \xrightarrow{\text{Ether}} C_6H_5 - C_2H_5 + 2NaBr$.

Question 52: How is maleic acid obtained from benzene?

Answer: Benzene is oxidized by passing its vapors mixed with air over a heated vanadium pentoxide (V_2O_5) catalyst at $450°C$. This yields maleic anhydride, which upon hydrolysis with water gives maleic acid.

Question 53: Discuss hydroxylation of ethene.

Answer: Ethene undergoes hydroxylation when treated with a cold, dilute, alkaline solution of potassium permanganate (Baeyer's reagent). The pink color of $KMnO_4$ is discharged, and 1,2-ethanediol (ethylene glycol) is formed.

Question 54: Define Markownikov's rule. Give an example.

Answer: Markownikov's rule states that in the addition of an unsymmetrical reagent to an unsymmetrical alkene, the negative part of the adding reagent goes to the carbon atom of the double bond that has the lesser number of hydrogen atoms. Example: Addition of HBr to propene yields 2-bromopropane as the major product.

Question 55: Prepare ozonide from ethene.

Answer: Ethene reacts with ozone (O_3) across its double bond to form an unstable intermediate called a molozonide, which spontaneously rearranges to form a relatively stable ethene ozonide.

Question 56: How is water added to propyne?

Answer: Propyne reacts with water in the presence of mercuric sulphate ($HgSO_4$) and sulphuric acid (H_2SO_4) at $75°C$. Initial hydration gives an unstable enol (1-propen-2-ol), which immediately tautomerizes to yield a ketone, acetone (propanone).

Question 57: Convert acetylene into acetic acid.

Answer: Acetylene is hydrated in the presence of $HgSO_4$ and H_2SO_4 to form acetaldehyde. The acetaldehyde is then oxidized using acidified potassium dichromate ($K_2Cr_2O_7/H_2SO_4$) to produce acetic acid.

Question 58: Convert ethyne into acrylonitrile.

Answer: Ethyne (acetylene) reacts with hydrogen cyanide (HCN) in the presence of a CuCl / NH_4Cl catalyst to yield acrylonitrile ($CH_2 = CH - CN$), which is an important monomer for synthetic fibers.

Question 59: Convert CH4 into formaldehyde by catalytic oxidation.

Answer: A mixture of methane and oxygen is passed over a heated copper catalyst at $400°C$ and 200 atm pressure. Methane undergoes partial catalytic oxidation to form methanol, which upon further oxidation yields formaldehyde ($HCHO$).

Question 60: Give nitration reaction of methane.

Answer: Alkanes like methane undergo nitration in the vapor phase. Methane reacts with nitric acid vapors at $400°C$ to $500°C$ to form nitromethane and water. Equation: $CH_4 + HNO_3 \xrightarrow{400°C} CH_3NO_2 + H_2O$.

Question 61: How can 1-chloropropane be converted to propene?

Answer: 1-chloropropane is converted to propene via a dehydrohalogenation (β-elimination) reaction. It is treated with a hot, concentrated alcoholic solution of potassium hydroxide (KOH), yielding propene, KCl, and water.

Question 62: Write equations for the preparation of ethanol by the fermentation of Molasses.

Answer: Molasses (sucrose) is hydrolyzed by the enzyme invertase from yeast: $C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase}} C_6H_{12}O_6(\text{Glucose}) + C_6H_{12}O_6(\text{Fructose})$. Zymase then converts glucose into ethanol: $C_6H_{12}O_6 \xrightarrow{\text{Zymase}} 2C_2H_5OH + 2CO_2$.

Question 63: How are ethene and diethyl ether produced from ethyl alcohol?

Answer: Ethyl alcohol undergoes dehydration with conc. H_2SO_4. At $180°C$, it loses a water molecule to form ethene (C_2H_4). At a lower temperature of $140°C$ and with excess alcohol, it undergoes intermolecular dehydration to form diethyl ether ($C_2H_5 - O - C_2H_5$).

Question 64: Why ethanol has higher boiling point than diethyl ether?

Answer: Ethanol possesses a highly polar -OH group that forms strong intermolecular hydrogen bonds, requiring significant energy to break. Diethyl ether lacks the required hydrogen attached directly to oxygen, cannot form hydrogen bonds, and thus has a much lower boiling point.

Question 65: Explain Lucas test.

Answer: Lucas test distinguishes primary, secondary, and tertiary alcohols using a mixture of conc. HCl and anhydrous $ZnCl_2$. Tertiary alcohols immediately form an insoluble oily layer of alkyl chloride; secondary alcohols form an oily layer in 5-10 minutes, and primary alcohols require heating to react.

Question 66: Convert phenol into 2, 4, 6 tribromophenol and Cyclohexanol.

Answer: 1. An aqueous solution of phenol reacts with bromine water at room temperature to immediately precipitate white 2,4,6-tribromophenol. 2. Phenol vapor mixed with hydrogen gas over a nickel catalyst at $150°C$ undergoes catalytic hydrogenation to form cyclohexanol.

Question 67: Mention the product when phenol is distilled with Zn dust by giving reaction.

Answer: Distilling phenol with zinc dust results in reduction, yielding benzene gas and zinc oxide.

Equation: $C_6H_5OH + Zn \xrightarrow{\text{distillation}} C_6H_6 + ZnO$.

Question 68: Give reactions of phenol with Bromine water and Conc. H2SO4.

Answer: With Bromine water: Phenol reacts rapidly to give a white precipitate of 2,4,6-tribromophenol. With conc. H_2SO_4: Phenol undergoes sulphonation at room temperature to form a mixture of ortho- and para-hydroxybenzenesulphonic acids.

Question 69: What is iodoform test?

Answer: The iodoform test involves reacting a substance with iodine and aqueous NaOH. The formation of a yellow crystalline solid (iodoform, CHI_3) confirms the presence of methyl ketones, acetaldehyde, or secondary alcohols containing a methyl group adjacent to the carbon bearing the -OH group (e.g., ethanol).

Question 70: What is Benedict's solution test? Give reaction.

Answer: It is a test for aliphatic aldehydes using an alkaline solution containing a cupric citrate complex. Aldehydes reduce the Cu^{2+} ions to cuprous oxide (Cu_2O), forming a brick-red precipitate. Reaction: $RCHO + 2Cu(OH)_2 + NaOH \xrightarrow{\Delta} RCOONa + Cu_2O(s)\downarrow + 3H_2O$.

Question 71: How does hydrazine react with acetone?

Answer: Acetone reacts with hydrazine (NH_2NH_2) in the presence of an acid catalyst in a nucleophilic addition-elimination reaction. Water is lost to form acetone hydrazone ($CH_3 - C(CH_3) = N - NH_2$).

Question 72: Write reaction between acetic acid and ammonia for the formation of amide.

Answer: Acetic acid reacts with ammonia to form ammonium acetate, which upon heating loses a molecule of water to produce acetamide. $CH_3COOH + NH_3 \rightarrow CH_3COONH_4 \xrightarrow{\Delta} CH_3CONH_2 + H_2O$.

Question 73: Define polysaccharides, also give example. A

nswer: Polysaccharides are complex, high molecular weight carbohydrates that yield many molecules of monosaccharides upon hydrolysis. They are amorphous, tasteless, and insoluble in water. Examples include starch, cellulose, and glycogen.

Question 74: What is the difference between oligosaccharides and polysaccharides?

Answer: Oligosaccharides yield 2 to 9 monosaccharide units upon hydrolysis and are sweet, crystalline, and water-soluble (e.g., sucrose). Polysaccharides yield hundreds or thousands of monosaccharides, are tasteless, amorphous, and insoluble in water (e.g., starch).

Question 75: Differentiate between DNA and RNA.

Answer: DNA (Deoxyribonucleic acid) stores genetic information, contains the sugar deoxyribose, is double-stranded, and uses thymine as a base. RNA (Ribonucleic acid) synthesizes proteins, contains the sugar ribose, is single-stranded, and uses uracil in place of thymine.

Question 76: Write down the structural formulas of Glycine and Alanine amino acids.

Answer: Glycine (the simplest amino acid): H_2N-CH_2-COOH. Alanine: $CH_3-CH(NH_2)-COOH$.

Question 78: What is hardening of oils? Give reaction.

Answer: Hardening of oils is the catalytic hydrogenation of unsaturated vegetable oils (liquids) into solid fats (like margarine/banaspati ghee). It involves adding hydrogen gas across the double bonds of the oil at $200°C$ using a Nickel catalyst. Reaction: Liquid Oil + $H_2 \xrightarrow{Ni,200°C}$ Solid Fat.

Answer: The saponification number is defined as the number of milligrams of potassium hydroxide (KOH) required to completely saponify one gram of fat or oil. It gives an indication of the average molecular mass of the fatty acids present.

Question 80: What is meant by addition polymerization? Give an example.

Answer: Addition polymerization involves the repeated addition of identical unsaturated monomer molecules to each other without the elimination of any small molecules. An example is the polymerization of ethene into polyethene under high temperature and pressure.

Question 81: Give structures of the monomers of polyvinyl chloride and polystyrene.

Answer: The monomer of polyvinyl chloride (PVC) is vinyl chloride: $CH_2=CH-Cl$. The monomer of polystyrene is styrene (vinyl benzene): $C_6H_5-CH=CH_2$.

Question 82: How polyvinyl acetate is formed? Write its equation.

Answer: Polyvinyl acetate is formed by the addition polymerization of vinyl acetate monomers in the presence of a peroxide initiator. Equation: $n(CH_2=CH-O-CO-CH_3) \xrightarrow{\text{Polymerization}} -[CH_2-CH(O-CO-CH_3)]_n-$.

Question 83: What are freons and teflon?

Answer: Freons are commercially produced low molecular mass chlorofluorocarbons (like CCl_2F_2) used as refrigerants and aerosol propellants. Teflon (polytetrafluoroethylene) is a highly resistant, non-stick plastic polymer made by polymerizing tetrafluoroethylene ($CF_2=CF_2$).

Question 84: Write down four essential qualities of a good fertilizer.

Answer: A good fertilizer must: 1. Readily dissolve in water. 2. Not be injurious to plant roots. 3. Be stable so that its elements are accessible over a longer period. 4. Contain the required nutrient elements (N, P, K) in substantial amounts to easily make up soil deficiencies.

Question 85: Mention raw materials used for cement.

Answer: The essential raw materials used in cement manufacturing are calcareous materials (like limestone, chalk, or marble to provide CaO) and argillaceous materials (like clay or shale to provide silica, alumina, and iron oxide), along with a small percentage of gypsum added during grinding.

Short Questions NO.3

Question 1: What is bleaching powder? How is it prepared commercially? Give its uses.

Answer: Bleaching powder is a mixture of calcium hypochlorite and basic calcium chloride, represented as $Ca(OCl)Cl$. It is prepared commercially by passing chlorine gas over dry slaked lime in Hasenclever's or Beckman's plant. Reaction: $Ca(OH)_2+Cl_2 \rightarrow Ca(OCl)Cl+H_2O$. It is used for bleaching cotton, linen, and paper pulp, and for sterilizing water.

Question 2: What are disproportionation reactions? Explain your answer with an example.

Answer: A reaction in which a single substance undergoes simultaneous oxidation and reduction is called a disproportionation reaction. For example, when chlorine reacts with cold dilute NaOH, it is oxidized to sodium hypochlorite (+1) and reduced to sodium chloride (-1): $2NaOH+Cl_2 \rightarrow NaCl+NaClO+H_2O$.

Question 3: Discuss the various commercial uses of halogens and their compounds.

Answer: Fluorine is used to manufacture freons and Teflon. Chlorine is used for bleaching, making PVC, and as a water disinfectant. Bromine is used to make ethylene dibromide (lead scavenger) and silver bromide (photography). Iodine is used in pharmaceuticals as a germicide and in tincture of iodine.

Question 4: What are noble gases? Explain their inertness on the basis of their electronic configuration.

Answer: Noble gases are the elements of Group VIIIA (He, Ne, Ar, Kr, Xe, Rn). They are chemically inert because their outermost s and p orbitals are completely filled (ns^2np^6, except He which is $1s^2$). This stable

closed-shell octet configuration leaves no vacancies, making them highly reluctant to gain, lose, or share electrons.

Question 5: Write notes on the following: (i) Oxyfluorides of xenon. (ii) Applications of noble gases.

Answer: (i) Xenon forms oxyfluorides like $XeOF_2$, $XeOF_4$, and XeO_2F_2 by partial hydrolysis of its fluorides. For example: $XeF_4 + H_2O \rightarrow XeOF_2 + 2HF$. (ii) Helium is used in weather balloons and deep-sea diving gas mixtures. Neon is used in advertising glow tubes. Argon provides an inert atmosphere in welding and incandescent light bulbs.

Question 6: What is "Iodized Salt"?

Answer: Iodized salt is table salt (NaCl) that has been mixed with a minute amount of iodine-containing salts, such as potassium iodide (KI) or potassium iodate (KIO_3). It is essential in the human diet to prevent iodine deficiency, which causes goiter (enlargement of the thyroid gland).

