SAMPLE PAPER 9

CHEMISTRY

A Highly Simulated Practice Questions Paper
*for CBSE **Class XII** (Term I) Examination*

Instructions

(i) This question paper contains three sections.
(ii) Section A has 25 questions. Attempt any 20 questions.
(iii) Section B has 24 questions. Attempt any 20 questions.
(iv) Section C has 6 questions. Attempt any 5 questions.
(v) Each questions carry 0.77 mark.
(vi) There is NO negative marking.

Roll No.

Maximum Marks : 35
Time allowed : 90 min

Section A

This section consists of 25 multiple choice questions with overall choice to attempt ***any 20*** *questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.*

1. Which of the following is used to prepare Cl_2 gas at room temperature from concentrated HCl ?

(a) NaOH (b) H_2S (c) $KMnO_4$ (d) Cr_2O_3

2. Which primitive unit cell has unequal edge lengths ($a \neq b \neq c$) and all axial angles different from 90°?

(a) Hexagonal (b) Monoclinic (c) Tetragonal (d) Triclinic

3. What is the main product of the reaction between 2-methylpropene with HBr?

(a) 1-bromobutane
(b) 1-bromo-2-methylpropane
(c) 2-bromobutane
(d) 2-bromo-2-methylpropane

4. Compound '*X*' is formed when three parts of conc. HCl and one part of conc. HNO_3 get mixed.

The correct option related to '*X*' is

(a) '*X*' is known as *aqua-regia*
(b) '*X*' is used for dissolving gold
(c) '*X*' is used for decomposition of salts of weaker acids
(d) Both (a) and (b)

5. The product obtained when acetyl bromide reacts with excess of CH_3MgI followed by treatment with a saturated solution of NH_4Cl?

(a) Acetone (b) Acetamide
(c) 2-methyl-2-propanol (d) Acetyl iodide

6. Which solid will have the weakest intermolecular forces?

(a) Ice (b) Phosphorous
(c) Naphthalene (d) Sodium fluoride

7. Which of the following reason is correct for the comparatively high boiling point of hydrogen fluoride?

(a) High reactivity of fluorine
(b) Small size of hydrogen atom
(c) Formation of hydrogen bonds
(d) Small size of fluorine

8. The reaction used for the conversion alkyl halide into alkene is

(a) nucleophilic substitution reaction
(b) elimination reaction
(c) both nucleophilic substitution and elimination reaction
(d) rearrangement

9. Another name of permono sulphuric acid is

(a) Marshall's acid (b) Caro's acid (c) sulphuric acid (d) None of these

10. The correct percentage of empty space in a body centered cubic arrangement is

(a) 74 (b) 68 (c) 32 (d) 26

11. Elimination of bromine from 2-bromobutane results in the formation of compound (X). Here, 'X' is

(a) predominantly 2-butyne (b) predominantly 1-butene
(c) predominantly 2-butene (d) equimolar mixture of 1 and 2-butene

12. Which of the following statement is incorrect for nitrogen ?

(a) It has a small size
(b) It does not readily react with O_2
(c) It is a typical non-metal
(d) Presence of *d*-orbital for bonding

13. Identify the following mixture,
"A mixture containing two enantiomers in equal proportions will have zero optical rotation as the rotation due to one isomer will be cancelled by the rotation due to other isomer."

(a) Inversion (b) Retention (c) Racemic mixture (d) Enantiomers

14. HCl can be prepared by

(a) $NaCl + H_2SO_4 \xrightarrow{420K}$ (b) $NaHSO_4 + NaCl \xrightarrow{823K}$
(c) $NaNO_3 + H_2SO_4 \longrightarrow$ (d) Both (a) and (b)

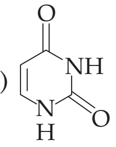
15. Which of the following shows negative deviation from Raoult's law?

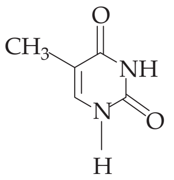
(a) $CHCl_3$ and CH_3COCH_3 (b) $CHCl_3$ and C_2H_5OH
(c) $C_6H_5CH_3$ and C_6H_6 (d) C_6H_6 and CCl_4

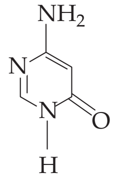
16. Tertiary alkyl halides are practically inert to S_N2 mechanisms. It is due to

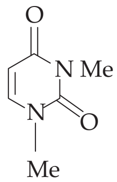
(a) insolubility
(b) instability
(c) inductive effect
(d) steric hindrance

17. Among the following compounds, which one is only found in RNA not in DNA ?

(a) 

(b) 

(c) 

(d) 

18. The correct reason for the H_2SO_4 corrosive action on skin is due to

(a) reaction with proteins
(b) its oxidising agent
(c) its non-dehydrating property
(d) its dehydrating agent and absorption of water is highly exothermic

19. Guanine is an example of ....

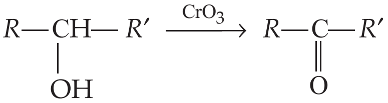
(a) a nucleotide
(b) nucleoside
(c) a nitrogenous base
(d) a phosphate derivative

20. PCl_5 exists but NCl_5 does not exist. It is due to

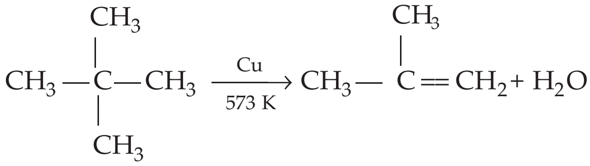
(a) lower electronegativity of P than N
(b) lower tendency of N to form covalent bond
(c) availability of vacant *d*-orbital in P but not in N
(d) statement is itself incorrect

