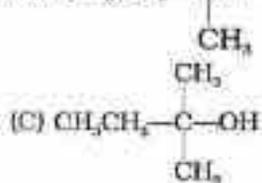
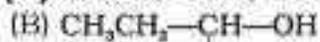


SET – A (CHEMISTRY) CLASS -12

Halo alkanes & Halo arenes

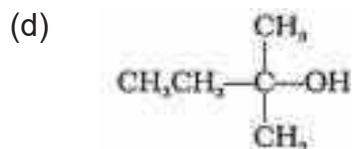
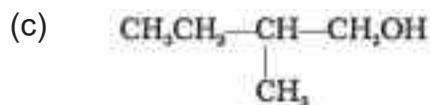
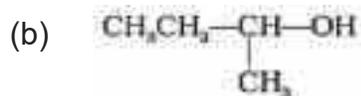
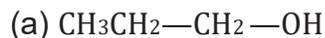
Multiple Choice Questions

1. The order of reactivity of following alcohols with halogen acids is _____.

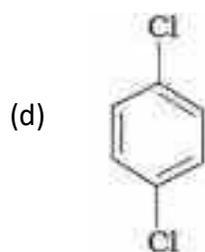
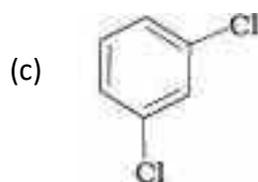
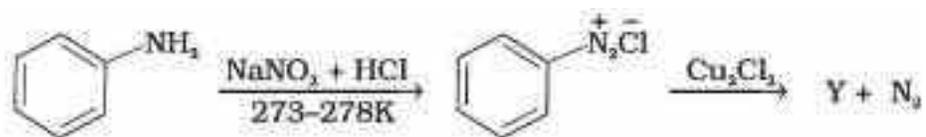


- (a) (A) > (B) > (C)
(b) (C) > (B) > (A)
(c) (B) > (A) > (C)
(d) (A) > (C) > (B)

2. Which of the following alcohols will yield the corresponding alkyl chloride on reaction with concentrated HCl (without using ZnCl_2) at room temperature?



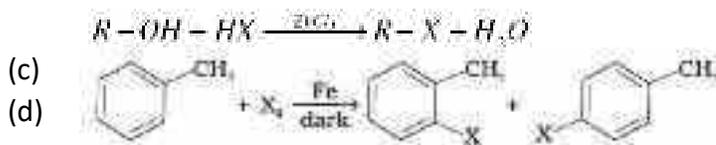
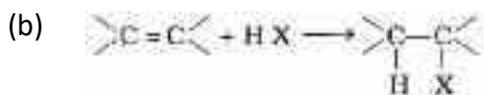
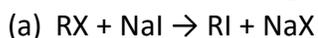
3. Identify the compound Y in the following reaction.



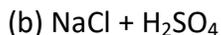
4. Toluene reacts with a halogen in the presence of iron (III) chloride giving ortho and para halo compounds. The reaction is

- (a) Electrophilic elimination reaction
- (b) Electrophilic substitution reaction
- (c) Free radical addition reaction
- (d) Nucleophilic substitution reaction

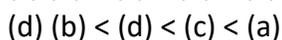
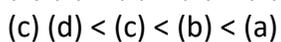
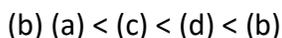
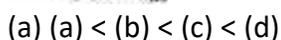
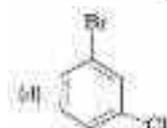
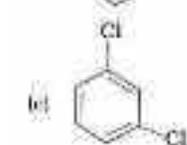
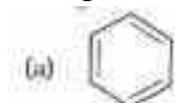
5. Which of the following is halogen exchange reaction?



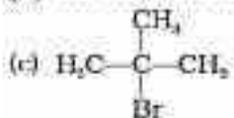
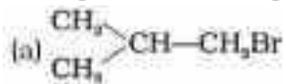
6. Which reagent will you use for the following reaction?



7. Arrange the following compounds in the increasing order of their densities.

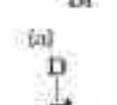
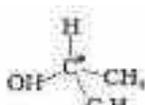
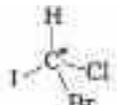


8. Arrange the following compounds in increasing order of their boiling points.



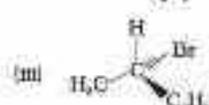
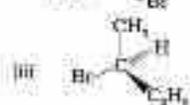
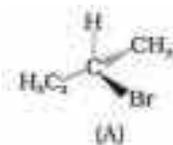
- (a) (b) < (a) < (c)
 (b) (a) < (b) < (c)
 (c) (c) < (a) < (b)
 (d) (c) < (b) < (a)

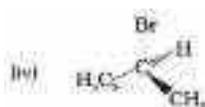
9. In which of the following molecules carbon atom marked with asterisk (*) is asymmetric?