Question 7: What are Freons and Teflon?

Answer: Freons are chlorofluorocarbons (like CCl_2F_2) used extensively as refrigerants and aerosol propellants. Teflon is a synthetic non-stick, corrosion-resistant plastic polymer made by the polymerization of tetrafluoroethylene ($CF_2 = CF_2$).

Question 8: Why is HF a weaker acid than other halogen acids?

Answer: HF is a weak acid due to its exceptionally strong hydrogen bonding, which traps the proton, and the high bond dissociation energy of the H-F bond. This makes it difficult for HF to completely ionize and release protons in an aqueous solution compared to the larger, weaker bonds in HCl, HBr, and HI.

Question 9: How does fluorine differ from its family members?

Answer: Fluorine differs from other halogens due to its small size, highest electronegativity, and low F-F bond dissociation energy. It only exhibits a -1 oxidation state (others show positive states too), forms extensive hydrogen bonds, and its compounds are predominantly ionic and highly stable.

Question 10: Why is the oxidizing power of F_2 higher than other halogens?

Answer: Fluorine is the most powerful oxidizing agent because of its low bond dissociation energy ($158\ kJ/mol$) and its remarkably high hydration energy for the fluoride ion. This allows it to readily accept electrons and reduce itself while oxidizing other elements easily.

Question 11: Perchloric acid ($HClO_4$) is considered as a valuable analytical reagent. Why?

Answer: Perchloric acid is the strongest known oxyacid. It is a valuable analytical reagent because its conjugate base, the perchlorate ion (ClO_4^-), is an extremely weak nucleophile and a poor ligand. This makes perchloric acid ideal for use in non-aqueous titrations and situations where complex formation must be avoided.

Question 12: Write four properties of hydrogen fluoride.

Answer: 1) HF is a colorless, fuming liquid at room temperature. 2) It has a higher boiling point ($19.5°C$) than other hydrogen halides due to strong hydrogen bonding. 3) It is a weak acid in dilute solutions. 4) It readily attacks glass (SiO_2) to form fluorosilicates.

Question 13: What happens when I_2O_5 reacts with carbon monoxide?

Answer: Iodine pentoxide (I_2O_5) acts as a strong oxidizing agent. When it reacts with carbon monoxide, it quantitatively oxidizes CO to carbon dioxide (CO_2) and is itself reduced to elemental iodine (I_2).
Reaction: $I_2O_5 + 5CO \rightarrow I_2 + 5CO_2$. This reaction is used for the quantitative analysis of CO.

Question 14: What is meant by available chlorine?

Answer: The amount of active chlorine produced by the action of a dilute acid on bleaching powder is called "available chlorine." It indicates the oxidizing or bleaching strength of the powder. An average sample of bleaching powder contains 35-40% available chlorine. Reaction: $Ca(OCl)Cl + H_2SO_4 \rightarrow CaSO_4 + H_2O + Cl_2$.

Question 15: How can XeF_2 and XeF_4 be prepared?

Answer: XeF_2 is prepared by heating a mixture of Xe and F_2 in a 2:1 ratio at $400°C$ in a sealed nickel tube: $Xe + F_2 \rightarrow XeF_2$. XeF_4 is prepared by heating Xe and F_2 in a 1:5 ratio at $400°C$ under 6 atm pressure: $Xe + 2F_2 \rightarrow XeF_4$.

Question 16: What are typical and non-typical transition elements? Why are they called so?

Answer: Elements of Group IIB (Zn, Cd, Hg) and Group IIIB (Sc, Y, La) are non-typical transition elements because they do not show typical properties like variable oxidation states or colored compounds (their d-orbitals

are either completely full or empty). Typical transition elements (like Fe, Co, Cu) have partially filled d-orbitals in their common oxidation states and show all characteristic transition properties.

Question 17: Give four important characteristics of Transition elements.

Answer: 1) They exhibit variable oxidation states. 2) They form colored complex compounds. 3) They act as excellent catalysts. 4) Their compounds often exhibit paramagnetism due to unpaired d-electrons.

Question 18: Define interstitial compounds. Give an example.

Answer: Interstitial compounds are non-stoichiometric compounds formed when small non-metal atoms (like H, B, C, N) fit into the empty spaces (interstices) within the crystal lattice of transition metals. Example: Hydrogen can occupy the interstitial spaces in palladium to form an interstitial hydride.

Question 19: What is meant by coordination sphere? Give one example.

Answer: The central metal atom or ion along with its directly attached ligands is enclosed in square brackets and collectively called the coordination sphere. Example: In $K_4[Fe(CN)_6]$, the coordination sphere is the complex anion $[Fe(CN)_6]^{4-}$.

Question 20: Why is maximum paramagnetic strength associated with the middle elements of the d-block series? Answer: Paramagnetism depends directly on the number of unpaired electrons. Elements in the middle of the d-block (like Mn and Fe) have d-orbitals that are half-filled (d^5), giving them the maximum possible number of unpaired electrons (5 or 4), which leads to maximum paramagnetic strength.

Question 21: What are substitutional alloys?

Answer: Substitutional alloys are solid solutions formed when some atoms of the host metal crystal lattice are substituted or replaced by atoms of another transition metal of a similar size. Example: Brass is an alloy where some copper atoms in the lattice are replaced by zinc atoms.

Question 22: Define coordination ligand. Give one example.

Answer: A ligand is an atom, ion, or molecule that donates a pair of electrons to the central transition metal ion to form a coordinate covalent bond. Ligands are Lewis bases. Example: Ammonia ($:NH_3$) acts as a neutral monodentate ligand.

Question 23: What are Chelates? Give an example.

Answer: When a polydentate ligand bonds to the same central metal ion through two or more donor atoms simultaneously, it forms a closed ring structure. This resulting complex is called a chelate. Example: The complex formed between a copper ion (Cu^{2+}) and the bidentate ligand ethylenediamine.

Question 24: Differentiate between wrought iron and steel.

Answer: Wrought iron is the purest commercial form of iron containing 0.12% - 0.25% carbon, making it tough, malleable, and weldable. Steel is an alloy of iron containing 0.25% - 2.25% carbon, making it harder and stronger than wrought iron, with varying properties depending on heat treatment and alloying elements.

Question 25: Under what conditions does aluminum get corroded?

Answer: Aluminum normally resists corrosion due to its protective Al_2O_3 oxide layer. However, it corrodes badly if the aluminum powder is heated to high temperatures, or if it is exposed to concentrated alkaline solutions or salt solutions (like marine environments) which destroy the protective oxide coating.

Question 26: What is sacrificial corrosion?

Answer: Sacrificial corrosion occurs when a more reactive metal is deliberately connected to a less reactive metal to protect the latter from rusting. In galvanizing, zinc (anode) is coated over iron (cathode). If the coating breaks, zinc decays by losing electrons and protects the iron from corroding.

Question 27: What is the chromyl chloride test?

Write the equation. Answer: It is a confirmatory test for chloride ions. When a solid metal chloride is heated with solid potassium dichromate and concentrated H_2SO_4, deep red vapors of chromyl chloride (CrO_2Cl_2) evolve. Reaction: $K_2Cr_2O_7 + 4NaCl + 6H_2SO_4 \rightarrow 2KHSO_4 + 4NaHSO_4 + 2CrO_2Cl_2 + 3H_2O$.

Question 28: Write the structure of the dichromate ion ($Cr_2O_7^{2-}$).

Answer: The dichromate ion consists of two tetrahedral chromate units sharing a common oxygen atom at the vertex. The Cr-O-Cr bond angle is 126°. Two chromium atoms are centrally located, linked by one oxygen bridge, with three terminal oxygens on each Cr atom.

Question 29: Give any two uses of $KMnO_4$.

Answer: 1) It is widely used as a powerful oxidizing agent in laboratory titrations and industrial syntheses. 2) It is used as a disinfectant and germicide for sterilizing water and treating wounds.

Question 30: How does $KMnO_4$ react with Oxalic acid?

Answer: In an acidic medium, potassium permanganate oxidizes oxalic acid into carbon dioxide and water, while the permanganate ion is reduced to the colorless Mn^{2+} ion. Reaction: $2KMnO_4 + 5H_2C_2O_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 10CO_2 + 8H_2O$.

Question 31: What is vital force theory?

Answer: The vital force theory was a widespread 19th-century belief that organic compounds could only be synthesized within living plants and animals under the influence of a mysterious, supernatural "vital force," and could never be artificially synthesized from inorganic materials in a lab.

Question 32: How was the vital force theory rejected by Wohler?

Answer: Friedrich Wöhler rejected the vital force theory in 1828 by synthesizing an organic compound, urea, in the laboratory by heating an inorganic salt, ammonium cyanate. Reaction: $NH_4CNO \xrightarrow{\Delta} NH_2 - CO - NH_2$ (Urea).

Question 33: What is the modern definition of Organic chemistry?

Answer: Organic chemistry is the branch of chemistry that deals with the study of compounds of carbon and hydrogen (hydrocarbons) and their derivatives, encompassing both naturally occurring and synthetic compounds.

Question 34: Define catenation. Answer: Catenation is the unique ability of carbon atoms to covalently link with one another in an endless fashion to form long straight chains, branched chains, and diverse ring structures. This property is primarily responsible for the millions of known organic compounds.

Question 35: Define the term carbonization. Indicate three fractions obtained by the carbonization of coal. Answer: Carbonization (or destructive distillation) is the process of strongly heating coal in the absence of air at $500°C - 1000°C$ to break it down. Three main fractions obtained are: 1) Coke, 2) Coal gas, and 3) Coal tar.

Question 36: What are fossil fuels? How are they formed?

Answer: Fossil fuels (coal, petroleum, and natural gas) are energy-rich carbon reservoirs. They were formed over millions of years inside the earth's crust by the slow biochemical and thermal decomposition of the buried remains of dead plants and animals under high temperature and pressure.

Question 37: What do you know about the cracking of petroleum? Explain.

Answer: Cracking is the thermal decomposition of higher hydrocarbons (having high boiling points) into a variety of lower, more volatile hydrocarbons (like gasoline). For example, heating $C_{16}H_{34}$ to $700°C$ breaks it into smaller alkanes and alkenes, augmenting the supply of motor fuel.

Question 38: What is catalytic cracking?

Answer: Catalytic cracking is the breaking down of higher hydrocarbons at a lower temperature ($500°C$) and lower pressure (2 atm) in the presence of a catalyst, typically a mixture of silica (SiO_2) and alumina (Al_2O_3). It produces better quality gasoline with a higher octane number.

Question 39: Differentiate between Homocyclic and Heterocyclic compounds.

Answer: Homocyclic compounds are cyclic organic compounds whose rings consist exclusively of carbon atoms (e.g., Benzene, Cyclohexane). Heterocyclic compounds have rings containing one or more heteroatoms (like N, O, or S) in addition to carbon atoms (e.g., Pyridine, Furan).

Question 40: What are Alicyclic compounds? Give two examples.

Answer: Alicyclic compounds are homocyclic compounds that contain a ring of three or more carbon atoms but behave and resemble aliphatic, open-chain compounds in their properties rather than aromatic ones. Examples: Cyclopropane and Cyclohexane.

Question 41: Define functional group. Give two examples of oxygen-containing functional groups. Answer: A functional group is an atom, group of atoms, or a multiple bond that imparts characteristic chemical properties to an organic molecule. Two oxygen-containing examples are the Hydroxyl group (-OH, in alcohols) and the Carboxyl group (-COOH, in carboxylic acids).

Question 42: What is orbital hybridization? Explain sp^3, sp^2 and sp modes of hybridization of carbon.

Answer: Hybridization is the mixing of atomic orbitals of different energies to form new equivalent hybrid orbitals. sp^3 mixes one 's' and three 'p' orbitals for tetrahedral alkanes; sp^2 mixes one 's' and two 'p' orbitals for planar alkenes; sp mixes one 's' and one 'p' orbital for linear alkynes.