21. Which of the following reaction is/are correct ?

(a) $CH_3—CH{=}CH—CH_2OH \xrightarrow{PCC} CH_3CH_2CH_2CHO$

(b) 

$R—\underset{\displaystyle OH}{\underset{|}{CH}}—R' \xrightarrow{CrO_3} R—\underset{\displaystyle O}{\underset{\|}{C}}—R'$

(c) 

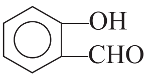
$CH_3—\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}—CH_3 \xrightarrow[573\text{ K}]{Cu} CH_3—\overset{\displaystyle CH_3}{\overset{|}{C}}{=}CH_2 + H_2O$

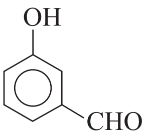
(d) Both (b) and (c) are correct.

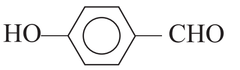
22. The solution that forms maximum boiling azeotropes is

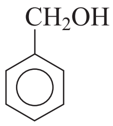
(a) carbon disulphide—acetone
(b) benzene—toluene
(c) acetone—chloroform
(d) *n*-hexane—*n*-heptane

23. Which of the following is most acidic ?

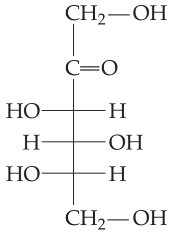
(a) 

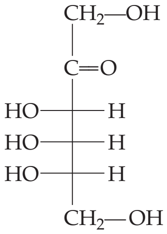
(b) 

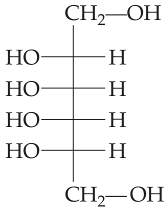
(c) 

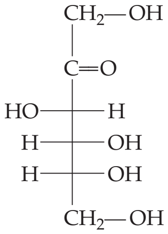
(d) 

24. Choose the correct structure of D-(–)-fructose.

(a) 

(b) 

(c) 

(d) 

25. Which of the following statements is incorrect ?

(a) The reactions of phenol with metals and sodium hydroxide indicate its basic nature

(b) The hydroxyl group in phenol is directly attached to sp^2-hybridised carbon of benzene ring

(c) The charge distribution in phenol causes the oxygen of —OH group to be positive

(d) A compound in which hydroxyl group attached to an aromatic ring is more acidic than the one in which hydroxyl group is attached to an alkyl group

Section B

*This section consists of 24 multiple choice questions with overall choice to attempt **any 20** questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.*

26. Which of the following is not the characteristic of ionic solids ?

(a) Very low value of electrical conductivity in the molten state

(b) Brittle nature

(c) Very strong forces of interaction

(d) Anisotropic

27. Vapour pressure of pure *A* in 70 mm Hg at 25°C. It forms an ideal solution with '*B*' in which mole fraction of *A* is 0.8. If the vapour pressure of the solution is 84 mm of Hg at 25°C, the vapour pressure of pure *B* at 25°C is

(a) 56 mm of Hg (b) 70 mm of Hg

(c) 140 mm of Hg (d) 28 mm of Hg

28. The correct statement regarding defects in the crystalline solid is

(a) Schottky defects have no effect on the density of crystalline solids

(b) Frenkel defects decreases the density of crystalline solids

(c) Frenkel defect is a dislocation defect

(d) Schottky defect is found in ZnS and AgBr

29. The value of Henry's constant K_H is

(a) greater for gases with higher solubility

(b) greater for gaseous with lower solubility

(c) constant for all gases

(d) not related to the solubility of gases

30. An atom forms fcc centered cubic crystal with density, $d = 8.92$ g/mL and edge length, $a = 3.6 \times 10^{-8}$ cm^3. The molecular mass of atom in amu is

(a) 98 amu (b) 63 amu

(c) 32 amu (d) 93 amu

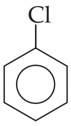
31. Identify the major product that is obtained on treatment of $CH_3CH_2CH(F)CH_3$ with CH_3O^-/CH_3OH is

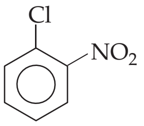
(a) $CH_3CH_2CH(OCH_3)CH_3$
(b) $CH_3CH{=}CHCH_3$
(c) $CH_3CH_2CH{=}CH_2$
(d) $CH_3CH_2CH_2CH_2OCH_3$

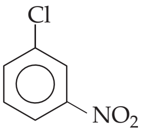
32. Nitrogen forms N_2 but phosphorus is converted into P_4 from P_2. The reason is

(a) weak $p\pi$-$p\pi$ bonding
(b) weak $d\pi$-$p\pi$ bonding
(c) strong $p\pi$-$p\pi$ bonding
(d) triple bond is present in phosphorus atoms

33. Consider the following compounds.

I. 

II. 

III. 

The increasing order of rate of reaction towards nucleophilic substitution is

(a) I < II < III
(b) III < II < I
(c) I < III < II
(d) III < I < II

34. Extra pure N_2 can be obtained by thermal decomposition of

(a) NH_3 with CuO
(b) NH_4NO_3
(c) $(NH_4)_2Cr_2O_7$
(d) $Ba(N_3)_2$

35. Select the correct statement(s).

(a) Alcohols are weaker acids than water
(b) Water is a better proton donor than alcohol
(c) Sodium ethoxide is a stronger base than sodium hydroxide
(d) All of the above

36. Consider the following reactions,

$$2NaOH + SO_2 \longrightarrow A + H_2O$$
$$A + H_2O + SO_2 \longrightarrow 2B$$

What are *A* and *B* in the above reactions?