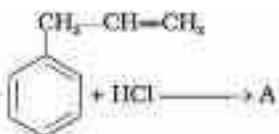
- (a) (a), (b), (c), (d)
 (b) (a), (b), (c)
 (c) (b), (c), (d)
 (d) (a), (c), (d)

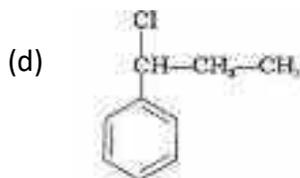
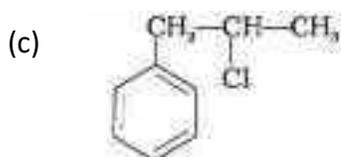
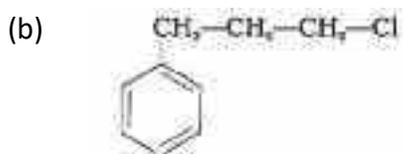
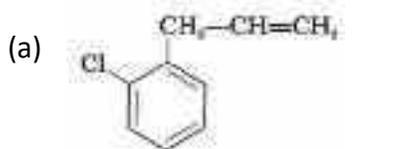
10. Which of the following structures is enantiomeric with the molecule (A) given below:





- (a) (i)
 (b) (ii)
 (c) (iii)
 (d) (iv)
11. Which of the following is an example of vic-dihalide?
 (a) Dichloromethane
 (b) 1,2-dichloroethane
 (c) Ethylidene chloride
 (d) Allyl chloride
12. The position of $-\text{Br}$ in the compound in $\text{CH}_3\text{CH}=\text{CHC}(\text{Br})(\text{CH}_3)_2$ can be classified as
 (a) Allyl
 (b) Aryl
 (c) Vinyl
 (d) Secondary
13. Chlorobenzene is formed by reaction of chlorine with benzene in the presence of AlCl_3 . Which of the following species attacks the benzene ring in this reaction?
 (a) Cl^-
 (b) Cl^+
 (c) AlCl_3
 (d) $[\text{AlCl}_4]^-$
14. Ethylidene chloride is a/an _____.
 (a) vic-dihalide
 (b) gem-dihalide
 (c) allylic halide
 (d) vinylic halide
15. What is 'A' in the following reaction?





16. A primary alkyl halide would prefer to undergo _____.

- (i) SN1 reaction
- ii) SN2 reaction
- iii) α -Elimination
- (iv) Racemization

17. Which of the following alkyl halides will undergo SN1 reaction most readily?

- (a) $(\text{CH}_3)_3\text{C}-\text{F}$
- (b) $(\text{CH}_3)_3\text{C}-\text{Cl}$
- (c) $(\text{CH}_3)_3\text{C}-\text{Br}$
- (d) $(\text{CH}_3)_3\text{C}-\text{I}$

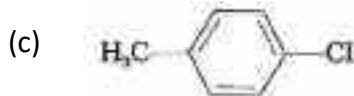
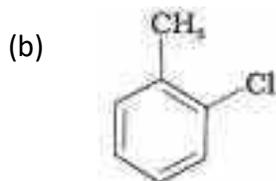
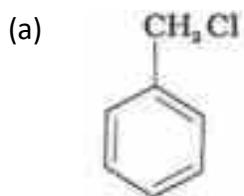
18. Which is the correct IUPAC name for



- (a) 1-Bromo-2-ethylpropane

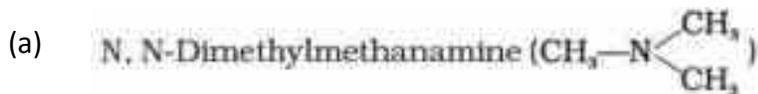
- (b) 1-Bromo-2-ethyl-2-methylethane
- (c) 1-Bromo-2-methylbutane
- (d) 2-Methyl-1-bromobutane

19. The reaction of toluene with chlorine in the presence of iron and in the absence of light yields _____.



(d) Mixture of (b) and (c)

20. Chloromethane on treatment with excess of ammonia yields mainly



(b) *N*-methylmethanamine ($\text{CH}_3-\text{NH}-\text{CH}_3$)

(c) Methanamine (CH_3NH_2)

(d) Mixture containing all these in equal proportion

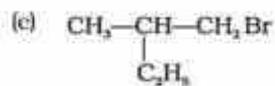
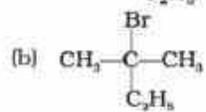
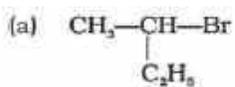
21. Molecules whose mirror image is non-superimposable over them are known as chiral. Which of the following molecules is chiral in nature?

