

CHEMISTRY (043)
Marking Scheme

SECTION A

1.(d)N-N is weaker than P-P

other statements as incorrect as Phosphorus has a higher melting point due to bigger size than Nitrogen. Nitrogen is inert due to formation of triple bonds and has a lower covalence due to non - availability of d –orbitals

2. (c)metal deficiency defect (anion is missing from lattice site)

In Frenkel defect the smaller ion occupies the interstitial sites and Schottky defect equal number of cations and anions are missing. Interstitial defect an atom or molecule occupies intestinal sites so in these three defects the ratio of positive and negative ions (Stoichiometric) of a solid is not disturbed in these three

3. (b) Raoult's law

4. (c) Metal excess defect (formation of F centres)

5. (c) 1,4-dicholorbenzene (para isomers are more symmetric and ortho and meta)

6. (d) existence of alpha and beta forms of glucose .

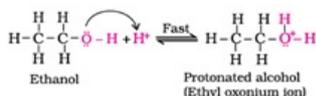
7. (c) S_N² reaction (alkoxide ion reacts with primary alkyl halide in a single step to form ether)

8. (b) a mixture of HOCl and HCl is produced in the presence of sunlight

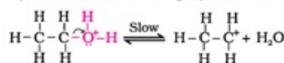


9. (a)protonation of alcohol molecule

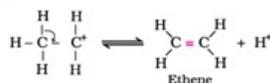
Step 1: Formation of protonated alcohol.



Step 2: Formation of carbocation. It is the slowest step and hence, the rate determining step of the reaction.



Step 3: Formation of ethene by elimination of a proton.

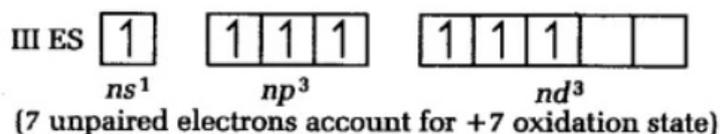


10. Amorphous solids are:

(a) isotropic (the value of any physical property is same along any direction)

11. (c) Reimer- Tiemann reaction (Kolbe's reaction is used to prepare salicylic acid, Etard reaction for benzaldehyde, Reimer- Tiemann reaction for salicylaldehyde and Stephen's reduction for aldehyde)

12. (d) 22 carat gold (it is an alloy so solid in solid solution)
13. (a) Hydrogen bonding (alcohols form intermolecular hydrogen bonds)
14. (b) H₂S (boiling point increases down the group but water forms strong hydrogen bonds so has higher boiling point than H₂S)
15. (d) pH does not affect the primary structure of protein (pH effects the tertiary structure)
16. (b) 1-Phenyl-3-bromopropane
 $((C_6H_5)CH_2CH=CH_2 + HBr \text{ (organic peroxide)} \rightarrow (C_6H_5)CH_2CH_2CH_2Br$ anti-Markovnikov addition)
17. (b) It gives nitroethane on heating with aqueous solution of AgNO₂
 (C₂H₅Br reacts with metallic Na to give butane, gives ethene on boiling with alcoholic potash and forms C₂H₅SH (thiol) on heating with alcoholic KSH)
18. (c) 4 (Covalency of nitrogen is restricted to 4 due to non availability of d orbitals)
19. (b) exothermic and reversible process (according to Le-Chatlier principle Solubility of gases in liquids decreases with rise in temperature)
20. (a) Nitrogen (due to small size and high electronegativity N-N is weak)
21. (c) glycogen (It is a polymer of glucose)
22. (d) Helium (He is monoatomic and has low atomic mass)
23. (c) miscible in water in all proportions Lower molecular mass alcohols are able to form hydrogen bonds with water
24. (d) +7 (Cl : 1s²2s²2p⁶3s²3p⁵)



25. (a) When placed in water containing more than 0.9% (mass/ volume) NaCl solution because fluid inside blood cells is isotonic with 0.9% NaCl solution

SECTION B

26. (a) 7.5 mol

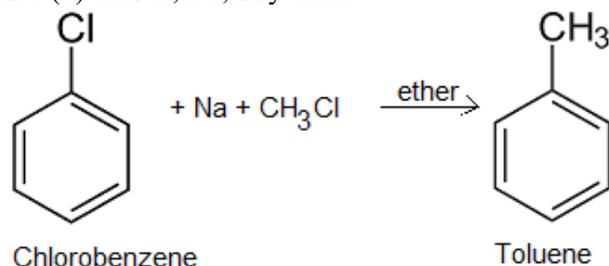
$$\Delta T_f = K_f m$$

$$\Delta T_f = K_f \frac{n_2 \times 1000}{w_1}$$

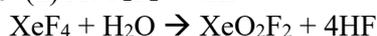
$$14 = 1.86 \times \frac{n_2 \times 1000}{1000}$$

$$n_2 = 7.5 \text{ mol}$$

27. (b) CH_3Cl , Na, Dry ether



28. (d) $\text{XeO}_2\text{F}_2 + 4\text{HF}$



29. (c) It undergoes inversion in the configuration on hydrolysis

30. (b) partial double bond character of C-OH bond

31. (a) Nitrogen (High IE of N is because of smallest size in the group and completely half-filled p subshell)