	A	*B*
(a)	Na_2SO_3	$NaHSO_3$
(b)	$NaHSO_3$	Na_2SO_3
(c)	Na_2SO_4	Na_2O
(d)	$NaHSO_3$	Na_2SO_4

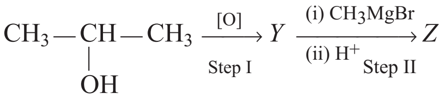
37. Select the incorrect statement about Kolbe's reaction.

(a) Phenoxide ion is less reactive than phenol towards electrophilic aromatic substitution
(b) A weak electrophile CO_2 is used in this reaction
(c) *Ortho*-hydroxybenzoic acid is formed as the main product
(d) Salicylic acid is formed as the main product

38. Which of the following dissolves in water but does not give any oxyacid solution ?

(a) SO_2
(b) QF_2
(c) SCl_4
(d) SO_3

39. Regarding the given sequence of reactions.



$$CH_3-\underset{\substack{|\\ OH}}{CH}-CH_3 \xrightarrow[\text{Step I}]{[O]} Y \xrightarrow[\text{(ii) } H^+ \quad \text{Step II}]{\text{(i) } CH_3MgBr} Z$$

Choose the incorrect statement from the following.

(a) Product Z is 2-methylpropan-2-ol

(b) Product Y is acetone

(c) Step II is nucleophilic addition reaction followed by hydrolysis

(d) Step I is insertion of oxygen into C—C single bond

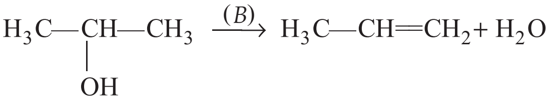
40. The type of hybridisation and number of lone pair(s) of electrons of Xe in $XeOF_4$, respectively, are

(a) sp^3d^2 and 1 (b) sp^3d and 2

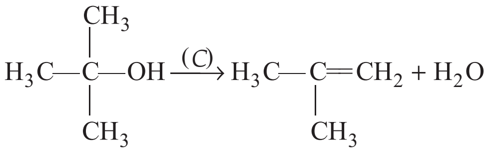
(c) sp^3d and 1 (d) sp^3d^2 and 2

41. Consider the following reactions :

I. $C_2H_5OH \xrightarrow{(A)} CH_2=CH_2 + H_2O$

II. 

$$H_3C-\underset{\substack{|\\ OH}}{CH}-CH_3 \xrightarrow{(B)} H_3C-CH=CH_2 + H_2O$$

III. 

$$H_3C-\overset{\substack{CH_3\\ |}}{\underset{\substack{|\\ CH_3}}{C}}-OH \xrightarrow{(C)} H_3C-\underset{\substack{|\\ CH_3}}{C}=CH_2 + H_2O$$

Identify A, B and C in the given reaction.

	A	B	C
(a)	20% H_3PO_4, 358 K	85% H_3PO_4, 440 K	H_2SO_4; 443 K
(b)	85% H_3PO_4, 440 K	H_2SO_4; 443 K	20% H_3PO_4, 358 K
(c)	H_2SO_4; 443 K	85% H_3PO_4, 440 K	20% H_3PO_4, 358 K
(d)	H_2SO_4; 443 K	20% H_2SO_4; 358 K	85% H_3PO_4, 440 K

42. The first noble gas compound obtained was

(a) $Xe^+PtF_6^-$ (b) XeF_4

(c) XeF_2 (d) $XeOF_4$

43. What are the two types of secondary structure of proteins?

(a) α-helix and β-pleated structure

(b) β-helix and α-pleated structure

(c) Fibrous and globular structure

(d) Fibrous and non-fibrous structure

44. Which of the following statements are correct for SO_2 gas ?

(a) It acts as bleaching agent in moist conditions

(b) Its molecule has angular geometry

(c) Its dilute solution is used as disinfectant

(d) All of the above statements are correct

Direction (Q. Nos. 45-49) *For given questions two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.*

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true, but R is not the correct explanation of A.

(c) A is true, but R is false.

(d) A is false, but R is true.

45. **Assertion** Face centered cubic cell has 4 atoms per unit cell.

Reason In fcc unit cell, there are 8 atoms at the corners and 3 atoms at face centres.

46. **Assertion** Lowering of vapour pressure is dependent on the number of solute particles present in the solution.

Reason Lowering of vapour pressure and relative lowering of vapour pressure are colligative properties.

47. **Assertion** Aryl halide undergoes nucleophilic substitution with ease.

Reason The carbon-halogen bond in aryl has partial double bond character.

48. **Assertion** Lucas reagent is a mixture of anhydrous $ZnCl_2$ and conc. HCl.

Reason Primary alcohol produces ppt. with Lucas reagents.

49. **Assertion** Glucose reacts with phenyl hydrazine and Fe.

Reason $NaHCO_3$ cannot break the ring structure.

Section C

*This section consists of 6 multiple choice questions with an overall choice to attempt **any 5**. In case more than desirable number of questions are attempted, ONLY first 5 will be considered for evaluation.*

50. Complete the following analogies :

A : Secondary alkyl halide : : *B* : Tertiary alkyl halide.

