

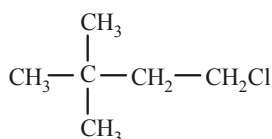
Sample Paper

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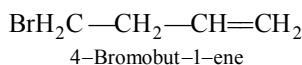
ANSWER KEYS																			
1	(a)	7	(c)	13	(a)	19	(b)	25	(c)	31	(a)	37	(c)	43	(c)	49	(a)	55	(d)
2	(b)	8	(a)	14	(d)	20	(a)	26	(b)	32	(c)	38	(b)	44	(b)	50	(a)		
3	(d)	9	(d)	15	(a)	21	(d)	27	(a)	33	(a)	39	(d)	45	(b)	51	(a)		
4	(a)	10	(d)	16	(b)	22	(d)	28	(c)	34	(c)	40	(b)	46	(a)	52	(b)		
5	(d)	11	(c)	17	(b)	23	(d)	29	(b)	35	(b)	41	(a)	47	(d)	53	(c)		
6	(a)	12	(c)	18	(c)	24	(a)	30	(a)	36	(a)	42	(a)	48	(b)	54	(d)		

SOLUTIONS

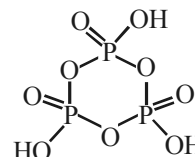
- (a) In $C_6H_5CH_2Br$ carbocation is $C_6H_5\overset{\oplus}{C}H_2$ which is stable due to resonance.
- (b) α -D glucose and β -D glucose are the isomers which differ in the orientation (configuration) of H and OH groups around C_1 atom.
- (d) Neohexyl chloride is a primary halide as in it Cl-atom is attached to a primary carbon.



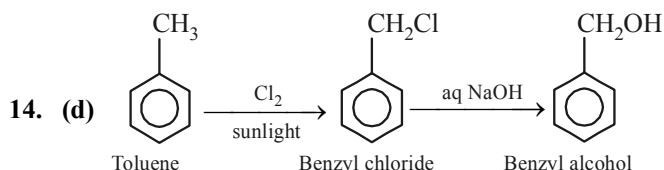
- (a) $4\text{HNO}_3 + \text{P}_4\text{O}_{10} \longrightarrow 4\text{HPO}_3 + 2\text{N}_2\text{O}_5$
- (d) Crystalline solids are anisotropic, i.e. their physical properties are different if measured in different directions.
- (a) Solubility decreases and K_H increases with increase in temperature.
- (c) Solid CH_4 is a molecular solid. In this, the constituent molecules are held together by van der Waal's forces.
- (a) For a given alkyl group, the order of reactivity is $\text{R-I} > \text{R-Br} > \text{R-Cl} > \text{R-F}$ \rightarrow decreasing halogen reactivity.
This order depends on the carbon-halogen bond energy; the carbon-fluorine bond energy is maximum and thus fluorides are least reactive while carboniodine bond energy is minimum hence iodides are most reactive.
- (d)
- (d) 4-Bromobut-1-ene is not an allylic halide



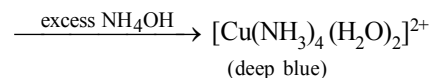
- (c) In cyclic metaphosphoric acid, number of P-O-P bonds is three.



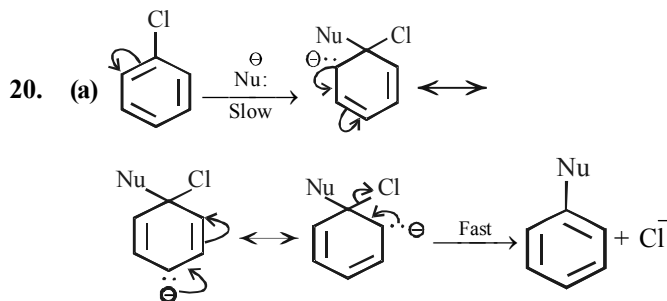
- (c) $\text{HCl} + \text{An. ZnCl}_2$ is known as Lucas reagent. It is used to determine degree of an alcohol. The reaction follows nucleophilic substitution reaction in which $-\text{OH}$ group is replaced by $-\text{Cl}$. In this reaction carbocation is formed as intermediate. Higher the stability of intermediate carbocation higher will be the reactivity of reactant molecule. Since 3° carbocation is more stable than 2° carbocation as well as 1° carbocation, so the order of reactivity of alcohols is $3^\circ > 2^\circ > 1^\circ$.
- (a) In F-centre unpaired electron is present in anion vacancy.