Question 43: Explain geometrical isomerism with an example.
Answer: Geometrical (cis-trans) isomerism arises due to the restricted rotation around a carbon-carbon double bond, leading to different spatial arrangements of attached groups. Example: In cis-2-butene, both methyl groups are on the same side of the double bond, while in trans-2-butene, they are on opposite sides.
Question 44: Define metamerism with an example.
Answer: Metamerism is a type of structural isomerism that arises due to the unequal distribution of carbon atoms on either side of the same polyvalent functional group. Example: Diethyl ether ($CH_3CH_2 - O - CH_2CH_3$) and methyl n-propyl ether ($CH_3 - O - CH_2CH_2CH_3$) are metamers.
Question 45: Describe position isomerism with an example.
Answer: Position isomerism occurs when compounds have the same carbon skeleton and functional group, but the position of the functional group on the chain differs. Example: 1-chloropropane ($CH_3 - CH_2 - CH_2 - Cl$) and 2-chloropropane ($CH_3 - CHCl - CH_3$).
Question 46: Explain the free radical mechanism for the reaction of chlorine with methane in the presence of sunlight.
Answer: The reaction proceeds in three steps: 1) Initiation: Sunlight homolytically cleaves Cl_2 into reactive chlorine free radicals ($Cl^{\cdot}$). 2) Propagation: $Cl^{\cdot}$ abstracts a hydrogen from methane, forming a methyl radical ($CH_3^{\cdot}$), which reacts with another Cl_2 to form CH_3Cl and a new $Cl^{\cdot}$. 3) Termination: Radicals combine to end the chain (e.g., $CH_3^{\cdot} + Cl^{\cdot} \rightarrow CH_3Cl$).
Question 47: What is meant by octane number? Why does a high octane fuel have a lesser tendency to knock in an automobile engine?
Answer: Octane number is an arbitrary scale indicating the anti-knock quality of a fuel, with isooctane rated at 100. High octane fuel consists of highly branched hydrocarbons, which burn smoothly and uniformly, resisting premature ignition (knocking) and thus maximizing engine efficiency.
Question 48: Write down the mechanism for Kolbe's electrolytic method for the preparation of alkanes.
Answer: Concentrated aqueous sodium acetate ionizes to acetate ions. At the anode, acetate ions lose electrons to form acetate radicals, which rapidly lose CO_2 to yield methyl radicals. Two methyl radicals dimerize to form ethane. Anode: $2CH_3COO^- \rightarrow 2CH_3COO^{\cdot} + 2e^- \rightarrow 2CH_3^{\cdot} + 2CO_2 \rightarrow CH_3 - CH_3$.
Question 49: What is Raney-Nickel? Where is it prepared?
Answer: Raney-Nickel is a highly active, finely divided form of nickel catalyst. It is prepared by treating a Nickel-Aluminum alloy with aqueous caustic soda (NaOH), which dissolves out the aluminum, leaving a porous, highly reactive nickel skeleton used for catalytic hydrogenation.
Question 50: Define Markownikov's Rule and give one example.
Answer: Markownikov's rule states that when an unsymmetrical reagent adds to an unsymmetrical alkene, the negative part of the reagent attaches to the double-bonded carbon that has the lesser number of hydrogen atoms. Example: Addition of HBr to propene gives 2-bromopropane, not 1-bromopropane.
Question 51: Give the mechanism of bromination of ethene.
Answer: It's an electrophilic addition. The Br_2 molecule is polarized by the alkene's pi-electrons. A positive bromine atom (Br^+) transfers to the ethene, forming a cyclic bromonium ion intermediate. Finally, the nucleophilic bromide ion (Br^-) attacks from the opposite side to form trans-1,2-dibromoethane.
Question 52: How is trans-2-Butene prepared from an alkyne? Give its chemical reaction.
Answer: Trans-alkenes are prepared by the controlled, partial reduction of alkynes using sodium (Na) metal dissolved in liquid ammonia (NH_3) at $-33°C$. Reaction: $CH_3 - C \equiv C - CH_3 + 2[H] \xrightarrow{Na/liq.NH_3} trans - CH_3 - CH = CH - CH_3$.
Question 53: What happens when a vic-dihalide is treated with Zn-dust?
Answer: A vicinal dihalide undergoes dehalogenation when heated with zinc dust in an anhydrous solvent like methanol. The zinc extracts both adjacent halogen atoms to form zinc halide, creating a carbon-carbon double bond (an alkene). Reaction: $R - CHBr - CH_2Br + Zn \xrightarrow{CH_3OH} R - CH = CH_2 + ZnBr_2$.
Question 54: How does ethyne react with Alkaline $KMnO_4$?

Answer: Ethyne undergoes oxidative cleavage when treated with a strong oxidizing agent like alkaline $KMnO_4$. The triple bond is fully oxidized, adding oxygen and cleaving to ultimately produce oxalic acid ($HOOC - COOH$) after passing through intermediate stages like glyoxal.

Question 55: How will you synthesize Benzene and Chloroprene starting from ethyne?

Answer: 1) Benzene is synthesized by passing ethyne gas through a red-hot copper tube at $300°C$, causing catalytic trimerization. 2) Chloroprene is made by dimerizing ethyne with Cu_2Cl_2/NH_4Cl to vinylacetylene, which then adds HCl to yield chloroprene ($CH_2 = C(Cl) - CH = CH_2$).

Question 56: Compare the reactivity of ethane, ethene, and ethyne.

Answer: The order of reactivity is Ethene > Ethyne > Ethane. Ethene's pi-bond is highly exposed and reactive to electrophiles. Ethyne has two pi-bonds, but its sp-hybridized carbons hold the electrons tighter, making it less reactive than ethene toward electrophiles. Ethane, with only strong sigma bonds, is the least reactive.

Question 57: Distinguish ethene from ethyne by a chemical reaction.

Answer: Ethyne, being a terminal alkyne with an acidic hydrogen, reacts with ammoniacal silver nitrate solution ($AgNO_3/NH_4OH$) to form a white precipitate of disilver acetylide ($Ag - C \equiv C - Ag$). Ethene does not possess acidic hydrogens and gives no reaction.

Question 58: Why are alkynes slightly acidic in nature? Justify with an example.

Answer: In terminal alkynes, the carbon atom is sp-hybridized, possessing 50% s-character. This draws the bonding electrons closer to the carbon nucleus, making the attached hydrogen atom act as a proton (slightly acidic). Example: Ethyne reacts with active sodium to form sodium acetylide ($HC \equiv C^-Na^+$) and liberates H_2 gas.

Question 59: Convert propyne into acetone.

Answer: Propyne undergoes hydration when passed through hot aqueous H_2SO_4 containing $HgSO_4$ at $75°C$. According to Markownikov's rule, water adds to form an unstable enol (1-propen-2-ol), which immediately tautomerizes to the stable ketone, acetone ($CH_3 - CO - CH_3$).

Question 60: Benzene is a polymer of acetylene. Justify.

Answer: Benzene (C_6H_6) can be considered a polymer (specifically, a cyclic trimer) of acetylene (C_2H_2) because it is synthesized by joining three molecules of acetylene together. This is achieved practically by passing acetylene through a hot copper tube at $300°C$, yielding benzene.

Question 61: How will you distinguish between Methanal and ethanal?

Answer: Methanal (formaldehyde) and ethanal (acetaldehyde) can be distinguished by the Iodoform test. Ethanal, having a methyl group attached to the carbonyl carbon, reacts with Iodine and NaOH to give a yellow precipitate of Iodoform (CHI_3). Methanal lacks this group and gives no reaction.

Question 62: What is the difference between an Aldehyde and a Ketone?

Answer: Both contain a carbonyl group ($> C = O$). In aldehydes, the carbonyl carbon is bonded to at least one hydrogen atom, placing it at the end of a carbon chain. In ketones, the carbonyl carbon is bonded to two carbon atoms, placing it strictly within the interior of a carbon chain.

Question 63: Give one laboratory and one industrial method for the preparation of formaldehyde. Answer: Laboratory: Passing a mixture of methyl alcohol vapors and air over a platinized asbestos catalyst at $300°C$. Industrial: Catalytic oxidation of methanol over a heated silver or iron-molybdenum oxide catalyst at $500°C$. $2CH_3OH + O_2 \xrightarrow{Ag} 2HCHO + 2H_2O$.

Question 64: Describe with mechanism the aldol condensation reaction. Why does formaldehyde not give this reaction?

Answer: Two molecules of an aldehyde or ketone possessing an alpha-hydrogen react in the presence of dilute base to form a beta-hydroxy aldehyde (aldol). The base removes an alpha-proton to form a nucleophilic enolate ion, which attacks the carbonyl carbon of the second molecule. Formaldehyde ($HCHO$) lacks alpha-hydrogens, so it cannot form an enolate and fails this reaction.

Question 65: What types of aldehydes give Cannizzaro's reaction? Give its mechanism.

Answer: Aldehydes lacking alpha-hydrogens (e.g., formaldehyde, benzaldehyde) undergo Cannizzaro's disproportionation reaction with concentrated NaOH. Mechanism: A hydroxide ion attacks the carbonyl carbon,

forming an anion. This anion transfers a hydride ion (H^-) to a second aldehyde molecule, reducing it to an alcohol, while the first oxidizes to a carboxylic acid salt.

Question 66: Explain the mechanism of the reaction of phenylhydrazine with acetone.

Answer: This is an acid-catalyzed nucleophilic addition-elimination reaction. The nucleophilic nitrogen of phenylhydrazine attacks the protonated carbonyl carbon of acetone, forming an unstable intermediate. This intermediate rapidly loses a water molecule (elimination) to form a double bond, resulting in acetone phenylhydrazone.

Question 67: Give the mechanism of addition of HCN to acetone.

Answer: Base-catalyzed generation of the strong nucleophile, cyanide ion (CN^-), initiates the reaction. The CN^- attacks the electrophilic carbonyl carbon of acetone to form an alkoxide ion intermediate. The alkoxide ion then accepts a proton from water or HCN to yield the final product, acetone cyanohydrin.

Question 68: What is the "Haloform Reaction"? Give its uses.

Answer: Acetaldehyde, methyl ketones, and secondary alcohols with a methyl group react with halogen and aqueous NaOH to form a haloform (CHX_3) and the sodium salt of a carboxylic acid. It is widely used analytically (specifically the Iodoform test) to detect the presence of the CH_3CO- or $CH_3CH(OH)-$ groups by yielding yellow iodoform crystals.

Question 69: How can the iodoform test be used to distinguish methyl ketones from other ketones?

Answer: Methyl ketones (like acetone) have the required CH_3CO- unit and react positively with Iodine and NaOH, producing a bright yellow precipitate of iodoform (CHI_3). Other ketones (like 3-pentanone) lack this methyl group adjacent to the carbonyl and give a negative test.

Question 70: Write a reaction which is used to protect an aldehyde group against an alkaline oxidizing agent.

Answer: Aldehydes react with dry HCl and an alcohol (like ethanol) to form acetals. Acetals are stable to bases and alkaline oxidizing agents. Reaction: $R-CHO+2C_2H_5OH \xrightarrow{dryHCl} R-CH(OC_2H_5)_2+H_2O$. The acetal protects the aldehyde and can be later hydrolyzed back by acid.

Question 71: Discuss the oxidation of Ketones with $K_2Cr_2O_7/H_2SO_4$.

Answer: Ketones are resistant to mild oxidation but undergo oxidative cleavage with strong agents like acidified $K_2Cr_2O_7$ under vigorous conditions. The carbon-carbon bond adjacent to the carbonyl group breaks, forming a mixture of carboxylic acids with fewer carbon atoms than the original ketone.

Question 72: What is the sodium bisulphite test?

Answer: When shaken with a saturated aqueous solution of sodium bisulphite ($NaHSO_3$), aldehydes and small methyl ketones undergo nucleophilic addition to form white, crystalline bisulphite addition products. The crystals can be filtered and treated with acid/base to regenerate the pure aldehyde/ketone, making it useful for purification.

Question 73: What is the "Fehling's solution test" for aldehydes?

Answer: Fehling's solution is an alkaline complex of Cu^{2+} (using tartrate). When heated with an aliphatic aldehyde, the aldehyde is oxidized to an acid, and the Cu^{2+} is reduced to Cu^+, depositing a brick-red precipitate of cuprous oxide (Cu_2O). Ketones do not give this test.

Question 74: What is Benedict's solution test? Also, give its reaction with formaldehyde.

Answer: Benedict's solution uses a citrate complex of Cu^{2+} to test for aliphatic aldehydes. Formaldehyde reduces the cupric ions to a brick-red precipitate of Cu_2O. Reaction: $HCHO+2Cu(OH)_2+NaOH \xrightarrow{\Delta} HCOONa+Cu_2O\downarrow$ (brick-red) $+3H_2O$.

Question 75: Write down four uses of formaldehyde.

Answer: 1) Its 40% aqueous solution (formalin) is used as a biological preservative. 2) Used to manufacture synthetic resins like Bakelite and Formica. 3) Used in making Urotropine, a urinary antiseptic. 4) Used in the silvering of mirrors as a reducing agent.

Question 76: What are fatty acids? Give an example.

Answer: Fatty acids are aliphatic monocarboxylic acids. They are called fatty acids because higher members of this series (like palmitic and stearic acids) are obtained by the hydrolysis of natural fats and oils. Example: Acetic acid (CH_3COOH) or Stearic acid ($C_{17}H_{35}COOH$).

2. The electrophile attacks the π-electron cloud of benzene to form a resonance-stabilized carbocation intermediate (the sigma complex).
3. A base removes a proton (H^+) from the sp3 carbon of the intermediate, restoring the aromatic π system and yielding the substituted product.