Choose best suitable option that are given below :

(a) $A : S_N2$ only : : $B : S_N1$ only

(b) $A : S_N2$ only : : $B : S_N1$ or elimination reaction depending upon stability of carbocation or more substituted alkene

(c) $A : S_N2$ or elimination reaction depending upon strength of base : : $B : S_N1$ or elimination depending upon stability of carbocation or more substituted alkene

(d) $A : S_N1$ only : : $B : S_N2$ only

51. Which of the following analogies is incorrectly matched ?

(a) Impurity defect : Solid solution of $CdCl_2$ and AgCl : : Metal excess defect : Violet colour of KCl crystal

(b) Frenkel defect : Density of solid decreases : : Schottky defect : Density of solid remain same

(c) Network solids : Gaint molecules : : Hydrogen bonded molecular solid : Volatile liquids or soft solids at room temperature

(d) (a) and (b) both are incorrect

52. Match the item given in Column I with that of given Column II and mark the correct codes that are given below.

Column I (Example)		**Column II** (Type of solution)	
A.	Soda water	1.	A solution of gas in solid
B.	Sugar solution	2.	A solution of gas in liquid
C.	German silver	3.	A solution of solid in liquid
D.	Hydrogen gas in palladium	4.	A solution of solid in solid

Codes

	A	B	C	D
(a)	2	3	4	1
(b)	2	1	4	3
(c)	4	3	1	2
(d)	2	4	3	1

Case *Read the passage given below and answer the following questions (53-55)*

Alkene hydration is a catalytic process that involves the addition of water across the double bond of an alkene to produce an alcohol. The result involves breaking the pi bond in the alkene, an OH bond in water and the formation of C—H bond and a C—OH bond. This is most direct and atom economical approach to the synthesis of alcohols. Acid-catalysed alkene hydration is the most well known hydration process. This process is used industrially with several different acidic species as the catalyst, including zeolites, oxides, phosphoric acid and sulphuric acid. There are several major drawbacks with this catalytic process.

The first drawback is the acidic environment which is very corrosive and can lead to degradation of reactors or the need to use specially engineered and expensive reactors to resist the acidic conditions. Another drawback is the acidic environment required for hydration is not suitable for alkenes with acid-sensitive functional groups.

Thus, this process is only used with simple alkenes such as ethylene, propylene and butenes. The final and biggest drawback is the selectivity of the reaction.

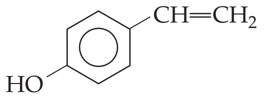
53. Hydration of propyne in the presence of $HgSO_4$ and sulphuric acid will produce

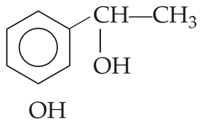
(a) propan-1-ol
(b) propan-2-ol
(c) propane
(d) propanone

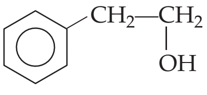
54. Methylcyclohexene on hydration under acidic condition will give

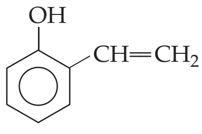
(a) 1-methylcyclohexan-2-ol
(b) 1-methylcyclohexan-1-ol
(c) 2-methylcyclohexan-2-ol
(d) 2-methylcyclohexanone

55. On adding H_2O to ethenyl benzene in the presence of dil. H_2SO_4, we get

(a)


(b)


(c)


(d)


Answers

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

EXPLANATIONS

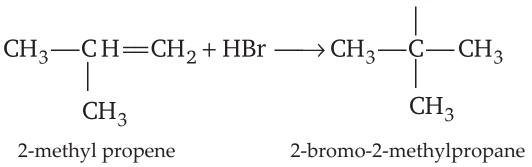
1. $KMnO_4$ oxidises halogen acids to halogen.

$$2KMnO_4 + \underset{\text{Conc.}}{16HCl} \longrightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2\uparrow$$

$\therefore KMnO_4$ is used to prepare Cl_2 from concentrated HCl.

2. Triclinic primitive unit cell has edge lengths $a \neq b \neq c$ and axial angles $\alpha \neq \beta \neq \gamma \neq 90°$. Among the seven basic or primitive crystalline systems, the triclinic system is most unsymmetrical.

3. 2-methyl propene on reaction with HBr gives 2-bromo-2-ethylpropene.

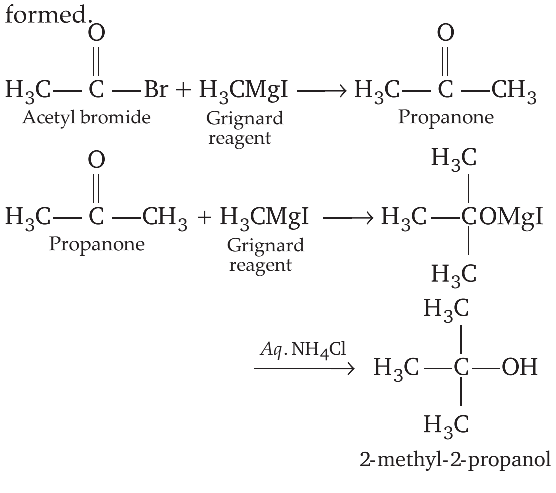


$$\underset{\text{2-methyl propene}}{CH_3-\underset{\underset{CH_3}{|}}{C}H=CH_2} + HBr \longrightarrow \underset{\text{2-bromo-2-methylpropane}}{CH_3-\overset{\overset{Br}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3}$$

4.
$$3HCl(\text{conc.}) + HNO_3(\text{conc.}) \longrightarrow \underset{\substack{(X)\\ \text{Aqua-regia}}}{HNO_3 \cdot 3HCl}$$

Aqua-regia is used for dissolving noble metals like gold, plantinum. HCl decomposes salts of weaker acids, e.g. carbonates, hydrogen carbonates, sulphites, etc.