32. (d) M_2O_3

Metal M ions form ccp structure. Let number of ions of M be : X

No. of tetrahedral voids = 2x

No. of octahedral voids = x

Number of oxide ions will be $\frac{1}{2}x + \frac{1}{2}(2x) = \frac{3}{2}x$

Formula of oxide = $\text{MxO}_{\frac{3}{2}x} = \text{M}_2\text{O}_3$

33. c) X = o and p-chlorotoluene Y = trichloromethylbenzene

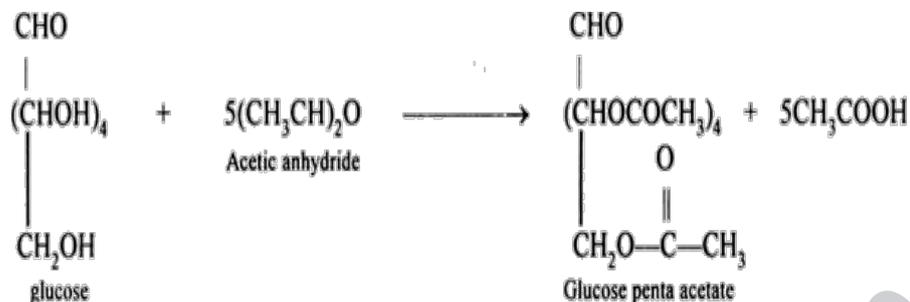
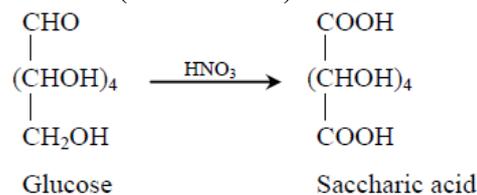
The reaction of toluene with Cl_2 in presence of FeCl_3 gives 'X' due to electrophilic substitution reaction taking place at ortho and para positions and reaction in the presence of light gives 'Y', due to substitution reaction occurring via free radical mechanism

. Thus 'X' and 'Y' are X = o and p-chlorotoluene Y = trichloromethylbenzene

34. (d) angular, 128pm ; 128pm (Ozone is a resonance hybrid of two equivalent structures)

35. (c) Osmosis

36. d) A= $\text{OHC}-(\text{CHOCOCH}_3)_4-\text{CH}_2\text{OCOCH}_3$ B= $\text{COOH}-(\text{CH}_2)_4-\text{COOH}$



37. (d) Adsorption of litmus by $\text{Al}(\text{OH})_3$

In lake test for Al^{3+} ions, there is the formation of coloured 'floating lake' In lake test for Al^{3+} ions, there is the formation of coloured 'floating lake' due to adsorption

38. (c) 3 g/cm^3

Using formula

$$\text{Density} = \frac{(Z \times X \times m)}{(a^3 \times \text{Na})}$$

$$\begin{aligned}
 D &= \frac{4 \times 58.5}{(0.5 \times 10^{-7})^3 \times 6.023 \times 10^{23}} \\
 &= 3.1 \text{ g/cm}^3
 \end{aligned}$$

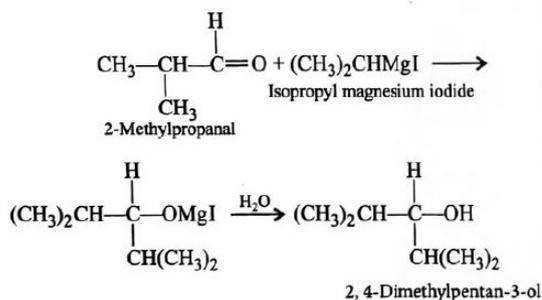
39. (d) $\text{BiH}_3 < \text{SbH}_3 < \text{AsH}_3 < \text{PH}_3 < \text{NH}_3$ [increasing bond angle] correct order

(a) $\text{I}_2 < \text{Br}_2 < \text{F}_2 < \text{Cl}_2$ [increasing bond dissociation enthalpy]: incorrect order , correct order is $\text{Cl}_2 > \text{Br}_2 > \text{F}_2 > \text{I}_2$.