What are Friedel-Crafts reactions? Give a mechanism with an example of Friedel-Crafts alkylation. Answer: These are reactions used to introduce an alkyl or acyl group onto a benzene ring using a Lewis acid catalyst ($AlCl_3$). Alkylation Example: Benzene + CH_3Cl in the presence of $AlCl_3$ yields Toluene. Mechanism: $CH_3Cl + AlCl_3 \rightarrow CH_3^+$ (electrophile) + $AlCl_4^-$. The CH_3^+ attacks the benzene ring to form a carbonium ion intermediate, which then loses a proton to $AlCl_4^-$ to form toluene, HCl, and regenerate $AlCl_3$.

Detail out three reactions in which benzene behaves as if it is a saturated hydrocarbon and three reactions in which it behaves as if it is unsaturated.

Answer: Saturated behavior (Substitution reactions): 1) Nitration (HNO_3/H_2SO_4). 2) Sulphonation (conc. H_2SO_4). 3) Halogenation in the presence of $FeCl_3$. Unsaturated behavior (Addition reactions): 1) Catalytic hydrogenation to cyclohexane. 2) Addition of Cl_2 in sunlight to form Benzene Hexachloride. 3) Ozonolysis to form glyoxal.

What is the general pattern of reactivity of benzene towards electrophiles?

Answer: The dense π-electron cloud of benzene acts as a nucleophile, making it highly attractive to electrophilic attack. However, because addition would destroy its exceptional aromatic stability, benzene overwhelmingly undergoes electrophilic *substitution* reactions to preserve the resonance-stabilized ring.

Why is the hydroxyl group (-OH) an ortho and para directing group?

Answer: The oxygen atom in the -OH group has lone pairs of electrons that it donates to the benzene ring via the resonance effect. This effectively increases the electron density on the ring, specifically concentrating it at the ortho and para positions, thus directing incoming electrophiles to those specific sites.

What are primary and tertiary alkyl halides? Give one example each.

Answer: Primary alkyl halides have the halogen attached to a carbon that is directly bonded to at most one other carbon (e.g., Ethyl chloride, CH_3CH_2Cl). Tertiary alkyl halides have the halogen attached to a carbon bonded to three other carbons (e.g., tert-Butyl chloride, $(CH_3)_3C{-}Cl$).

Define alkyl halide. Which is the best method of preparing alkyl halides?

Answer: Alkyl halides (R-X) are halogen derivatives of alkanes. The best preparation method is reacting an alcohol with thionyl chloride ($SOCl_2$) in the presence of pyridine. It is ideal because the byproducts (SO_2 and HCl) are gases that escape, leaving pure alkyl halide behind.

Why are alkyl halides more reactive than alkanes? Answer: Alkanes contain only non-polar, strong C-C and C-H bonds, making them highly unreactive. Alkyl halides contain a highly polar C-X bond due to the halogen's electronegativity. This leaves the carbon atom with a partial positive charge (electrophilic center), making it highly reactive towards nucleophilic attack.

How does bond polarity of the C-X bond affect the reactivity of alkyl halides?

Answer: The polarity of the C-X bond dictates the reaction mechanism. The more electronegative halogen pulls electron density away, creating an electrophilic carbon center. This polar bond attracts nucleophiles to attack the carbon, while the halogen simultaneously acts as a leaving group.

Write a detailed note on the mechanism of nucleophilic substitution reactions.

Answer: In these reactions, an attacking nucleophile displaces a weaker nucleophile (the leaving group) from an alkyl halide. They proceed via two pathways: S_N2 (a one-step concerted mechanism where attack and departure happen simultaneously, favored by primary halides) and S_N1 (a two-step mechanism forming a carbocation intermediate, favored by tertiary halides).

What do you understand by the term beta-elimination reaction? Explain briefly the two possible mechanisms of beta-elimination reactions.

Answer: It is a reaction where a proton is removed from the β-carbon and a halogen from the α-carbon to form an alkene. E2 mechanism: A single-step concerted process where a strong base removes the proton exactly as the leaving group departs. E1 mechanism: A two-step process where the leaving group departs first to form a carbocation, followed by the base removing a β-proton.

Answer: Lipids are naturally occurring organic molecules (fats, oils, waxes) that are insoluble in water but soluble in non-polar organic solvents. Saponification Number: The milligrams of KOH required to completely saponify one gram of fat or oil. Iodine Number: The number of grams of iodine absorbed by 100 grams of fat or oil, indicating its degree of unsaturation (double bonds).

Long Questions

Question NO.5

1. What is Mendeleev's periodic table? Discuss improvements in Mendeleev's periodic table.
2. Define ionization energy. How does it vary in a group and periods of the periodic table?
3. What are hydrides? Classify them on the basis of nature of bonding. Explain only ionic hydride in detail.
4. Explain the position of hydrogen over its group of periodic table with two similarities and two differences.
5. Explain the peculiar behavior of Lithium, give eight points.
6. Compare the chemical behaviour of Lithium with magnesium.
7. Explain the peculiar behaviour of beryllium.
8. Describe the process for the preparation of sodium metal on industrial scale by Down's cell? What are the advantages of this process?
9. Describe the commercial preparation of sodium hydroxide by Diaphragm cell with diagram.
10. Give four applications of lime in agriculture and four applications in industry.

Question NO.6

1. How is potassium permanganate (KMnO4) prepared by (i) Stadeler's process and (ii) Electrolytic oxidation process?
2. Explain the following properties of Transition metals in detail: (i) Paramagnetism (ii) Colour.
3. Describe Bessemer's Process for the manufacture of steel with the help of a diagram.
4. Explain the following terms with an example for each: (a) Ligand (b) Coordination sphere (c) Central metal atom (d) Substitutional alloy.
5. Describe the electrochemical theory to explain the corrosion of metals.
6. What is the ozone layer and where does it exist? Describe the role of chlorofluorocarbons (CFCs) in destroying ozone and the effects of its depletion.
7. What is acid rain? Write down its causes and explain how it affects our environment.
8. What is smog? Explain the pollutants which are the main cause of photochemical smog and write the conditions required for its formation.
9. Describe briefly how water is purified by the processes of aeration and coagulation.
10. What is meant by solid waste management? Explain the process of incineration of industrial and municipal waste.

Question NO.7

1. What is orbital hybridization? Explain the sp^3, sp^2, and sp modes of hybridization of carbon with respect to the structures of ethane, ethene, and ethyne, respectively.
2. What is cracking of petroleum? Describe its significance and explain the different types of cracking (thermal, catalytic, and steam cracking).
3. What is Isomerism? Explain structural isomerism and its various types (chain, position, functional group, metamerism, and tautomerism) with suitable examples.
4. Discuss geometrical (cis-trans) isomerism. Why is there no free rotation around a carbon-carbon double bond? Explain the necessary conditions for a compound to exhibit geometrical isomerism, giving two examples.
5. Describe Aldol Condensation with a detailed reaction mechanism. Why does formaldehyde not undergo this reaction? Give an example of aldol condensation using ethanal.

Answer: a) Aldehydes: Due to the hydrogen attached to the carbonyl, they are easily oxidized by acidified $K_2Cr_2O_7$ into carboxylic acids containing the exact same number of carbon atoms. b) Ketones: They strongly resist oxidation. Under extreme, vigorous conditions, the C-C bond adjacent to the carbonyl cleaves, producing a mixture of carboxylic acids with fewer carbon atoms than the original ketone.

What is the silver mirror test? Give an example.

Answer: Also known as Tollens' test, it is used to identify aldehydes. When an aldehyde is warmed with Tollens' reagent (ammoniacal silver nitrate), the aldehyde is oxidized to an acid, and the silver ions (Ag^+) are reduced to metallic silver, which deposits as a brilliant mirror on the inner wall of the test tube. Example: Acetaldehyde + Tollens' reagent → Acetic Acid + Silver mirror.

What is the "Fehling's solution test" for aldehydes?

Answer: Fehling's solution is an alkaline complex of Cu^{2+} ions. When boiled with an aliphatic aldehyde, the aldehyde is oxidized, and the blue Cu^{2+} ions are reduced to cuprous oxide (Cu_2O), which precipitates as a characteristic brick-red solid. Ketones do not respond to this test.

How does formaldehyde react with NH_2OH?

Answer: Formaldehyde undergoes a nucleophilic addition-elimination condensation reaction with hydroxylamine (NH_2OH) in weakly acidic conditions. The molecules combine and eliminate a water molecule to form formaldehyde oxime. Reaction: $HCHO + H_2N - OH \rightarrow H_2C = N - OH + H_2O$.

Write four important uses of Acetaldehyde.

Answer: 1) To manufacture acetic acid commercially. 2) To prepare chloral, a raw material for synthesizing the insecticide DDT. 3) To manufacture ethyl acetate and ethanol. 4) To produce paraldehyde (a hypnotic sleep-inducing drug) and metaldehyde (used as a solid fuel and slug poison).

What are fatty acids? Why is this name used? Give two examples.

Answer: Fatty acids are aliphatic monocarboxylic acids. The name was adopted because higher molecular weight members of this series (typically with long unbranched chains) were originally obtained by the hydrolysis of naturally occurring animal fats and vegetable oils. Examples: Palmitic acid ($C_{15}H_{31}COOH$) and Stearic acid ($C_{17}H_{35}COOH$).

Why is the boiling point of carboxylic acids relatively high?

Answer: Carboxylic acids have intensely polar carboxyl (-COOH) groups capable of forming strong and extensive intermolecular hydrogen bonds. This tightly associates the molecules in the liquid phase, requiring a large amount of thermal energy to separate them, yielding higher boiling points than alcohols of similar mass.

Why do most carboxylic acids exist as dimers?

Answer: In the liquid or vapor state, carboxylic acids stabilize themselves by forming cyclic dimers. Two molecules align such that the partially positive hydrogen of one hydroxyl group forms a hydrogen bond with the partially negative carbonyl oxygen of the other, effectively doubling the apparent molecular mass.

How are carboxylic acids prepared by the oxidation of alkenes?

Answer: When symmetrical alkenes are heated with a strong oxidizing agent like alkaline $KMnO_4$, the carbon-carbon double bond undergoes complete oxidative cleavage. The molecule splits at the double bond, heavily oxidizing the carbons to yield two moles of carboxylic acid. (e.g., 2-butene yields two moles of acetic acid).

Write the mechanism of the reaction between acetic acid and Ammonia.

Answer: It is a two-step process. First, an acid-base neutralization occurs: the acetic acid donates a proton to ammonia to form a stable salt, ammonium acetate (CH_3COONH_4). Upon strong heating, this solid salt undergoes dehydration (loses a molecule of H_2O) to form an amide known as acetamide (CH_3CONH_2).

What is vinegar? Describe how vinegar is prepared from ethanol.

Answer: Vinegar is a 6-8% dilute aqueous solution of acetic acid. Commercially, it is prepared by the Quick Vinegar process, where dilute ethanol is oxidized by atmospheric oxygen. The reaction is enzymatically catalyzed by aerobic *Acetobacter* bacteria present on wooden shavings in a vat.

What are amino acids? Explain their different types with one example in each case.

Answer: Amino acids are organic molecules containing both a basic amino group ($-NH_2$) and an acidic carboxyl group ($-COOH$). Based on the relative position of the amino group to the carboxyl, they are: α-amino acids

Question 89: What are essential and Non-essential amino acids?
Answer: Essential amino acids (e.g., Valine, Leucine) cannot be synthesized by the human body and must be supplied through the diet. Non-essential amino acids (e.g., Glycine, Alanine) can be synthesized by the body from other metabolic intermediates and are not strictly required in the diet.
Question 90: What is the difference between a protein and a polypeptide?
Answer: Both are chains of amino acids linked by peptide bonds. A polypeptide generally refers to a shorter chain with a molecular weight of less than 10,000. A protein is a much larger, complex macromolecule with a molecular weight greater than 10,000, possessing highly specific 3D structures and biological functions.