5. When acetyl bromide reacts with excess of CH_3MgI and further treated with saturated solution of NH_4Cl then 2-methyl-2-propanol is formed.



$$\underset{\text{Acetyl bromide}}{H_3C-\overset{\overset{O}{\|}}{C}-Br} + \underset{\substack{\text{Grignard}\\ \text{reagent}}}{H_3CMgI} \longrightarrow \underset{\text{Propanone}}{H_3C-\overset{\overset{O}{\|}}{C}-CH_3}$$

$$\underset{\text{Propanone}}{H_3C-\overset{\overset{O}{\|}}{C}-CH_3} + \underset{\substack{\text{Grignard}\\ \text{reagent}}}{H_3CMgI} \longrightarrow H_3C-\overset{\overset{H_3C}{|}}{\underset{\underset{H_3C}{|}}{C}}OMgI$$

$$\xrightarrow{Aq.\,NH_4Cl} \underset{\text{2-methyl-2-propanol}}{H_3C-\overset{\overset{H_3C}{|}}{\underset{\underset{H_3C}{|}}{C}}-OH}$$

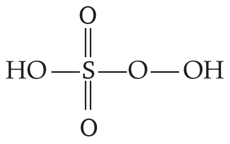
6. Ice has the lowest melting point out of the given solids, hence it has the weakest intermolecular forces.

7. HF has strong inter-molecular forces due to hydrogen bonding between HF and H.

8. Alkyl halide is best converted to alkene by mean of elimination reaction in form of dehydrohalogenation.

$$\underset{\text{Alkyl halide}}{R-CH_2CH_2X} \xrightarrow{\text{Dehydrohalogenation}} \underset{\text{Alkene}}{R-CH=CH_2}$$

9. Permonosulphuric acid (H_2SO_5) is known as Caro's acid. The correct structure of Caro's acid is



$$HO-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-O-OH$$

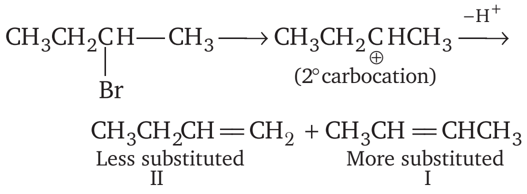
10. Packing efficiency (i.e. space occupied) for bcc is 68% .

$\therefore$ % of empty space = 100 − 68 = 32%

Note Packing efficiency

$$= \frac{\text{Volume occupied by two spheres in the unit cell}}{\text{Total volume of unit cell}}$$

11.



$$CH_3CH_2\underset{\underset{Br}{|}}{C}H-CH_3 \longrightarrow \underset{(2^\circ\,\text{carbocation})}{CH_3CH_2\underset{\oplus}{C}HCH_3} \xrightarrow{-H^+}$$

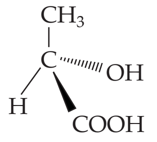
$$\underset{\substack{\text{Less substituted}\\ \text{II}}}{CH_3CH_2CH=CH_2} + \underset{\substack{\text{More substituted}\\ \text{I}}}{CH_3CH=CHCH_3}$$

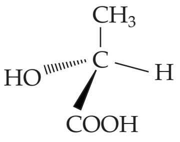
Stability of I > II, hence I is predominant.

According to Saytzeff rule, in dehydrohalogenation reactions, the preffered product is that alkene which has the greater number of alkyl group attached to the doubly bonded carbon atoms.

12. The electronic configuration of N is $1s^2 2s^2 2p^3$. Its *d*-orbital does not involve for bonding.

13. A mixture containing two enantiomers in equal proportions will have zero optical rotation , as the rotation due to one isomer will be cancelled by the rotation due to other isomer is known as racemic mixture, e.g.

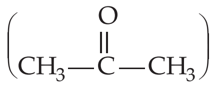

(R)-Lactic acid


(S)-Lactic acid

14. $NaCl + H_2SO_4 \xrightarrow{420\,K} NaHSO_4 + HCl$

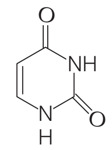
$NaHSO_4 + NaCl \xrightarrow{823\,K} Na_2SO_4 + HCl$

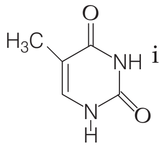
In both reactions, HCl is prepared.

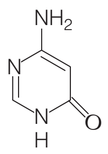
15. Acetone 
$\left(CH_3-\overset{\overset{O}{\|}}{C}-CH_3\right)$ and chloroform $(HCCl_3)$ will show a negative deviation due to their association after mixing.

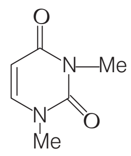
16. Tertiary alkyl halides are practically inert to S_N2 mechanism because of steric hindrance. As a result of which attacking Nu^- has less tendency to attack at the substrate.

17. RNA contains, adenine (A), guanine (G), cytosine (C) and uracil (U). In the given options,

(a)  is uracil (present in RNA only)

(b)  is thymine (present in DNA only)

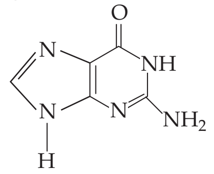
(c)  is cytosine (present in both DNA and RNA)

(d)  is not a pyrimidine base but a derivative of uracil.

18. H_2SO_4 has very high corrosive action on skin because it act as dehydrating agent and adsorption of water in highly exothermic.