- (a) For example, decrease in the vapour pressure of water by adding 1.0 mol of sucrose to one kg of water is nearly similar to that produced by adding 1.0 mol of urea to the same quantity of water at the same temperature.
- (b) $\text{C}_2\text{H}_5\text{OH}$ and $\text{CH}_3 - \text{O} - \text{CH}_3$ are isomers.
- (b) $[\text{Cu}(\text{H}_2\text{O})_6]\text{SO}_4 + 2\text{NH}_4\text{OH} \longrightarrow [\text{Cu}(\text{H}_2\text{O})_4(\text{OH})_2]$
(pale blue)

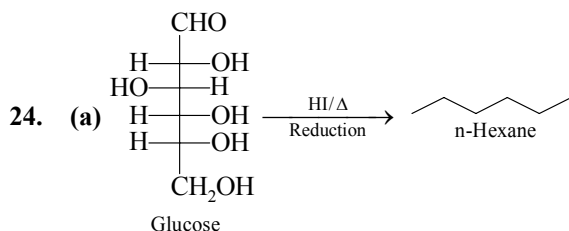


18. (c) Each chromosome is made up of DNA tightly coiled many times around proteins called histones that supports its structure.
19. (b) If two halogen atoms are present on the same carbon atom, then they are known as gem-dihalides or alkylidene halides.

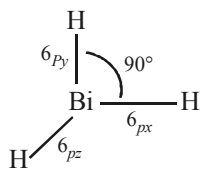


$$\text{Rate} \propto [\text{C}_6\text{H}_5\text{Cl}] [\text{Nu}^-]$$

21. (d) Oxidising power decreases down the group.
22. (d) When an unripe mango is placed in a concentrated salt solution to prepare pickle then mango loses water due to osmosis and gets shriveled.
23. (d) As the oxidation state of the central halogen atom increases, the halogen-oxygen bond becomes more and more covalent. As a result, the thermal stability of the oxoacid increases. Thus, HClO_4 is most stable to heat, whereas HClO is least stable to heat.



25. (c) As the size of central atom increases, the lone pair of electrons occupies a larger volume. In other words, electron density on the central atom decreases and consequently its tendency to donate a pair of electrons decreases along with basic character from NH_3 to BiH_3 .
26. (b) VSEPR theory breaks down for heavier elements. There is no significant $s-p$ mixing for PH_3 onwards down the group. For PH_3 , there is very little contribution from the P_{3s} -orbital. We can assume the P-H bonds are predominantly $\text{P}_{3p}-\text{H}_{1s}$ bonds. Thus, the geometry around P is determined mostly by the orientation of the p -orbitals. e.g. in BiH_3 , the H-Bi-H angle $\approx 90^\circ$



And the lone pair of Bi remains in $6s$ orbital. The s -orbital is closer to the nucleus, which means that the negative charge of the electrons is better stabilised.

27. (a)
$$\Delta T_f = K_f \frac{1000 W_2}{M_2 W_1} = \frac{1.86 \times 1000 \times 68.5}{342 \times 1000}$$

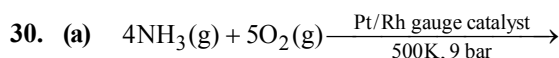
$$= 0.372$$

$$T_f = T^\circ \Delta_f - \Delta T_f \Rightarrow T_f = -0.372^\circ\text{C}$$

28. (c)
$$\Delta T_b = \frac{K_b \times w \times 1000}{M \times W}$$

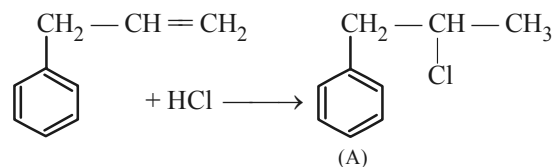
$$\therefore K_b = \frac{\Delta T_b \times 100 \times 100}{10 \times 1000} = \Delta T_b$$

29. (b) This method is not applicable for the preparation of aryl halides because the C-O bond in phenol has a partial double bond character and is difficult to break being stronger than a single bond.