Short Questions NO.4

What are aromatic hydrocarbons? How are they classified? Answer: Aromatic hydrocarbons are closed-ring organic compounds that contain at least one benzene ring or exhibit benzene-like stability. They are classified into monocyclic (containing a single benzene ring, e.g., benzene, toluene) and polycyclic (containing two or more fused or isolated benzene rings, e.g., naphthalene, biphenyl).
What is meant by the term: Aromatic?
Answer: Originally derived from "aroma" (sweet-smelling), the term now describes a class of planar, cyclic compounds that possess a continuous delocalized π-electron cloud. They follow Hückel's Rule ($4n + 2\ \pi$ electrons) and exhibit exceptional chemical stability, preferring substitution reactions over addition.
What are polycyclic aromatic hydrocarbons? Give two examples.
Answer: These are aromatic compounds whose molecules contain two or more benzene rings. They can be isolated (rings connected by a single bond) or fused (rings sharing carbon atoms). Examples: Naphthalene (fused rings) and Biphenyl (isolated rings).
Prove that benzene has a cyclic structure.
Answer: Benzene reacts with exactly three molecules of hydrogen (H_2) in the presence of a Nickel catalyst at 200°C to form cyclohexane. Similarly, it adds three molecules of chlorine (Cl_2) in sunlight to form Benzene Hexachloride ($C_6H_6Cl_6$). The addition of exactly three moles of reagent proves the presence of three double bonds within a closed, continuous ring.
Describe the structure of Benzene on the basis of Resonance method.
Answer: According to resonance theory, benzene is not a single static structure but a resonance hybrid of two Kekulé structures (alternating single and double bonds) and three Dewar structures. All carbon-carbon bond lengths are perfectly equal (1.397 Å), representing a continuous, completely delocalized π-electron cloud above and below the carbon ring.
What is aromatization? Answer: The conversion of open-chain aliphatic hydrocarbons (having 6 or more carbon atoms) into aromatic ring compounds like benzene is called aromatization. It requires high temperature (500°C) and a catalyst (e.g., Cr_2O_3/Al_2O_3). For example, converting n-hexane into benzene.
How is benzene prepared from sodium benzoate and phenol?
Answer: From Sodium Benzoate: Heated with soda lime (NaOH + CaO), it undergoes decarboxylation to yield benzene. From Phenol: Phenol vapors are distilled with zinc dust, which reduces the phenol to yield benzene and zinc oxide ($C_6H_5OH + Zn \rightarrow C_6H_6 + ZnO$).
Benzene can be prepared commercially from acetylene. Give reaction with conditions.
Answer: Acetylene undergoes cyclic trimerization to form benzene when it is passed through a red-hot copper tube at 300°C. Reaction: $3C_2H_2 \xrightarrow{Cu,300°C} C_6H_6$.
What is the Wurtz-Fittig reaction? Answer: An extension of the Wurtz reaction used to synthesize alkylbenzenes. A mixture of an aryl halide and an alkyl halide is reacted with sodium metal in the presence of dry ether. Reaction: $C_6H_5Br + CH_3Br + 2Na \xrightarrow{ether} C_6H_5 - CH_3$ (Toluene) $+ 2NaBr$.
Give the general mechanism of the electrophilic aromatic substitution reactions.
Answer: The mechanism involves three steps:

1. Generation of a strong electrophile (E^+).

(attached to the adjacent carbon, e.g., Glycine), β-amino acids (attached to the second carbon, e.g., β-alanine), and γ-amino acids (e.g., γ-aminobutyric acid).

Write a short note on the acidic and basic characters of an amino acid.

Answer: Amino acids are amphoteric species. The carboxyl group functions as an acid by donating a proton, while the amino group functions as a base by accepting a proton. This allows the molecule to buffer solutions effectively by neutralizing both added acids and added bases.

What is a Zwitterion? Why is it called an internal salt?

Answer: A Zwitterion (dipolar ion) is a neutral molecule carrying both a localized positive and negative charge. In an amino acid, the acidic -COOH group transfers its proton to the basic $-NH_2$ group to form $-COO^-$ and $-NH_3^+$. It is an "internal salt" because the acid-base neutralization reaction occurred entirely within the same molecule.

What is a peptide bond? Give the formula of a dipeptide.

Answer: A peptide bond is the specific amide linkage ($-CO-NH-$) formed when the carboxyl group of one amino acid reacts with the amino group of another amino acid, releasing a molecule of water. Formula of a dipeptide (Glycylalanine): $H_2N-CH_2-CO-NH-CH(CH_3)-COOH$.

What are polymers? Give two examples.

Answer: Polymers are giant macromolecules formed by the repetitive chemical linking of thousands of small, identical or similar basic units called monomers. Examples: Polyethylene (used in plastic bags) and Nylon-6,6 (used in textiles).

Differentiate between thermoplastic and thermosetting polymers.

Answer: Thermoplastics (e.g., PVC, Polystyrene) consist of long, unlinked polymer chains; they soften upon heating and harden on cooling repeatedly, allowing them to be easily remolded. Thermosetting polymers (e.g., Bakelite) undergo irreversible chemical cross-linking when heated, forming a rigid 3D network that cannot be melted or reshaped again.

What is condensation polymerization? Give an example.

Answer: A polymerization process where bi-functional or poly-functional monomers link together, accompanied by the continuous elimination of small byproduct molecules like water, HCl, or ammonia. Example: The formation of Nylon-6,6 from hexamethylenediamine and adipic acid, which eliminates water.

How is PVC prepared? Give its uses. Answer: Polyvinyl Chloride (PVC) is prepared by the addition polymerization of vinyl chloride monomers ($CH_2=CHCl$) at 52°C and 9 atm pressure, using an organic peroxide as an initiator. Uses: Manufacturing pipes, raincoats, vinyl flooring, and insulation for electrical cables.

What are carbohydrates and how are they classified?

Answer: Carbohydrates are polyhydroxy aldehydes or ketones, or complex substances that yield these upon hydrolysis. They are classified into: Monosaccharides (simple sugars that cannot be hydrolyzed, e.g., glucose), Oligosaccharides (yield 2 to 9 monosaccharides on hydrolysis, e.g., sucrose), and Polysaccharides (yield hundreds of monosaccharides, e.g., starch).

What is the difference between Glucose and Fructose?

Answer: While both are isomeric monosaccharides with the formula $C_6H_{12}O_6$, Glucose is an aldohexose containing a terminal aldehyde functional group and forms a six-membered ring. Fructose is a ketohexose containing an internal ketone functional group and typically forms a five-membered ring.

Differentiate between glycosidic linkage and peptide linkage.

Answer: A glycosidic linkage ($C-O-C$) is an ether-like bond that joins individual monosaccharide units together to build carbohydrates. A peptide linkage ($-CO-NH-$) is an amide bond that joins amino acids together to build proteins. Both linkages are formed via condensation reactions that eliminate water.

What is the denaturation of proteins?

Answer: Denaturation is the disruption of the highly ordered secondary, tertiary, or quaternary physical structure of a protein, usually caused by heat, radiation, or extreme changes in pH. This unfolds the protein chain, resulting in the complete loss of its biological activity, though the primary peptide bonds remain intact.

What are lipids? Define saponification number and iodine number.

Define oxonium ion. Answer: An oxonium ion is a positively charged oxygen atom that is bonded to three other atoms or groups, possessing a full octet. Ethers act as Lewis bases; when treated with strong mineral acids, the ether oxygen accepts a proton to form a highly stable dialkyloxonium ion salt.

What is the difference between an Aldehyde and a Ketone?

Answer: In an aldehyde, the carbonyl carbon ($C = O$) is bonded to at least one hydrogen atom, placing it at the terminus of a carbon chain. In a ketone, the carbonyl carbon is bonded to two distinct carbon atoms, placing it within the interior of the carbon chain.

Give one laboratory and one industrial method for the preparation of formaldehyde.

Answer: Laboratory Method: Passing a mixture of methyl alcohol vapors and air over a platinized asbestos catalyst at 300°C. Industrial Method: Catalytic oxidation of methanol by passing it with air over an iron oxide-molybdenum oxide catalyst at 500°C.

Describe with mechanism the aldol condensation reaction. Why does formaldehyde not give this reaction?

Answer: Two molecules of an aldehyde or ketone possessing an α-hydrogen react in dilute base to form a β-hydroxy carbonyl compound (an aldol). Mechanism: The base removes an α-hydrogen to form a nucleophilic enolate ion. This enolate attacks the carbonyl carbon of the second molecule to form the aldol. Formaldehyde ($HCHO$) lacks α-hydrogens, so it cannot form an enolate to initiate the reaction.

What types of aldehydes give Cannizzaro's reaction? Give its mechanism.

Answer: Aldehydes lacking α-hydrogens (like formaldehyde and benzaldehyde) undergo this reaction. Mechanism: A strong hydroxide ion attacks the carbonyl carbon, forming a tetrahedral anion. This intermediate transfers a hydride ion (H^-) to a second aldehyde molecule. One molecule is oxidized to a carboxylic acid salt, while the other is reduced to an alcohol.

Justify that Cannizzaro's reaction is a self-oxidation reduction reaction.

Answer: It is a disproportionation reaction because two molecules of the exact same substance react. One aldehyde molecule accepts a hydride ion and is reduced to a primary alcohol, while the other simultaneously loses the hydride ion and is oxidized to the salt of a carboxylic acid.

Describe briefly the mechanism of nucleophilic addition to a carbonyl compound.

Answer: The highly electronegative oxygen polarizes the C=O bond, making the carbon electrophilic. An incoming nucleophile attacks the carbonyl carbon, breaking the π-bond and pushing electrons onto the oxygen to form a tetrahedral alkoxide intermediate. The alkoxide then accepts a proton from the solvent to yield the final addition product.

Give the mechanism of addition of HCN to acetone.

Answer: The reaction is base-catalyzed to generate the strong nucleophile, cyanide ion (CN^-), from HCN. The CN^- attacks the electrophilic carbonyl carbon of acetone, forming a tetrahedral intermediate. This intermediate abstracts a proton from HCN (regenerating the CN^- catalyst) to form acetone cyanohydrin.

Explain with mechanism the addition of sodium bisulphite to acetone. What is the utility of this reaction?

Answer: When acetone is treated with saturated sodium bisulphite ($NaHSO_3$), the nucleophilic sulfite ion attacks the carbonyl carbon, forming an intermediate that undergoes proton transfer to form a solid crystalline bisulphite addition product. Utility: It is used for the separation and purification of aldehydes and ketones from non-carbonyl mixtures, as they can be easily regenerated by treating the crystals with acid.

What is the "Haloform Reaction"? Give its uses.

Answer: Acetaldehyde, methyl ketones, and secondary alcohols with a methyl group react with halogens (Cl_2, Br_2, I_2) in the presence of NaOH to form a haloform (CHX_3) and the sodium salt of a carboxylic acid. Its primary use (the Iodoform test) is as a diagnostic test to identify the presence of the specific CH_3CO- or $CH_3CH(OH)-$ groups.

How can the iodoform test be used to distinguish methyl ketones from other ketones?

Answer: Methyl ketones possess a terminal methyl group adjacent to the carbonyl (CH_3-CO-). When treated with iodine and NaOH, they yield a distinct, bright yellow precipitate of iodoform (CHI_3). Ketones without this terminal methyl group (like 3-pentanone) will not react and give a negative test.

Discuss the oxidation of (a) aldehydes and (b) ketones with K2Cr2O7 / H2SO4.

Question 77: How is a carboxylic acid prepared from Grignard's reagent?
Answer: Grignard reagents ($RMgX$) react rapidly with solid carbon dioxide (dry ice) in anhydrous ether to form an intermediate magnesium carboxylate complex. Subsequent acid hydrolysis yields the carboxylic acid.
Reaction: $RMgX + CO_2 \rightarrow R - COOMgX \overset{H_2O/H^+}{\rightarrow} R - COOH + Mg(OH)X$.

Question 78: Why is the boiling point of a carboxylic acid relatively high?
Answer: Carboxylic acids have highly polar $-COOH$ groups that form strong, extensive intermolecular hydrogen bonding. This strong association holds the molecules tightly together, requiring significant thermal energy to separate them, resulting in boiling points much higher than corresponding alcohols or alkanes.
Question 79: Why do most carboxylic acids exist as dimers?
Answer: In the liquid or vapor phase, carboxylic acid molecules pair up via cyclic, double hydrogen bonding between the partially positive hydrogen of one molecule's hydroxyl group and the partially negative oxygen of another's carbonyl group. This exceptionally stable arrangement forms a dimer.
Question 80: Write down the mechanism of the reaction of $SOCl_2$ with acetic acid.
Answer: The hydroxyl oxygen of acetic acid attacks thionyl chloride ($SOCl_2$), expelling a chloride ion to form a chlorosulphite intermediate. The chloride ion then attacks the carbonyl carbon, causing the loss of SO_2 gas and HCl gas, leaving behind acetyl chloride (CH_3COCl).
Question 81: Write the mechanism of the reaction between acetic acid and Ammonia.
Answer: Acetic acid and ammonia initially undergo an acid-base neutralization to form a salt, ammonium acetate (CH_3COONH_4). When this solid salt is heated, it undergoes dehydration (loss of a water molecule) to yield acetamide (CH_3CONH_2).
Question 82: How is acetic acid prepared by the oxidation of ethyl alcohol?
Answer: Ethyl alcohol is oxidized by passing it through acidified potassium dichromate ($K_2Cr_2O_7 + H_2SO_4$). It first oxidizes to acetaldehyde, which is rapidly further oxidized to acetic acid. Reaction: $C_2H_5OH + [O] \rightarrow CH_3CHO + H_2O \overset{[O]}{\rightarrow} CH_3COOH$.
Question 83: What is vinegar? Describe how vinegar is prepared from ethanol.
Answer: Vinegar is a 6-8% aqueous solution of acetic acid. It is prepared commercially by the Quick Vinegar Process, where dilute ethanol is oxidized by atmospheric oxygen in the presence of Acetobacter (Mycoderma aceti) bacteria acting as an aerobic fermenting catalyst.
Question 84: What are amino acids? Explain their different types with one example in each case. Answer: Amino acids are organic compounds containing both an amino group ($-NH_2$) and a carboxyl group ($-COOH$). Based on the position of the amino group relative to the carboxyl, they are Alpha (α), Beta (β), or Gamma (γ) amino acids. Example: α-amino acid is Glycine ($H_2N - CH_2 - COOH$).
Question 85: Write a short note on the acidic and basic characters of an amino acid.
Answer: Amino acids are amphoteric. The carboxyl group acts as an acid by donating a proton, while the basic amino group accepts a proton. This internal acid-base transfer forms a dipolar, neutral ion called a Zwitterion, allowing the molecule to react with both strong acids and strong bases.
Question 86: What is a peptide bond? Write down the formula of a dipeptide.
Answer: A peptide bond is the specific amide linkage ($-CO - NH -$) formed when the carboxyl group of one amino acid reacts with the amino group of another, eliminating a molecule of water. A dipeptide formula: Glycylalanine is $H_2N - CH_2 - CO - NH - CH(CH_3) - COOH$.
Question 87: What are zwitterions? Why are they called an internal salt?
Answer: A zwitterion is a neutral molecule carrying both a positive and a negative electrical charge. In amino acids, the proton transfers from the acidic $-COOH$ group to the basic $-NH_2$ group to form $-COO^-$ and $-NH_3^+$. It acts as an "internal salt" because the acid and base reacted within the same molecule.
Question 88: What is the Ninhydrin Test?
Answer: The Ninhydrin test is a general colorimetric test used for detecting the presence of alpha-amino acids. When an amino acid is boiled with Ninhydrin reagent, oxidative decarboxylation and deamination occur, yielding a deep blue or purple colored complex known as Ruhemann's purple.

render it unfit for human consumption. Methylated spirit: Ethanol denatured by the addition of about 10% methanol.