19. Guanine is a heterocyclic nitrogenous purine base present in nucleic acids.

Structure of guanine is as follows



20. Phosphorus (3rd period element) can raise covalency facilitating vacant *d*-orbitals but not N.

P (ground) [Ne] $3s^2\,3p^3\,3d^0$

P (excited) [Ne] $3s^1\,3p^3\,3d^1$

That's why PCl_5 exists but NCl_5 does not exist.

21. The option (b) and (c) both are correct.

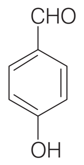
Correct (a) reaction is as follows :

(a) $H_3C-CH{=}CH-CH_2OH \xrightarrow{PCC}$

$CH_3-CH{=}CH-CHO$

22. Solution which show negative deviation from Raoult's law are called maximum boiling azeotrope. Hence, acetone and chloroform form maximum boiling azeotrope.

23.

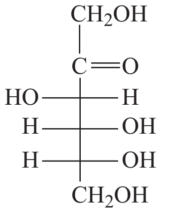

p-hydroxy benzaldehyde

The phenoxide ion left from *o*-hydroxybenzaldehyde and *p*-hydroxybenzaldehyde are stabilised by $-I$ and $-R$ effect of the $-CHO$ group.

But in *o*-isomer due to chelation, it is difficult to remove the H-atom.

Hence, *p*-hydroxybenzaldehyde is the strongest acid.

24. Structure of D-(–) - fructose.



—OH on the lowest asymmetric carbon is on the right side, so it has D-configuration.

25. Statements (b), (c) and (d) are correct whereas statement (a) is incorrect.

Corrected statement is as follows:

The reactions of phenol with metals and sodium hydroxide indicates its acidic nature.

26. Ionic solids are easily dissociate into its ions in molten state and hence, show high electrical conductivity. They are anisotropic and brittle and ions are linked together by very strong forces of interactions.

27. Given $p_A^\circ = 70$ mm Hg

$$\chi_A = 0.8$$
$$\chi_B = (1 - 0.8) = 0.2$$
$$p = 84 \text{ mm Hg}$$

According to Raoult's law,

$$p = \overset{\circ}{p_A}\chi_A + \overset{\circ}{p_B}\chi_B$$
$$84 = 0.8 \times 70 + 0.2\, p_B^\circ$$
$$\overset{\circ}{p_B} = \frac{28}{0.2} = 140 \text{ mm Hg}$$

28. Statement (c) is correct, while the other statements are incorrect. Corrected form of other statement are as follows :

Due to missing of ions, Schottky defect results in decreased density but Frenkel defect has no effect over density because in it only ions dislocate from its original position to interstitial site. Moreover, Frenkel defect is shown by ZnS, AgBr etc.

29. The value of Henry's constant K_H is greater for gases with lower solubility

According to Henry's law,

$$p = K_H \cdot \chi$$
$$K_H \propto \frac{1}{\chi}$$

where, p = partial pressure of gas

χ = solubility of gas in liquid

K_H = Henry's constant

30. Given,

Density $(d) = 8.92$ g/mL

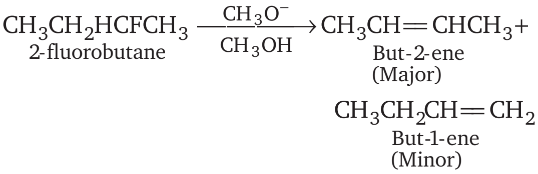
Edge length $(d) = 3.6 \times 10^{-8}$ cm^3,

$Z = 4$ (fcc crystal)

The molecular mass of atom in a lattice can be calculated by using the formula,

$$d = \frac{ZM}{N_A \times a^3} \Rightarrow M = \frac{d \cdot N_A \cdot a^3}{Z}$$
$$M = \frac{8.92 \times 6.023 \times 10^{23} \times (3.6)^3 \times (10^{-8})^3}{4}$$
$$M = 62.06 \simeq 63 \text{ amu}$$

31. The major product obtained on treatment of $CH_3CH_2CH(F)CH_3$ with CH_3O^-/CH_3OH is $CH_3CH = CHCH_3$. It is in accordance with Saytzeff's rule which states that dehydrohalogenation occur in such a way that the major product is were highly substituted product. Reaction involved is as follows:



$$\underset{\text{2-fluorobutane}}{CH_3CH_2HCFCH_3} \xrightarrow[CH_3OH]{CH_3O^-} \underset{\substack{\text{But-2-ene}\\ \text{(Major)}}}{CH_3CH{=}CHCH_3} + \underset{\substack{\text{But-1-ene}\\ \text{(Minor)}}}{CH_3CH_2CH{=}CH_2}$$

32. $p\pi$-$p\pi$ bonding is weak in P than N so, it does not form P_2 like N_2. Heavier elements of group 15 do not form $p\pi$-$p\pi$ bonds as their atomic orbitals are so large and diffuse that they cannot have effective overlapping.

33. The bond formed between C of benzene ring and halogen is more stable because of resonance, it has partial double bond character. So, rate of reaction towards nucleophilic substitution is slow. This substitution is facilitated by the presence of electron withdrawing group at *ortho* and *para* position because electron density is high at these positions.

Compound (II) and (III) both has one electron withdrawing group but in compound (II) electron withdrawing ($—NO_2$) group is present at *ortho* position, so rate of reaction in compound (II) is more than that of (III) while in (I) no electron withdrawing group is present.

Hence, the correct option is (I) < (III) < (II).