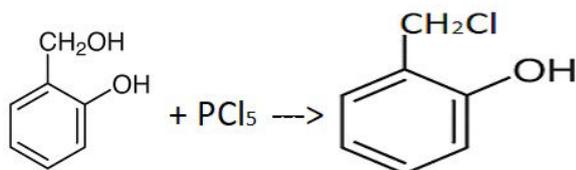
(b) $\text{H}_2\text{O} > \text{H}_2\text{S} < \text{H}_2\text{Te} < \text{H}_2\text{Se}$ [increasing acidic strength]: incorrect order , correct order is $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$

(c) $\text{NH}_3 < \text{N}_2\text{O} < \text{NH}_2\text{OH} < \text{N}_2\text{O}_5$ [increasing oxidation state] : incorrect order NH_3 (Oxidation state -3) N_2O (Oxidation state +1) NH_2OH (Oxidation state -1) N_2O_5 (Oxidation state +5)

40. (d) 2- methylpropanal and isopropyl magnesium iodide



41. (b) 2- chloromethylphenol



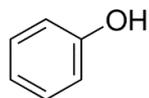
42. (a) Ammonia is the weakest reducing agent and the strongest base among Group 15 hydrides. The reducing character of hydrides increases down the group due to decrease in bond dissociation enthalpy.

43 (a)(i) and (iv)

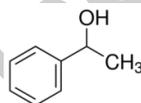
(i) $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$ (secondary) (ii) $(\text{C}_2\text{H}_5)_3\text{COH}$ (tertiary)

(iii)

(iv)

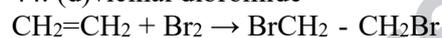


Phenol not an alcohol



secondary

44. (d) vicinal dibromide



45. (c)

Assertion: Electron gain enthalpy of oxygen is less than that of Fluorine but greater than Nitrogen. (correct)

Reason: Ionisation enthalpies of the elements follow the order Nitrogen > Oxygen > Fluorine (incorrect)

Ionisation enthalpies of the elements follow the order Fluorine > Nitrogen > Oxygen

46. (b) **Assertion:** Alkyl halides are insoluble in water. (correct)

Reason: Alkyl halides have halogen attached to sp^3 hybrid carbon. (correct)

Alkyl halides are insoluble in water because they are unable to form hydrogen bonds with water or break pre-existing hydrogen bonds.

47. (c) **Assertion:** Molarity of a solution changes with temperature. (correct)

Reason: Molarity is a colligative property. (incorrect)

Molarity is a means to express concentration. It is not a physical property.

48. (a) **Assertion:** SO_2 is reducing while TeO_2 is an oxidising agent. (correct)

Reason: Reducing property of dioxide decreases from SO_2 to TeO_2 (correct and reason for Assertion)

49. (c) **Assertion:** Cryoscopic constant depends on nature of solvent. (correct)

Reason: Cryoscopic constant is a universal constant (incorrect)

Cryoscopic constant varies with type of solvent

SECTION C

50. (b) i-D, ii-C, iii- A, iv-B

Amino acids form proteins and exist as zwitter ion, Thymine is a nitrogenous base in DNA, Insulin is a protein, phosphodiester linkage is found in nucleic acids so also in DNA and Uracil is nitrogenous base found in RNA which is a nucleic acid.

51. (d) Helium: meteorological observations :: Argon: metallurgical processes

Nitrogen: $1s^2 2s^2 2p^3$:: Argon: $1s^2 2s^2 2p^6$ is configuration of Neon not Argon

Carbon: maximum compounds :: Xenon: no compounds, Xenon forms compounds

XeF_2 : Linear :: ClF_3 : Trigonal planar, ClF_3 is T shaped not trigonal planar

52. (a) A : Isomers B: Enantiomer

Isomers have Same molecular formula but different structure

Enantiomers are Non superimposable mirror images

Q53. (c) 6

The radius of Ag^+ ion is 126 pm and of I^- ion is 216 pm. The coordination number of Ag^+ ion is:

$$\rho = r_{\text{cation}}/r_{\text{anion}} = 126/216 = 0.58$$

Radius ratio lies in the range 0.414 – 0.732, so has coordination number 6 or 4 according to the table.

Since none of the options is 4, so the answer is 6

Q54. (d) 290 pm

Square planar means ratio ratio is between 0.414 – 0.732

If radius of cation is 120 pm then anion should be in the range $\rho = r_{\text{cation}}/r_{\text{anion}}$

$$0.414 = 120/x \text{ so } x = 289.8 = 290 \text{ pm}$$

$$0.732 = 120/x \text{ so } x = 163.9 = 164 \text{ pm}$$

Q55. (a) all of its nearest neighbour anions