Absolute alcohol cannot be prepared by the fermentation process. Why?

Answer: Fermentation naturally halts when the ethanol concentration reaches about 14% because the yeast enzymes become inactive. Subsequent fractional distillation can only purify it to 95.6% (rectified spirit) because at this composition, ethanol and water form an azeotropic mixture that boils at a constant temperature.

Water has a higher boiling point than ethanol. Explain.

Answer: A water molecule possesses two highly polar O-H bonds and two lone pairs on oxygen, allowing each molecule to form up to four strong intermolecular hydrogen bonds in a dense 3D network. Ethanol (C_2H_5OH) has only one O-H group and a bulky non-polar alkyl chain, leading to fewer and weaker hydrogen bonds, thus a lower boiling point.

Ethyl alcohol is a liquid while methyl chloride is a gas. Give reason.

Answer: Ethyl alcohol contains a polar -OH group, which results in strong intermolecular hydrogen bonding. This intense intermolecular attraction pulls the molecules close together, existing as a liquid. Methyl chloride lacks hydrogen bonding (experiencing only weaker dipole-dipole forces) and remains a gas at room temperature.

Ethanol gives different products with conc. H_2SO_4 under different conditions. Justify it. Answer: Temperature and concentration control the reaction pathway. At a high temperature of 180°C, ethanol undergoes intramolecular dehydration (eliminating water from a single molecule) to form Ethene. At a lower temperature of 140°C with an excess of alcohol, it undergoes intermolecular dehydration (water removed between two molecules) to form Diethyl ether.

Write down two methods for preparing phenol.

Answer: 1) Dow's Method: Chlorobenzene is treated with 10% NaOH at 360°C and 300 atm pressure to form sodium phenoxide, which is then acidified with HCl to yield phenol. 2) From Sodium Benzene Sulphonate: Fusing the salt with solid NaOH at 320°C forms sodium phenoxide, which yields phenol upon acidification.

Phenol behaves as an acid; explain.

Answer: Phenol acts as a weak acid because it donates a proton to form a phenoxide ion. The resulting phenoxide ion is highly stabilized by resonance; the negative charge on the oxygen is delocalized throughout the benzene ring. This stabilization drives the equilibrium forward, facilitating proton release.

Give the reaction of phenol with: a) Bromine water b) Conc. H_2SO_4.

Answer: a) Bromine water: Phenol undergoes rapid polyhalogenation, immediately forming a white precipitate of 2,4,6-tribromophenol. b) Conc. H_2SO_4: Phenol undergoes sulphonation at room temperature to yield a mixture of ortho- and para-hydroxybenzenesulphonic acids.

How is Bakelite prepared from phenol?

Answer: Phenol undergoes a condensation reaction with formaldehyde in the presence of an acid or base catalyst. It initially forms ortho and para-hydroxybenzyl alcohols. These units then polymerize, eliminating water, to form a highly cross-linked, rigid 3D thermosetting polymer known as Bakelite.

How does phenol react with alkali?

Answer: Due to its acidic character, phenol readily dissolves in strong aqueous alkalis like sodium hydroxide (NaOH) to undergo an acid-base neutralization reaction, forming a water-soluble salt (sodium phenoxide) and water. Reaction: $C_6H_5OH + NaOH \rightarrow C_6H_5O^-Na^+ + H_2O$.

What is Williamson's synthesis of ether?

Answer: It is the best laboratory method for preparing symmetrical and unsymmetrical ethers. An alkyl halide (RX) undergoes an S_N2 substitution reaction with a sodium or potassium alkoxide ($R'ONa$) to yield an ether ($R-O-R'$). Reaction: $CH_3CH_2Cl + CH_3ONa \rightarrow CH_3CH_2 - O - CH_3 + NaCl$.

Write down the reactions of diethyl ether with HI and PCl5.

Answer: With HI: Diethyl ether reacts with hydroiodic acid upon heating to cleave the ether bond, forming ethyl alcohol and ethyl iodide. (Excess HI converts the alcohol fully to ethyl iodide). With PCl_5: Heating diethyl ether with phosphorus pentachloride cleaves the ether, producing two moles of ethyl chloride and phosphoryl chloride ($POCl_3$).

6. What is Cannizzaro's reaction? Detail the reaction mechanism. Why do aldehydes lacking an alpha-hydrogen undergo this reaction while others do not?
7. How do organic compounds differ from inorganic ones? Discuss in detail at least six unique features of organic compounds (such as catenation, isomerism, non-ionic character, etc.).
8. Explain the general mechanism of nucleophilic addition reactions to carbonyl compounds. Discuss how acid and base catalysts facilitate these reactions.
9. Explain with mechanism the addition of sodium bisulphite ($NaHSO_3$) to acetone. What is the industrial and analytical utility of this reaction?
10. Write detailed notes on the oxidation of aldehydes and ketones. Include the use of strong oxidizing agents ($K_2Cr_2O_7/H_2SO_4$) as well as mild ones like Tollen's reagent and Fehling's solution.

Question NO.8

1. How do you distinguish between saturated and unsaturated hydrocarbons chemically? Explain with suitable chemical reactions (such as Baeyer's test and the bromine water test).
2. Detail the methods for the preparation of ethane ($CH_3 - CH_3$) by: (i) the decarboxylation of mono-carboxylic acids, and (ii) Kolbe's electrolytic method, including its mechanism.
3. Write down the chemical reactions of ethene with the following reagents: (i) O_2 in the presence of Ag_2O, (ii) cold dilute $KMnO_4$, (iii) Ozone (O_3), and (iv) $HOCl$.
4. How will you synthesize the following compounds starting from ethyne? (i) Benzene, (ii) Chloroprene, (iii) Acetaldehyde, and (iv) Oxalic acid.
5. Explain the acidic nature of alkynes, providing at least three examples with chemical equations.
6. What are β-elimination reactions? Discuss briefly the two possible mechanisms ($E1$ and $E2$) of β-elimination reactions.
7. Differentiate between S_N1 and S_N2 reactions, discussing their mechanisms, kinetics, and stereochemistry.
8. Define alkyl halide. Give three distinct methods for preparing alkyl halides starting from alcohols.
9. What products are formed when ethyl magnesium bromide (CH_3CH_2MgBr) is treated with the following compounds, followed by acid hydrolysis: (i) Formaldehyde ($HCHO$), (ii) Acetaldehyde (CH_3CHO), (iii) Acetone ($(CH_3)_2CO$), and (iv) Carbon dioxide (CO_2)?
10. Using ethyl bromide (CH_3CH_2Br) as a starting material, how will you prepare the following compounds? Give the inorganic reagents and conditions necessary to carry out these reactions: (a) n-Butane, (b) Ethene, (c) Propanoic acid, and (d) Ethyl alcohol.

Question NO.9

1. What is resonance? Explain the structure of benzene on the basis of resonance and discuss its extraordinary stability.
2. What are Friedel-Crafts Reactions? Explain the mechanisms of alkylation and acylation of Benzene.
3. Write down four methods for the preparation of Benzene (include both commercial and laboratory methods).
4. Explain the mechanism of Nitration and Sulphonation of Benzene.
5. Discuss two industrial preparations of ethanol (e.g., from Molasses and Starch). How will you distinguish ethanol from methanol?
6. Describe the dehydration of primary, secondary, and tertiary alcohols with the help of suitable reactions.
7. What is the Lucas test? How will you distinguish between primary, secondary, and tertiary alcohols using this test?
8. Explain the acidic behavior of phenol. How is it different from alcohols, and how does phenol react with alkali to give a salt?
9. Write down two methods for preparing phenol (including Dow's method). How does phenol react with HNO_3 and bromine water?
10. Detail out two reactions in which Benzene behaves as a saturated hydrocarbon and two reactions in which it behaves as an unsaturated hydrocarbon.

Give the mechanism of SN1 reactions.
Answer: S_N1 proceeds in two distinct steps. Step 1 (Slow): The alkyl halide undergoes heterolytic cleavage to form a planar carbocation intermediate and a halide ion. Step 2 (Fast): The nucleophile attacks the planar carbocation from either the front or the back, leading to a racemic mixture of products if the carbon is chiral.
Justify that SN1 is unimolecular and SN2 is bimolecular.
Answer: In an S_N1 reaction, the rate-determining (slow) step involves only the ionization of the alkyl halide molecule, making the rate dependent on one concentration (unimolecular). In an S_N2 reaction, the rate-determining step involves the collision of both the attacking nucleophile and the alkyl halide, making the rate dependent on both concentrations (bimolecular).
Why does the SN2 mechanism give a product with inversion of configuration? Show with one reaction.
Answer: To avoid steric hindrance and electrostatic repulsion from the leaving group, the nucleophile attacks the carbon strictly from the opposite side (backside attack). This flips the geometry of the other three bonds like an umbrella in the wind. Reaction: $OH^- + (S) - 2 - bromobutane \rightarrow (R) - 2 - butanol + Br^-$.
Describe the mechanism of E2 reactions of alkyl halides.
Answer: E2 is a concerted, bimolecular mechanism. A strong base attacks and begins to extract a hydrogen from the β-carbon. Simultaneously, the C-H bond breaks to form a π-bond, and the C-X bond breaks, ejecting the halogen leaving group. All bond breaking and forming occurs in a single transition state.
What are electrophiles and nucleophiles?
Answer: Electrophiles ("electron-lovers") are electron-deficient species capable of accepting an electron pair (e.g., H^+, $AlCl_3$, NO_2^+). Nucleophiles ("nucleus-lovers") are electron-rich species possessing unshared electron pairs, ready to donate them to an electrophile (e.g., OH^-, NH_3, CN^-).
What is a Grignard reagent? What is the cause of its activity?
Answer: A Grignard reagent is an alkyl magnesium halide (R-Mg-X). Its extreme reactivity is due to the highly polar nature of the carbon-magnesium bond. Carbon is significantly more electronegative than magnesium, pulling the electron pair to acquire a partial negative charge. This gives the carbon strong carbanion character, making it an incredibly powerful nucleophile and base.
Why is dry ether necessary for the preparation of Grignard reagents?
Answer: Grignard reagents are so reactive that they immediately react with any source of protons, including atmospheric moisture (water), to form alkanes. Dry (anhydrous) ether provides an inert, moisture-free aprotic environment. Furthermore, ether's oxygen lone pairs solvate and stabilize the magnesium atom.
What products are formed when ethyl magnesium bromide is treated with HCHO followed by hydrolysis?
Answer: Reacting a Grignard reagent with formaldehyde ($HCHO$) yields a primary alcohol. Ethyl magnesium bromide (CH_3CH_2MgBr) reacting with $HCHO$, followed by acid hydrolysis, produces 1-propanol ($CH_3CH_2CH_2OH$).
Show the mechanism for the reaction of Acetone with Grignard's reagent.
Answer: The nucleophilic alkyl group of the Grignard reagent attacks the electrophilic carbonyl carbon of acetone. The π-electrons of the C=O bond shift onto the oxygen, forming an intermediate magnesium alkoxide complex. Acid hydrolysis of this complex releases the magnesium and yields a tertiary alcohol.
How will you distinguish between primary, secondary, and tertiary alcohols?
Answer: The Lucas test differentiates them using a mixture of concentrated HCl and anhydrous $ZnCl_2$. Tertiary alcohols instantly form an insoluble oily layer of alkyl chloride. Secondary alcohols form an oily layer within 5-10 minutes. Primary alcohols show no reaction at room temperature and form an oily layer only upon heating.
What is fermentation? Which compound may be obtained on an industrial scale by fermentation?
Answer: Fermentation is the slow, biochemical decomposition of large organic molecules into simpler ones catalyzed by enzymes secreted by microorganisms (like yeast). Ethyl alcohol (ethanol) is produced on a massive industrial scale by the fermentation of molasses or starch.
Explain the following terms: Absolute alcohol, Methylated spirit, Rectified spirit, Denaturing of alcohols.
Answer: Absolute alcohol: 100% pure, anhydrous ethanol. Rectified spirit: An azeotropic mixture containing 95.6% ethanol and 4.4% water. Denaturing of alcohols: The process of adding toxic substances to ethanol to