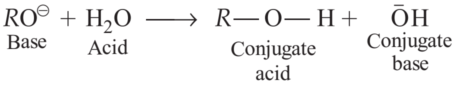
34. Extra pure N_2 can be obtained by thermal decomposition of barium azide as follows :

$$Ba(N_3)_2 \xrightarrow{\Delta} Ba(s) + 3N_2(g)$$

As the decomposed product of $Ba(N_3)_2$ contain solid Ba as by-product alongwith gaseous nitrogen, hence no addition step of separation is required.

35. All given statements are correct. Explanation of given statements are as follows :

(a) Alcohols are weaker acids than water as shown below :



$$\underset{\text{Base}}{RO^{\ominus}} + \underset{\text{Acid}}{H_2O} \longrightarrow \underset{\substack{\text{Conjugate}\\ \text{acid}}}{R—O—H} + \underset{\substack{\text{Conjugate}\\ \text{base}}}{\bar{O}H}$$

This reaction shows that water is better proton donor (i.e. stronger acid) than alcohols.

(c) An alkoxide ion is a better proton acceptor than hydroxide ion which suggests that alkoxides are stronger bases. Thus, sodium ethoxide is a stronger base than sodium hydroxide.

36. $2NaOH + SO_2 \longrightarrow \underset{(A)}{Na_2SO_3} + H_2O$

$\underset{(A)}{Na_2SO_3} + H_2O + SO_2 \longrightarrow \underset{(B)}{2NaHSO_3}$

Thus, (*A*) and (*B*) in the given reactions are Na_2SO_3 and $NaHSO_3$ respectively.

37. Statement (a) is incorrect about Kolbe's reaction. Corrected statement (a) is as follows : Phenoxide ion more reactive than phenol towards electrophilic aromatic substitution. Rest other statements are correct.

38. OF_2 dissolves in water but does not give any oxyacid solution. While SO_2 , SCl_4 and SO_3 give oxyacid in water.

$$SO_2 + H_2O \longrightarrow \underset{\text{Sulphurous acid}}{H_2SO_3}$$

$$SCl_4 + 3H_2O \longrightarrow \underset{\text{Sulphurous acid}}{H_2SO_3} + 4HCl$$

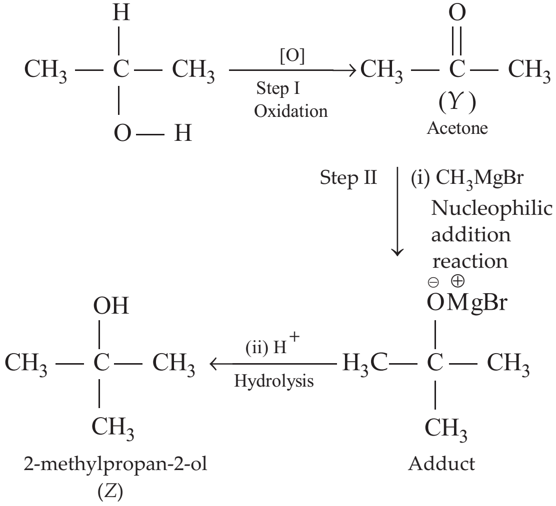
$$SO_3 + H_2O \longrightarrow \underset{\text{Sulphuric acid}}{H_2SO_4}$$

39. Statement (d) is incorrect.

Its correct form is as follows :

Step I is oxidation reaction,

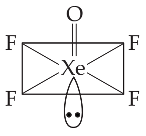
Complete sequence of reactions is as follows :



Rest other statements are correct.

40. In $XeOF_4$, Xe is sp^3d^2-hybridised. Geometry of the molecule is octahedral, but shape of the molecule is square pyramidal.

According to VSEPR theory, it has one π-bond. Remaining six electrons pairs form an octahedron with one position occupied by a lone pair.

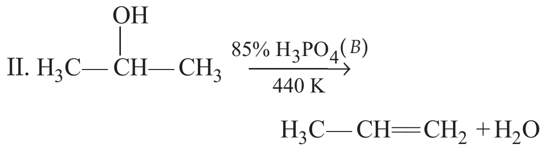


Number of bp = 5
Number of lp =1

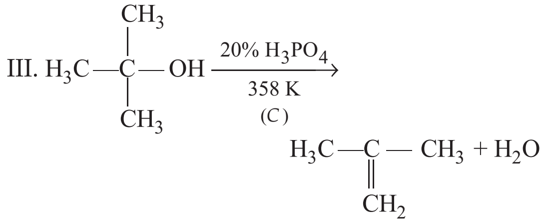
Hence, Xe contains one lone pair of electrons.

41. Reagent (*A*) is H_2SO_4, 443 K, reagent (*B*) is 85% H_3PO_4, 440 K and reagent (*C*) is 20% H_3PO_4 358 K. Reactions are as follows :

$$\text{I. } C_2H_5OH \xrightarrow[443\text{ K}]{H_2SO_4(A)} H_2C{=}CH_2 + H_2O$$



$$\text{II. } H_3C-\overset{OH}{\overset{|}{C}}H-CH_3 \xrightarrow[440\text{ K}]{85\%\ H_3PO_4(B)} H_3C-CH{=}CH_2 + H_2O$$



$$\text{III. } H_3C-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-OH \xrightarrow[\substack{358\text{ K}\\(C)}]{20\%\ H_3PO_4} H_3C-\underset{\underset{CH_2}{\|}}{C}-CH_3 + H_2O$$

The relative ease of dehydration of alcohols follows the order tertiary > secondary > primary.

