ANSWER KEYS

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

SOLUTIONS

1. **(d)**

2. **(b)** The slow decomposition of HNO_3 is represented by the equation

    $$4HNO_3 \rightarrow 4NO_2 + 2H_2O + O_2$$
    (yellow-brown)

3. **(b)** $4NH_3(g) + 5O_2(g) \xrightarrow{\text{Catalyst}} 4NO(g) + 6H_2O(g)$

    $2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$

    $3NO_2(g) + H_2O(l) \longrightarrow 2HNO_3(aq) + NO(g)$

4. **(c)** Open chain structure is unstable and converted to cyclic.

5. **(c)** $R-OH + SOCl_2 \xrightarrow{\text{Pyridine}} RCl + SO_2\uparrow + HCl\uparrow$

    SO_2 and HCl being gases escape leaving behind pure alkyl halide.

    Direct fluorination of alkane is highly exothermic process.

6. **(c)** Nitrogen form N_2 (*i.e.* $N\equiv N$) but phosphorus form P_4, because in P_2, $p_\pi — p_\pi$ bonding is present which is a weaker bonding.

7. **(a)**

8. **(c)** Colligative properties of dilute solution containing non volatile solute depends upon the number of particles of the solute present in the solution.

9. **(d)** For *bcc* lattice, body diagonal $= a\sqrt{3}$

    The distance between the body centered atom and one corner atom in cube will be $= \dfrac{\sqrt{3}a}{2}$

10. **(a)**

11. **(b)** The two isomeric forms ($\alpha-$ and $\beta-$) of D–glucopyranose differ in configuration only at C-1. Hence these are called anomers.

12. **(d)**

13. **(b)** It is the most electronegative element.

14. **(d)**

2, 4,6-Tribromophenol
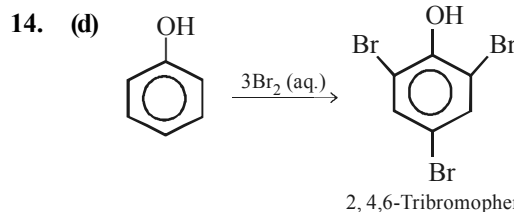
Note : The –OH group in phenol, being activating group, facilitates substitution in the *o*- and *p*-positions.
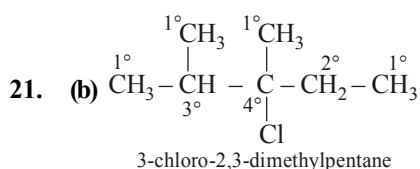
15. **(b)** At low temperature existence of a substance in solid state is due to slow molecular motion and strong cohesive forces.

    These two forces hold the constituent particles together thus causes existence of substance in solid state.

16. **(a)** Following are the three possible isomers of butanol

    (i) $CH_3CH_2 — CH_2 — CH_2OH$

    Butan–1–ol
    no chiral carbon

    (ii) $CH_3 — CH_2 — \overset{*}{C}H — CH_3$
    $|$
    OH

    Butan –2 – ol

    1-Chiral Carbon

    (iii)

    $$H_3C — \underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}} — CH_3$$

    2 – methylpropan – 2 – ol

    No Chiral Carbon

17. **(c)** The boiling point of water inside the cooker increases above 100°C due to accumulation of steam and increase in pressure. Thus making it possible to cook food faster.
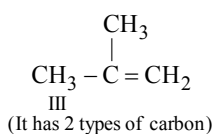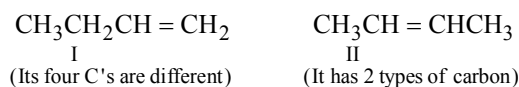
18. **(c)** $H_3\overset{3}{C} - \overset{2}{C}H - OCH_3$
$\qquad\qquad\underset{\underset{1}{CH_3}}{|}$
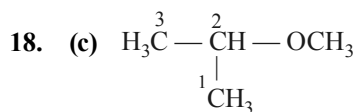
IUPAC name of the above compund is 2-methoxypropane.

19. **(b)** Order of M.P. of B.P. or critical temperature:
$H_2O > H_2Te > H_2Se > H_2S$

20. **(d)** Since diastereomers are all those isomers which are not enantiomers, there may be more than one diastereomer of a compound. An epimer differs in the configuration of only one chiral carbon, so an epimer can be C—2, C—3, C–4, etc. An anomer may be α- or β- ; so no term is absolutely specific.