2nd Year Chemistry

The Academic Vault Guess Paper

پنجاب کے تمام بورڈز (لاہور، راولپنڈی، فیصل آباد، سرگودھا، گجرانوالہ، ساہیوال، ملتان، بہاولپور، اور ڈیرہ غازی خاں) کے لئے۔

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Chapter# 1

Important Short Questions

1. Justify that ZnO is amphoteric in nature.
2. Although both sodium and phosphorus are present in the same period of the periodic table, yet their oxides are different in nature, Na_2O is basic while P_2O_5 is acidic in character.
3. Why the ionic radii of negative ions are larger than the size of their parent atoms?
4. What is electron affinity? Why is the second value of electron affinity of an element usually shown with a positive sign? / What is electron affinity? Give its trend in periodic table.
5. Why metallic character increases from top bottom in a group of metals?
6. Why the oxidation state of noble gases is usually zero? (taleemcity.com)
7. Why diamond is a non-conductor and graphite is fairly a good conductor?
8. Write similarities of hydrogen with alkali metals?
9. Zn, Cd and Hg were placed with Alkaline earth metals in Mendeleev's table?
10. Negative ion is always bigger in size than its parent atom. Why? (taleemcity.com)
11. Why melting and boiling points of elements belonging to group VA-VIIA are lower?
12. Write two similarities and two dissimilarities of hydrogen with IV-A. group of elements. Write down two similarities and two dissimilarities of hydrogen with halogen.
13. Why metals are good conductors?
14. Why the size of an anion is always greater than its parent atom?
15. Give differences of lithium from its own family members.
16. Define hydration energy. The hydration energies of the ions are in the following order. Justify. $Al^{+3} > Mg^{+2} > Na^{+}$
17. Why oxidation number of noble gases is usually zero?

Important Long Questions

1. Justify position of hydrogen at the top of Group IA, IV-A and VIIA in the periodic table.
2. Define ionization energy. Discuss its trend in periods and groups.
3. Define hydrides. Give their classification and properties. (taleemcity.com)
4. State Mendeleev's Periodic Law. What are the improvements made in Mendeleev's Periodic Table?
5. Give trends of metallic character in groups and periods and discuss the impact of atomic size on it.

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Chapter# 2

Important Short Questions

1. What is the role of KO2 in the breathing equipment? / What is the significance of KO_2 for mountaineers?
2. Why the aqueous solution of Na_2CO_3 is alkaline in nature?
3. Why lime water turns milky with CO_2 but becomes clear with excess CO2.

4. BeO is amphoteric oxide. Show with two suitable reactions. (taleemcity.com)
5. How gypsum is converted into plaster of pairs?
6. Why 2% gypsum is added in the cement?
7. Why is lime added to an acidic soil?
8. How lime mortar is prepared? Explain with chemical equations?
9. What is milk of magnesia and for which treatment is it used? (taleemcity.com)
10. What are the advantages of Down's cell for the preparation of sodium on commercial scale? Why Down's cell is preferable method for the preparation of sodium on large scale?
11. What are the main uses of plaster of Paris?
12. Give two similar properties of lithium and magnesium. (taleemcity.com)
13. What are two major problems faced during the working of diaphragm cell?
14. What reaction occur when (i). Lithium carbonate is heated (ii). Sodium bicarbonate is heated (iii) Lithium hydride is treated with water. (taleemcity.com)
15. Write formulas of: (i) Beryl (ii) Asbestos (iii) Chrysoberyl (iv) Calcite (v) Barite (v) Dolomite

Important Long Questions

1. Explain the preparation of sodium metal by Down's cell. **(Most imp.)**
2. Write a short note on the role of Gypsum in agriculture. **(Imp)**
   Write the commercial method for the preparation of NaOH? **(Imp)** OR
3. Discuss the preparation of sodium hydroxide on commercial scale by diaphragm-cell or Nelson's cell. (taleemcity.com)
   Explain peculiar behavior of Beryllium? **(Most imp.)**
4. Write four points of differences between beryllium and its group.
   Discuss the peculiar behavior of Lithium with
5. respect to the other members of alkali metals. **(Most imp.)**

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Chapter# 3

Important Short Questions

1. What is tincal. How would you prove that its aqueous solution is alkaline in nature?
2. What are silicones? Why are liquid silicones preferred over ordinary organic lubricants?
3. Why is CO_2 a gas at room temperature while SiO_2 is a solid? / Explain the structure of CO2.
4. What is chemical garden? (taleemcity.com)
5. Write uses of Borax and boric acid.
6. What is chemistry of Borax-bead test?
7. How will you convert boric acid into borax and vice versa? (taleemcity.com)
8. Write four uses of sodium silicate.
9. Write the reactions of boric acid with: (i) Ethyl alcohol (ii) NaOH
10. In what respects, carbon behaves differently from other members of group IV-A? Give two similarities between carbon and silicon/silicate.
11. Why aqueous solution of Borax is alkaline in nature?
12. Give the formulas of four boric acids with names. (taleemcity.com)
13. How aluminum reacts with aqueous sodium hydroxide? (taleemcity.com)
14. How is Borax used as water softening agent?
15. Why are borate glazes preferred over silicate glazes? (taleemcity.com)
16. What is vitreous silica?
17. Why are liquid silicones preferred over ordinary organic lubricants?
18. Give the names and the formulas of different acids of boron.

This year, there will be no long from this chapter.

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Chapter# 4

Important Short Questions

1. Why does aqua regia dissolve gold and platinum?

2. Write down the dissimilarities between oxygen and Sulphur. (taleemcity.com)
3. Why is SO_3 dissolved in H_2SO_4 and not in water?
4. Describe "Ring test" for the confirmation of the presence of nitrate ions in solution.
5. Write down the equation for the reaction between conc. H_2SO_4 and copper and explain what type of reaction is it.
   Justify that conc. H_2SO_4 acts as dehydrating agent by writing two equations.
6. NO_2 is a strong oxidizing agent. Prove the truth of this statement giving examples.
7. P_2O_5 is a powerful dehydrating agent. Prove giving example. (taleemcity.com)
8. How does P_2O_5 react with water in cold and hot states?
9. How does HNO_3 react with (a) Cu (b) Mn
10. How does NO_2 react with KI and H_2S?
11. Write four uses of HNO_3.
12. How does nitrogen differ from other elements of its group? (taleemcity.com)
13. How NO_2 is prepared from: (i) Lead nitrate (ii) $Cu+HNO_3$
    Write any two methods for preparation of nitrogen oxide (NO).
14. Write any four properties of sulphuric acid.
15. Nitrous acid is a reducing as well as oxidizing agent justify giving chemical reaction.
16. Discuss different allotropic forms of phosphorous?

This year, there will be no long from this chapter.

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Chapter# 5

Important Short Questions

1. Give important uses of Helium.
2. What is "Iodized Salt"?
3. What are Freons and Teflon? Give their uses?
4. Why iodine has metallic luster?
5. How are halogen acids ionized in water?
6. Halogens are strong oxidizing agents. Justify.
7. Why fluorine shows peculiar behavior? Give four reasons? (taleemcity.com)
8. Why HF is a weak acid than other halogen acids (HCl)?
   Write four properties of hydrogen fluoride.
9. Write any four applications of noble gases.
10. What is halothane? Write its formula.
11. How XeF2 and XeF4 can be prepared?
12. Write any four applications of Noble gases.
13. Oxidizing Power of halogen depends upon which factors? (taleemcity.com)
14. Give reaction of Chlorine with cold and hot NaOH.
15. What is bleaching power? How bleaching powder is prepared by Hasenclever's method?
16. Write four uses of bleaching powder.

Important Long Questions

1. Discuss peculiar behaviour of fluorine. **(Most Imp)**
2. How bleaching powder is prepared? Give its uses. **(Most Imp)**
3. What happens when bleaching powder reacts with: dil. & con. H_2SO_4, NH_3, HCl, H_2O. **(Most Imp)**
4. Discuss relative reactivities of halogens as oxidizing agent. Also describe commercial uses of halogens and their compounds? **(Imp)**
5. Write chemical reactions of fluorides of Xenon. **(Imp)**

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Chapter# 6

Important Short Questions

1. Why d and f block elements are called transition elements? (taleemcity.com)
2. Why Transition elements compounds are coloured and variable oxidation state?
3. Differentiate between Typical and Nontypical transition elements.
4. How galvanizing helps protecting iron from rust.
5. What is chromyl chloride test?
6. How chromate ions are converted into dichromate ions?

7. What are chelates? What are chelates found in transition metal complexes?
8. What is ligand? Give types of ligands.
9. Define coordination number? Give example.
10 What is coordination sphere?
11 What is sacrificial corrosion?
12 Write the uses of $K_2Cr_2O_7$.
13 What are interstitial compounds?
14 How entrapped bubbles of gases are removed from steel.
15 Define paramagnetic and diamagnetic substances. (taleemcity.com)
16 Why does damaged tin plated iron get rusted quickly.

This year, there will be no long from this chapter.

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Chapter# 7

Important Short Questions

1. What is vital force theory and why vital force theory was rejected?
2. What is catalytic cracking?
3. What is an octane number and how it is improved? (taleemcity.com)
4. What is destructive distillation?
5. What is natural gas? Write its two uses.
6. What are heterocyclic compounds?
7. Define aromatic compound, give an example.
8. What are alicyclic compounds? Give an example.
9. Define functional group. Give two examples containing oxygen.
10 What is isomerism? Explain with suitable examples.
11 Define metamerism with examples.
12 What is Zwitter ion? How is it formed? Write down its structural formula.
13 Define Cis-trans isomerism. Give one example. / Explain geometrical isomerism. Give one example. (taleemcity.com)
14 Define tautomerism by giving one example.
15 Why there is a free rotation around single bond, but no free rotation around double band?

Important Long Questions

1. Explain reforming of petroleum with the help of suitable example.
2. Define cracking and explain its type with examples. (taleemcity.com)
3. Define hybridization. Discuss the structure of ethne/ ethyne on its basis. **(Hybridization Sp2, Sp3 with example are most important)**
4. Define isomerism. Explain geometrical isomerism with examples.
5. How organic compounds are classified? Give suitable example of each type.

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Chapter# 8

Important Short Questions

1. Why alkanes are less reactive than alkenes?
2. What are clemmenson and Wolf-Kishner reduction reactions? How they differ?
3. Ethane can be converted into ethyl alcohol write equation? (taleemcity.com)
4. What is Raney-Nickel? Where it is used?
5. What is Baeyer's test? / How Baeyer's test is used to detect unsaturation in organic compounds?
6. Define Markownikov's rule and give one example.
7. Give mechanism of O3 Onloysis of ethane?
8. Prepare CiS and Trans alkenes from alkyne along with chemical equation.
9. How is ethyne converted into ethanol?
10 Convert CH triple bond CH into oxalic acid.
11 How ethyne is converted to (a) acetaldehyde (b) benzene Convert methane into: (i) Formaldehyde (ii) Nitromethane Synthesize i.benzene ii. Oxalic acid from ethyne.
12 Define polymerization? How can we convert ethene to polyethene?
13 How do you convert 2-butyne into cis- and trans –2 butene?

14 Why does alkane shows un reactivity?
15 Why pi-bond is more reactive than sigma-bond?
16 What is Hydrogenolysis?
17 How do you distinguish between ethane and ethyne? (taleemcity.com)
Convert methane into formic acid.
18 Convert ethyne into acetaldehyde.
Convert 1-butene to 1-butyne.
19 Give fours uses of methane.