42. The first compound of Xe was $Xe^+PtF_6^-$ which was discovered by Neil Bartlett. When oxygen is treated with PtF_6, a red compound $O_2^+PtF_6^-$ was formed. In this compound, the ionisation enthalpy of molecular oxygen was identical with that of Xe. This idea led to the discovery of compounds of Xe, when mixing of xenon and PtF_6 resulted in the formation of a red compound $Xe^+PtF_6^-$.

43.
- **Secondary structure** The conformation which the polypeptide chains assume as a result of H-bonding between $-\overset{O}{\overset{\|}{C}}-$ and —NH— groups of peptide bond is called secondary structure of proteins. They exist in two different structures which is as follows :
- **α-helix structure** It is one of the most common structure in which a polypeptide chain forms all possible hydrogen bonds by twisting into a right handed helix. In this structure, the —NH group of each amino acid unit is hydrogen bonded to the C$=$O of another amino acid unit present at an adjacent turn of the helix.
- **β-pleated sheet structure** All peptide chains are stretched out to nearly maximum extension and then laid side by side which are held together by intermolecular hydrogen bonds. The structure so formed resembles the pleated folds of drapery and thus, it is known as β-pleated sheet structure.

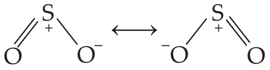
44. All the given statements are correct.

(a) SO_2 acts as bleaching agent in presence of moisture, it is due to the liberation of nascent hydrogen

$$SO_2(g)+2H_2O \longrightarrow H_2SO_4(aq.)+2[H]$$

$$2[H] + \text{Colouring matter} \rightarrow \text{Colourless matter.}$$

(b) SO_2 molecule is angular in shape



Resonating structure of SO_2

(c) Its dilute solution can be used as disinfectant. It also can be used as antichlor agent, preservative etc.

45. Assertion is true but Reason is false. In fcc unit cell, there are 8 atoms at the corners and 6 atoms at face centres.

46. Assertion is true but Reason is false.

Lowering of vapour pressure is directly proportional to the number of species presents in the solution. Only relative lowering of vapour pressure is a colligative property.

47. Assertion is false but Reason is true.

In aryl halides, the halogen atom decreases the electron density on benzene ring. But due to mesomeric effect it donates the electron pair to the benzene ring, therefore C—Cl bonds gets partial double bond character.

So, it becomes shorter and stronger and cannot be easily replaced by a nucleophile.

48. Assertion is true but Reason is false.

Lucas reagent is a mixture of anhyd. $ZnCl_2$ and conc. HCl is used for the distinction of monohydric alcohol. Tertiary alcohols on addition produce a precipitate immediately while secondary alcohols produce ppt. after 5 min. Primary alcohols do not produce any precipitate.

49. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion. Glucose does not react with $NaHSO_3$ due to ring structure of glucose.

50. S_N2 or elimination depending upon strength of base/Nu^- : Secondary alkyl halide : : S_N1 or elimination depending upon stability of carbocation or more substituted alkenes : Tertiary alkyl halide

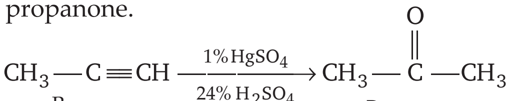
51. Frenkel defect : Density of solid remain same : : Schottky defect : Density of solid decrease.

- **Impurity defects** These defects arises when foreign atoms or ions are present at the lattice site or in the interstitial sites in place of host atoms. Example is the solid solution of $CdCl_2$ and AgCl.
- **Metal excess defect due to anionic vacancies** This type of defects are produced when metal halide is heated in metal vapours. e.g, Alkali halides such as NaCl, KCl, show this type of defect.
- **Schottky defect** It is a vacancy defect in ionic solids. This defect arises when equal number of cations and anions are missing from their lattice sites such that electrical neutrality is maintained. In this defect, density of the substance will decreases.
- **Frenkel defect** This defect arises when the smaller ion (usually cation) is dislocated from its normal site to an interstitial site. e.g. AgBr, AgCl, AgI, ZnS, etc., due to small size of $Ag^+$and Zn^{2+} ions.

  Due to this defect, electrical conductivity increases to a small extent. In this defect, density remains same.
- **Covalent or Network solids** A wide variety of crystalline solids of non-metals result from the formation of covalent bonds between adajcent atoms throughout the crystal are called covalent or network solids. These are also called a giant molecules.
- **Hydrogen bonded molecular solids** They consist of molecules containing polar covalent bonds between H and highly electronegative atoms like O, F or N atoms. Strong H-bonding binds molecules of such solids (e.g. H_2O-ice). These solids are volatile liquids or soft solids at room temperature and pressure.

52. A → (2); B → (3), C → (4); D → (1)

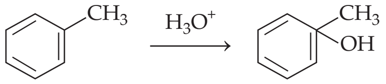
53. Hydration of propyne in the presence of $HgSO_4$ and sulphuric acid will produce propanone.



$$CH_3—C\equiv CH \xrightarrow[24\%\,H_2SO_4]{1\%\,HgSO_4} CH_3—\overset{\overset{\displaystyle O}{\|}}{C}—CH_3$$

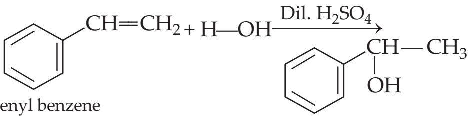
Propyne Propanone

54. Methyl cyclohexene on hydration under acidic condition will give 1-methylcyclohexan-1-ol.



Methylcyclohexene 1-methylcyclohexan-1-ol

55. On adding H_2O to ethenyl benzene in the presence of dil. H_2SO_4, we get 1-phenylethanol.



Ethenyl benzene

1-phenyl ethanol