21. **(b)** $\underset{\underset{\underset{\underset{\text{3-chloro-2,3-dimethylpentane}}{}}{Cl}}{\overset{\overset{\overset{1°CH_3 \quad 1°CH_3}{\quad| \qquad\quad |}}{}}{\underset{1°}{CH_3} - \underset{3°}{CH} - \underset{4°}{\overset{2°}{C}} - \overset{1°}{CH_2} - CH_3}}$

22. **(c)**

23. **(b)** C_4H_7Cl is a monochloro derivative of C_4H_8 which itself exists in three acyclic isomeric forms.

$$\underset{\underset{\text{(Its four C's are different)}}{I}}{CH_3CH_2CH = CH_2} \qquad \underset{\underset{\text{(It has 2 types of carbon)}}{II}}{CH_3CH = CHCH_3}$$

$$\underset{\underset{\text{(It has 2 types of carbon)}}{III}}{\underset{CH_3 - \overset{|}{C} = CH_2}{\overset{CH_3}{\overset{|}{}}}}$$

Grand total of acyclic isomers = 6 + 4 + 2 = 12

24. **(a)** According to Henry's law partial pressure of a gas in the solution is proportional to the mole fraction of gas in the solution.
$p = K_Hx$; $K_H = $ (Henry's constant)

25. **(c)** Ozone does not react with acidified solution of $K_2Cr_2O_7$.

26. **(b)** In DNA and RNA heterocyclic base and phosphate ester are at C_1' and C_5' respectively of the sugar molecule.
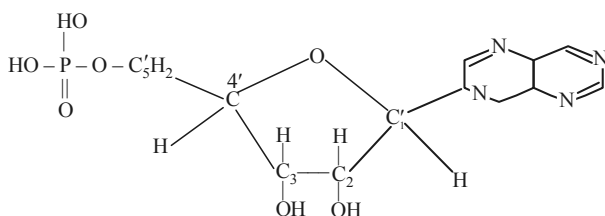
27. **(c)** MI > MBr > MCl > MF. As the size of the anion decreases covalency decreases.

28. **(c)** In liquid state BrF_3 dissociates into BrF_2^+ and BrF_4^- ions most easily.

29. **(c)** Molality (m)

$$= \cfrac{\text{Molarity}}{\text{Density} - \cfrac{\text{Molarity} \times \text{Molecular mass}}{1000}}$$
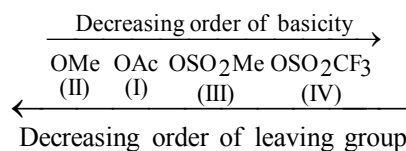
$$= \cfrac{18}{1.8 - \cfrac{18 \times 98}{1000}} = 500 \text{ mol kg}^{-1}$$

**30.** **(d)** Molarity (M) $= \dfrac{wt \times 1000}{\text{mol. wt.} \times \text{vol (mL)}}$

$2 = \dfrac{wt.}{63} \times \dfrac{1000}{250} \implies wt. = \dfrac{63}{2} \text{ g} = 31.5\text{g}$

wt. of 70% acid $= \dfrac{100}{70} \times 31.5 = 45$ g

31. **(b)** Weaker the base, better the leaving group. Hence

$$\xrightarrow{\text{Decreasing order of basicity}}$$
$$\underset{\underset{(II)}{\text{OMe}} \quad \underset{(I)}{\text{OAc}} \quad \underset{(III)}{\text{OSO}_2\text{Me}} \quad \underset{(IV)}{\text{OSO}_2\text{CF}_3}}{}$$
$$\xleftarrow{}$$
Decreasing order of leaving group

32. **(d)** The products of the concerned reaction react each other forming back the reactants.
$$XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF \cdot$$

33. **(b)**

α-D-glucose   β-D-glucose

anomers
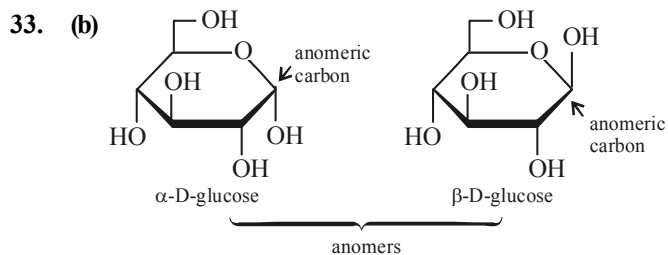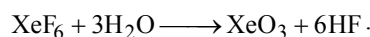
34. **(a)** Sandmeyer's reaction
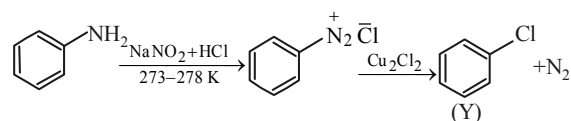
35. **(b)** The only well characterised compound having + 5 oxidation state of Bi is BiF_5. It is due to smaller size and high electronegativity of fluorine.

36. **(d)** $M = \dfrac{\rho \times a^3 \times N_A \times 10^{-30}}{Z}$

$$= \frac{10 \times (100)^3 \times 6.02 \times 10^{23} \times 10^{-30}}{4} = 15.05$$

∴ Number of atoms in 100

$$g = \frac{6.02 \times 10^{23}}{15.05} \times 100 = 4 \times 10^{25}$$

37. **(a)** $CH_3CH_2Cl > CH_2 = CHCl > C_6H_5Cl$

38. **(d)** Due to hydrogen bonding, HF is a liquid.