\therefore Two moles of NH_3 will produce 2 moles of NO on catalytic oxidation.

31. (a) Every amino acid exists exclusively as dipolar ion when the pH of the solution is equal to its isoelectric point (pI), hence at this pH it does not migrate to either electrode, while at other pH, an amino acid migrates either to cathode or to anode depending upon its pI. Thus at pH 9.60, amino acid with pI 5.40 will exist as an anion and migrate to anode; while that with pI 9.60 will not migrate to any electrode.
32. (c) Addition of HCl takes place in accordance with Markownikoff's rule.



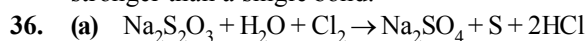
33. (a) The single N-N bond is weaker than the single P-P bond. This is why phosphorus shows allotropy but nitrogen does not.

34. (c) Density $d = \frac{ZM}{a^3 N_A}$

where $a = 400 \text{ pm} = 400 \times 10^{-10} \text{ cm}$

$$= \frac{2 \times 100}{(400 \times 10^{-10})^3 \times 6.023 \times 10^{23}} = 5.188 \text{ g/cc}$$

35. (b) This method is not applicable for the preparation of aryl halides because the C-O bond in phenol has a partial double bond character and is difficult to break being stronger than a single bond.



37. (c) From molarity equation

$$M_1 V_1 + M_2 V_2 = M_3 (V_1 + V_2)$$

$$1 \times 2.5 + 0.5 \times 3 = M_3 \times 5.5$$

$$M_3 = \frac{4}{5.5} = 0.73\text{M}$$

38. (b) Electron withdrawing substituents increase the acidic strength of phenols. so, *p*-nitrophenol (II) and *m*-nitrophenol (IV) are stronger acid than phenol (I). If $-\text{NO}_2$ group is present at *p*-position, then it exerts both $-\text{I}$ and $-\text{R}$ effect, but if it is present at meta position, then it exerts only $-\text{I}$ effect. Therefore, *p*-nitrophenol is stronger than *m*-nitrophenol.

On the other hand, electron releasing substituents decreases the acidic strength of phenol. If $-\text{OCH}_3$ group is present at meta position, it will exert $-\text{I}$ effect only.

But, if it is present at para position, it will exert $+\text{R}$ and $-\text{I}$ effect. Thus, *m*-methoxy benzyl alcohol is more acidic than *p*-methoxy phenol. Hence, the correct order of decreasing acidic strength will be :

$\text{II} > \text{IV} > \text{I} > \text{III} > \text{V}$.

39. (d) $\text{H}_4\text{P}_2\text{O}_5: 4 + 2x + 5(-2) = 0 \Rightarrow x = +3$
 $\text{H}_4\text{P}_2\text{O}_6: 4 + 2x + 6(-2) = 0 \Rightarrow x = +4$
 $\text{H}_4\text{P}_2\text{O}_7: 4 + 2x + 7(-2) = 0 \Rightarrow x = +5$
40. (b) In a cubic closed packed system (*ccp*)ABC ABC..... type of arrangement of layers is found. In this system, there are atoms at the corners as well as centre of the unit cell.

No. of atoms in the unit cell = z

Hence, the number of tetrahedral voids in the unit cell = $2z$.