Important Long Questions

1. Describe any four methods for the preparation of alkenes.
2. Prepare ethane from Kolbe's electrolytic method. Write down its mechanism.
Prepare ethyne from Kolbe's electrolytic method. Write down its mechanism.
3. Describe with examples the acidic nature of alkynes? (taleemcity.com)
4. Give comparison of reactivity of alkanes, alkenes and alkynes.
5. State Markownikov's rule. Give reactions of HBr with (i) Propene (ii) 2-Butene (iii) 1-Butene

Chapter# 9

Important Short Questions

1. Discuss the objections to the Kekule's model of benzene? / What arguments were given by Kekule to confirm the regular hexagonal structure for benzene? (taleemcity.com)
2. Write down the resonance structure of benzene.
3. Define resonance energy.
4. What is Wurtz-Fittig Reaction? Give an example.
5. Give the mechanism of Nitration and halogenation of benzene.
Explain sulphoration of benzene with mechanism of reaction.
6. What happens when Ozone is reacted with Benzene?
7. Prepare m-chloronitro benzene from benzene in two steps.
Benzene can be prepared commercially from acetylene. Give reaction with conditions.
8. How benzene is converted into maleic acid by catalytic oxidation?
9. Draw the structure of (a) Naphthalene (b)Anthracene
10 What are polycyclic aromatic hydrocarbons?
11 Discuss the x-ray structure of Benzene
12 How can we prepare benzene from? (i) n-Hexane (ii) Benzene sulphonic acid. (taleemcity.com)
13 Write the general mechanism for the electrophilic substitution reactions of benzene?
14 What happens when chlorine is passed through Benzen in sunljght.
15 Write any four ortho para directing groups.

Important Long Questions

1. Explain the structure of benzene on the basis of atomic orbital treatment
2. Write down four methods of preparation of Benzene. (taleemcity.com)
3. What are Friedel-Crafts reactions? Explain mechanism of alkylation and Acylation of Benzene.
4. Detail out two reactions in which benzene behave as saturated hydrocarbon and two reactions if behave as unsaturated.
5. Write down the mechanisms of the following reactions.
(i) Sulphonation
(ii) Nitration of benzene

Chapter# 10

Important Short Questions

1. What are primary and tertiary alkyl halides? Give one example each.
2. Convert ethyle bromide into (i) n-butane (ii) Ethene (iii) Ethyl alcohol (iv)Propane
3. What is wurtz reaction? Give its importance.
4. Give two examples of nucleophilic substitution reactions. (taleemcity.com)
5. What is β-Elemination reaction?
6. How is tetramethyl and tetraethyl lead is prepared?

7. How would you prepare alkyl halide from alcohol and thionyl chloride?
8. What are elimination reactions? Give examples of E1 and E2
9. Write the mechanism of SN1 reactions
10 What are electophile and nucleophile?
11 Justify given order of react5ivity on the basis of bond energy. R – I > R – Br > R – Cl > R - 1
12 Give methods to prepare alkyl halides from alcohols. (taleemcity.com)
13 What is Grignard reagent?
14 Convert ethyl alcohol into their respective halides by using PCl3 and PI5
15 Starting from C2H4Br how will you prepare ethane and ethene?
16 How do we get alkyl nitriles from Grignard's reagent?

Important Long Questions

1. What are β-elemination reaction? Differentiate between E1 and E2 reactions.
2. What are SN reactions? Differentiate between SN1 and SN2 reactions. (taleemcity.com)
3. What are Grignard's reagents? How these react with carbonyl compounds?
   How does Ethyl magnesium bromide react with: i. CO2 ii. CH3COCH3
4. Explain Nucleophilic substitution Unimolecular reaction (SN1) with example
5. Discuss SN2 reactions of alkyle halide in detail.

Chapter# 11

Important Short Questions

1. What do you mean by denaturing of alcohols?
   Give the structural formulae of
2. (i)Lactic acid (ii) Tartaric acid (iii) Picric Acid (iv) P-hydroxy benzyl alcohol (v) carbolic acid
3. Absolute alcohol cannot be prepared by fermentation process, why?
4. Explain Williamson synthesis for the preparation of ethers?
5. Define fermentation. What are the essential conditions for fermentation process?
6. Ethyl alcohol is a liquid while methyl Chloride is a gas. Why? (taleemcity.com)
   How Phenol is prepared by Dow's method. /
7. Give two methods for the preparation of phenol.
8. Prepare Bakelite from phenol?
9. Give the reactions of phenol with conc. H2SO4 and acetyl chloride.
10 How does picric synthesis take place?
11 Ethanol gives different products with conc.H2SO4 under different conditions. Justify.
12 What is Lucast test?
13 How can we distinguish between methanol and ethanol?
   Convert methanol into ethanol and acetone into ethyle alcohol.
14 How chloro benzene is converted into phenol.
15 Give reactions of alcohols in which C–O bond breaks?
16 Why water has higher boiling point than ethanol?
17 What is wood-spirit? How is it prepared from water gas? (taleemcity.com)
18 What are rectified spirit, commercial alcohol and absolute alcohol?
   Define fermentation. Give its conditions.
19 Absolute alcohols cannot be prepared by fermentation. Why?

Important Long Questions

1. Describe the industrial method of preparation of methanol with diagram.
   Give the reactions of phenol with the following:
2. (i) Zn (ii) NaOH (iii) bromine water
   (iv) HNO3 (v) H2SO4 (vi) CH3COCl
   Convert:
3. (i) Ethanol into Methane
   (ii) Methanal into ethanal
   What is fermentation? How ethanol is prepared from molasses and starch? **OR**
4. How ethyl alcohol (C2H4OH)is obtained by the fermentation of molasses and starch?
5. Give two methods for the preparation of phenol

Chapter# 12

Important Short Questions

1. What is cannizzaro's reaction? Write one example.
2. What is silver mirror/Tollen's test? / Discuss the chemistry of Tollen's test.
3. What is Fehling's solution test of aldehyde? OR How aldehydes can be distinguished by Fehling's solution test.
4. Write four uses of formaldehyde?
5. Write four uses of Acetaldehyde?
6. What is idoform test? Give its uses. / How iodoform is prepared from acetaldehyde and ethyl alcohol?
7. Write the mechanism of the reaction of HCN with carbonyl compounds.
8. What is formalin? (taleemcity.com)
9. Prepare acetone from calcium acetate.
10. Give industrial preparation of formaldehyde.
11. What is Haloform reaction? Give its uses.
12. How acetaldehyde is converted into lactic acid? **OR** How α-hydroxy acids are prepared from Acetaldehyde.
13. How the aldehydic group can be prevented against oxidizing agents. OR How acetaldehyde reacts with ethyl alcohol?
14. Give two tests for distinguishing between an aldehyde and a ketone. OR How Aldehydes can be distinguished by Benedict's solution test?
15. What is formalin?

Important Long Questions

1. Write a note on Cannizzarro's reactions. **OR** Discuss mechanism for the Cannizzaro's reaction of HCHO. **OR** What type of aldehydes give cannizzaross reaction/ Give its mechanism.
2. What is Aldol condensation? Give mechanism.
3. Write four tests by which aldehyde can be distinguish from ketones. (taleemcity.com)
4. How 2,4-dinitrophenyl hydrazones are prepared? Write mechanism of ammonia derivatives with carbonyl compound in general.
5. Describe the mechanism of the reaction of sodium bisulphite with acetone.

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Chapter# 13

Important Short Questions

1. What are essential and non-essential amino acids?
2. What are zwitter ions and how they are produced? Write its structural formula.
3. Explain acidic and basic behavior of amino acids?
4. How acetic anhydride is prepared from acetic acid?
5. What are amino acids? Give two examples.
6. Define neutral amino acids? Give examples.
7. Write formulae of Glycine, Alanine, melonoic acid and phthalic acid?
8. Write down the mechanism of ester formation.
9. How would you convert CH3 COOH to CH3 CONH2
10. How amino acid is synthesized. Give one example.
11. What is peptide bond? Write down formula of a dipeptide? (taleemcity.com)
12. How would you prepare carboxylic acid from Grignard Reagents?
13. What are acid anhydrides? How can we prepare acetic anhydride?
14. Write important uses of acetic acid?
15. How carboxylic acids are prepared by oxidative cleavage of alkenes?

Important Long Questions

1. Write down any four methods of preparation of acetic acid with reactions?
2. Define Zwitter ion. Discuss effect of acidic and basic medium on the dipoler ion structure of amino acid. (taleemcity.com)
3. Convert acetic acid into i. Methane ii. Acetyl chloride
4. Write a short note on acidic and basic character of amino acids.

5. Write down reactions of acetic acid with: Na_2CO_3, PCl_5, C_2H_5OH, NH_3, $SOCl_2$, HI/P

Chapter# 14

Important Short Questions

1. What is meant by rancidity of fats and oils? Why it occurs?
2. Write any two differences b/w DNA and RNA.
3. In what way oil, fats are different?
4. What is condensation polymerization? Give an example.
5. How proteins are denatured?
6. Write down the importance of proteins.
7. Write four uses of lipids.
8. Give two differences b/w oils and fats?
9. Define saponification number and iodine number. (taleemcity.com)
10. What are thermosetting polymers? Give two examples.
11. What do you mean by hardening of oils and fats? / How oils are converted into fats
12. Define saponification number
13. How PVC is prepared? Also give its uses
14. What is chemical nature of enzyme? Classify them.
15. Write down the mechanism of addition polymerization.

This year, there will be no long from this chapter.

Chapter# 15

Important Short Questions

1. What are fertilizers? Why are they needed?
2. What are micronutrients?
3. What are macro-nutrients? Name any three.
4. Write any four points of essential qualities of a good fertilizer? (taleemcity.com)
5. Give the important properties of fertilizers.
6. Why ammonium nitrate is not added to the crop of Paddy rice? OR Ammonium nitrate is a useful fertilizer for many crops except paddy rice, why?
7. What are phosphatic fertilizers? What is their role in plant growth? Give two formulas of phosphatic fertilizers?
   What are Potassium Fertilizers? Write importance of potassium fertilizers.
8. What is cement? Which raw materials are used for its preparation?
9. What do you mean by setting of cement. Write down the reactions taking place in first 24 hours
10. Define paper. (taleemcity.com)
11. Write names of four non-woody raw materials for the production of paper and pulp?
    How bleaching of pulp is done in Pakistan
12. Define cement and write down the raw materials used for manufacturing of cement
13. What is clinker? (taleemcity.com)
    Why cement is called as Portland cement?
14. Describe the composition of good Portland cement.
15. What is the function of Nitrogenous fertilizers for the Growth of plants?

Important Long Questions

1. What are fertilizers? Discuss the classification of fertilizers and their uses. (taleemcity.com)
2. Nitrogenous fertilizer is an important class of fertilizers for crops. Discuss.
3. How urea is manufactured in the industries? Support your answer with chemical equations.
4. Describe the manufacturing process of cement.

Chapter# 16

Important Short Questions

1. What are Leachates?
2. How detergents are threat to aquatic life.
3. What is acid rain and how it affects the environment? (taleemcity.com)
4. Explain the term BOD? / What is biological oxygen demand?

5. What is acid rain? (taleemcity.com)
6. How chlorofloro-carbons (CFCs) destroy the Ozone layer?
7. Discuss detergents as water pollutants?
8. Write down the effects on human health of CO.
9. What do you know about water pollution? How is water polluted by industrial effluents?
10 Name four components of environment.
11 What are primary and secondary pollutants? Give example of each.
12 What is chemical oxygen demand (COD)? How it is measured?
13 How oil spillage effects the aquatic life on earth. (taleemcity.com)
14 How is water purified by: (i) Aeration (ii) Coagulation
15 What is smog? Under what conditions, smog is formed?

This year, there will be no long from this chapter.

MCQs

معروضی کے لئے ہر سبق کے مشقی معروضی سوالات اور اضافی معروضی لازمی تیار کریں۔ بہترین تیاری کے لئے پاسٹ پیپرز کی معروضی تیار کریں۔

The Academic Vault

Your Notes

Ans: Primary oocyte → Secondary oocyte and First polar body → Egg and Second polar body.

Q3. Name the parts of the testis and ovary where gamete formation takes place.

Ans: Sperms are formed in seminiferous tubules of testes. Eggs are formed in follicles of ovaries.

Q4. What happens to the egg after it is released from the ovary?

Ans: It enters the fallopian tube where it may be fertilized by a sperm.

Q5. Compare spermatogenesis and oogenesis in terms of the number of gametes produced.

Ans: Spermatogenesis produces four motile sperms. Oogenesis produces only one large egg.

Q6. Describe two major ways through which HIV can be transmitted.

Ans: Through sexual contact and sharing contaminated needles or blood.

Q7. Differentiate between Oestrogen and Progesterone.

Ans: Oestrogen develops secondary sexual traits. Progesterone prepares the uterus for pregnancy.

Chapter 7: Inheritance

Q1. Write down the combination of alleles in the gametes of plant with genotype Rryy.

Ans: The combination of alleles in the gametes will be Ry and ry.

Q2. State Mendel's law of segregation.

Ans: It states that alleles separate during gamete formation so each gamete receives only one allele.

Q3. State Mendel's law of independent assortment.

Ans: It states that alleles of different genes separate independently from each other during gamete formation.

Q4. Define monohybrid cross and dihybrid cross.

Ans: Monohybrid cross involves one trait (e.g., height). Dihybrid cross involves two traits (e.g., seed shape and colour).

Q5. Draw a cross between RRyy and rrYY plants.