39. **(b)** Given $P_1 = 19$ mm Hg, $P_2 = 760$ mm Hg;
$\Delta H_{vap.} = 40670$ J/mol

Applying Clausius-Clapeyron's equation

$$\log \frac{P_2}{P_1} = \frac{\Delta H_{vap}}{2.303 \times R}\left(\frac{T_2 - T_1}{T_1 T_2}\right)$$

or $\log \dfrac{760}{19} = \dfrac{40670}{2.303 \times 8.3}\left(\dfrac{373 - T_1}{T_1 \times 373}\right)$

on solving, we get $T_1 = 291.4$ K

40. **(c)** Nucleophilic substitution reaction depend upon the stability of carbocation. As, presence of electron withdrawing group decreases the stability of carbocation in compounds (II) and (III), therefore, will give less stable carbocation than (I).
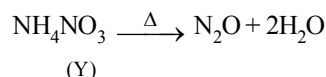
Further NO_2 group is a stronger EWG than — Cl.

Thus, p-NO_2— C_6H_4— $\overset{+}{C}H_2$ will be less stable than pCl — C_6H_4— $\overset{+}{C}H_2$

Hence, the order of stability of carbocations, and thus reactivity of parent alcohol will be:

O_2N—⟨○⟩—$\overset{+}{C}H_2$ $<$ Cl—⟨○⟩—$\overset{+}{C}H_2$ $<$ ⟨○⟩—$\overset{+}{C}H_2$
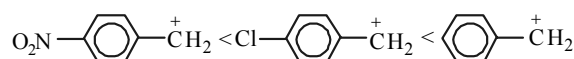
41. **(a)** $NH_4ClO_4 + HNO_3 \rightarrow HClO_4 + \underset{(X)}{NH_4NO_3}$

$\underset{(Y)}{NH_4NO_3} \xrightarrow{\Delta} N_2O + 2H_2O$

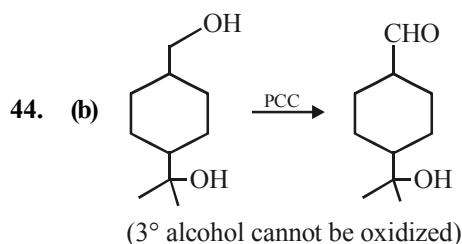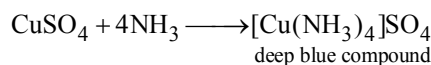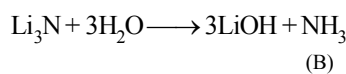**42.** **(d)** For an *fcc* crystal

$$r_{cation} + r_{anion} = \frac{edge\ length}{2}$$

$$110 + r_{anion} = \frac{508}{2}$$

$$r_{anion} = 254 - 110 = 144\ pm$$

43. **(a)** $\underset{(M)}{Li\,(s)} + N_2\,(g) \underset{\substack{high \\ temperature}}{\rightleftharpoons} 2Li_3N\,(s)$

$\underset{(B)}{Li_3N + 3H_2O \longrightarrow 3LiOH + NH_3}$

$CuSO_4 + 4NH_3 \longrightarrow \underset{deep\ blue\ compound}{[Cu(NH_3)_4]SO_4}$

44. **(b)**

(3° alcohol cannot be oxidized)

45. **(b)** The bond angle $\overset{\ddot{O}}{\underset{C \quad H}{\diagup\!\diagdown}}$ in alcohols is slightly less than the tetrahedral angle (109°-28′). It is due to the repulsion between the unshared electron pairs of oxygen.

46. **(c)** S_8 has puckered ring type structure.

47. **(a)** **R** is the correct explanation of **A**.

48. **(d)** $S_N I$ mechanism does not depend on the concentration of nucleophile. 2° alkyl halides are more reactive than 1° alkyl halides towards $S_N I$ mechanism, because 2° carbocation is more stable than 1° carbocation.

49. **(a)** $\underset{(Metal)}{M} + \underset{(Conc.)}{HNO_3} \longrightarrow \underset{(Metal\ nitrate)}{MNO_3} + \underset{(Nascent\ hydrogen)}{H}$

$2HNO_3 + \underset{(Nascent\ hydrogen)}{2H} \longrightarrow 2NO_2 + 2H_2O$
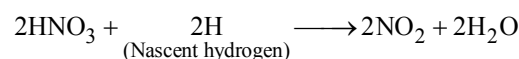
50. **(c)** In allylic halides hydrogen atom is bonded to sp^3 hybridised carbon atom. Whereas in vinylic halide, hydrogen atom is bonded to sp^2 hybridised carbon atom.

CH_3CHCl_2 $\underset{Cl \qquad Cl}{\overset{CH_2 - CH_2}{|\qquad\ |}}$

Ethylidene chloride   Ethylene dichloride
(*gem*-dihalide)   (*vic*-dihalide)

51. **(b)**   **52.** **(c)**

53. **(c)** Osmotic pressure is a colligative property.

54. **(b)** According to Raoult's law, the relative lowering in vapour pressure of a dilute solution is equal to the mole fraction of the solute present in the solution.

$$\frac{p° - p}{p} = \text{Mole fraction of solute} = \frac{n}{n + N}$$

55. **(d)** All are colligative properties.