41. (a) Both CO_3^{2-} and NO_3^- have same number of electrons.

$$\text{CO}_3^{2-} = 6 + 8 \times 3 + 2 = 32$$

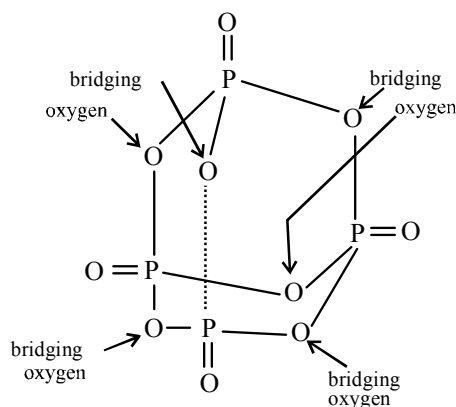
$$\text{NO}_3^- = 7 + 8 \times 3 + 1 = 32$$

Hence, CO_3^{2-} and NO_3^- are isoelectronic. Also, both have same type of hybridization (sp^2) and have trigonal planar structure. Hence, they are also isostructural.

42. (a) Dehydration of alcohols involve formation of carbocation intermediate. More the stability of C^+ more easier is the dehydration. Similarly if greater the conjugation, greater will be the stability, hence easier the dehydration.

43. (c) The $\text{C}-\text{O}$ bond length (136 pm) in phenol is slightly less than that in methanol (142 pm).

44. (b)

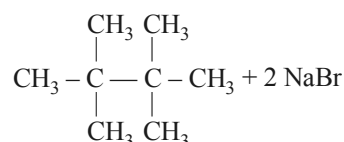


45. (b) PCC is a mild oxidising agent and it oxidizes alcohol into aldehyde. PCC is $\text{C}_5\text{H}_5\text{NH}^+ \text{CrO}_3^-$ and involves change in oxidation number of Cr from +6 to +3.

46. (a) $\text{H}-\text{F}$ and $\text{H}-\text{Cl}$ bonds are stronger than $\text{H}-\text{Br}$ bond. $\text{H}-\text{F}$ or $\text{H}-\text{Cl}$ bonds are not broken by the alkoxy free radicals obtained from peroxides, while HI is weaker than HBr as it is broken by the alkoxy free radicals obtained from peroxides, but the iodine atoms so, formed readily combine with each other to give iodine molecules, rather than attack the double bond of alkenes.

47. (d) Iodine, being a non-polar compound is more soluble in CCl_4 (non-polar compound) than in water as "like dissolves like".

48. (b) $(\text{CH}_3)_3\text{CBr} \xrightarrow[\text{Dry ether}]{\text{Na}}$



49. (a) Molar mass of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$)

$$= 12 \times 6 + 1 \times 12 + 16 \times 6 = 180 \text{ g}$$

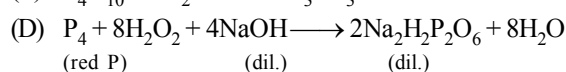
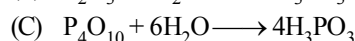
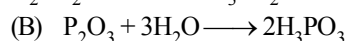
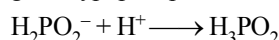
$$\text{Number of moles} = \text{Given mass/Molar mass}$$

$$= 180/180 = 1 \text{ mol}$$

$$\text{Molality (m)} = \text{Number of moles of solute/Mass of solvent (kg)} = 1/1 = 1 \text{ molal}$$

50. (a) $(\text{A})\text{P}_4 + 2\text{Ca}(\text{OH})_2 + 4\text{H}_2\text{O} \longrightarrow 2 \text{Ca}(\text{H}_2\text{PO}_2)_2 + 2\text{H}_2$
(white P) (hot) (calcium hypophosphite)

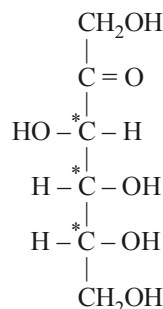
The salt is then treated with a strong non-oxidizing acid to give hypophosphorous acid.



$\text{Na}_2\text{H}_2\text{P}_2\text{O}_6$ can be converted to $\text{H}_4\text{P}_2\text{O}_6$ by passing it in an ion exchange column.

51. (a)

52. (b) Fructose has 3 chiral centre



53. (c) The bond energy of interhalogen compounds is less than the bond energy of halogens.

54. (d) All halogens (leaving F-F) have stronger bond than that in interhalogens.

55. (d) Interhalogen compounds are not highly volatile.