- (a) 2-Bromobutane
- (b) 1-Bromobutane
- (c) 2-Bromopropane
- (d) 2-Bromopropan-2-ol

22. Reaction of $C_6H_5CH_2Br$ with aqueous sodium hydroxide follows _____.

- (a) SN_1 mechanism
- (b) SN_2 mechanism
- (c) Any of the above two depending upon the temperature of reaction
- (d) Saytzeff rule

23. Which of the following compounds will give racemic mixture on nucleophilic substitution by OH^- ion?

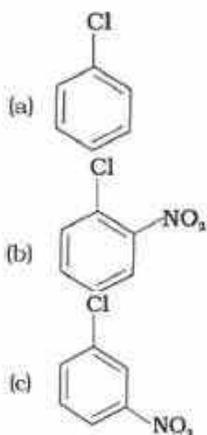


- (a) (a)
- (b) (a), (b), (c)
- (c) (b), (c)

(d) (a), (c)

Note: In the questions 24 to 27 arrange the compounds in increasing order of rate of reaction towards nucleophilic substitution.

24.



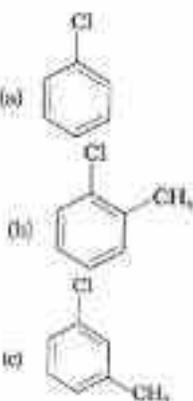
(a) (a) < (b) < (c)

(b) (c) < (b) < (a)

(c) (a) < (c) < (b)

(d) (c) < (a) < (b)

25.



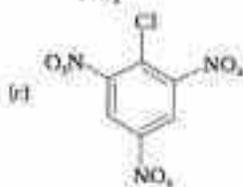
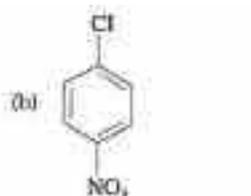
(a) (a) < (b) < (c)

(b) (a) < (c) < (b)

(c) $(c) < (b) < (a)$

(d) $(b) < (c) < (a)$

26.



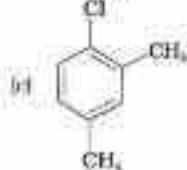
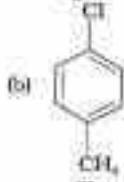
(a) $(c) < (b) < (a)$

(b) $(b) < (c) < (a)$

(c) $(a) < (c) < (b)$

(d) $(a) < (b) < (c)$

27.



(a) $(a) < (b) < (c)$

(b) $(b) < (a) < (c)$

- (c) (c) < (b) < (a)
(d) (a) < (c) < (b)

28. Which is the correct increasing order of boiling points of the following compounds?

1-Iodobutane, 1-Bromobutane, 1-Chlorobutane, Butane

- (i) Butane < 1-Chlorobutane < 1-Bromobutane < 1-Iodobutane
(ii) 1-Iodobutane < 1-Bromobutane < 1-Chlorobutane < Butane
(iii) Butane < 1-Iodobutane < 1-Bromobutane < 1-Chlorobutane
(iv) Butane < 1-Chlorobutane < 1-Iodobutane < 1-Bromobutane

29. Which is the correct increasing order of boiling points of the following compounds?

1-Bromoethane, 1-Bromopropane, 1-Bromobutane, Bromobenzene

- (i) Bromobenzene < 1-Bromobutane < 1-Bromopropane < 1-Bromoethane
(ii) Bromobenzene < 1-Bromoethane < 1-Bromopropane < 1-Bromobutane
(iii) 1-Bromopropane < 1-Bromobutane < 1-Bromoethane < Bromobenzene
(iv) 1-Bromoethane < 1-Bromopropane < 1-Bromobutane < Bromobenzene

Assertion and Reason Type

Note: In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (a) Assertion and reason both are correct and reason is correct explanation of assertion.**
(b) Assertion and reason both are wrong statements.
(c) Assertion is correct but reason is wrong statement.
(d) Assertion is wrong but reason is correct statement.
(e) Assertion and reason both are correct statements but reason is not correct explanation of assertion.

30. **Assertion:** Phosphorus chlorides (tri and penta) are preferred over thionyl chloride for

the preparation of alkyl chlorides from alcohols.

Reason: Phosphorus chlorides give pure alkyl halides.

31. **Assertion:** The boiling points of alkyl halides decrease in the order: $RI > RBr > RCl > RF$

Reason: The boiling points of alkyl chlorides, bromides and iodides are considerably higher than that of the hydrocarbon of comparable molecular mass.

32. **Assertion:** KCN reacts with methyl chloride to give methyl isocyanide

Reason: CN^- is an ambident nucleophile.

33. **Assertion:** tert-Butyl bromide undergoes Wurtz reaction to give 2, 2, 3, 3-tetramethylbutane.

Reason: In Wurtz reaction, alkyl halides react with sodium in dry ether to give hydrocarbon containing double the number of carbon atoms present in the halide.

34. **Assertion:** Presence of a nitro group at ortho or para position increases the reactivity of haloarenes towards nucleophilic substitution.

Reason: Nitro group, being an electron withdrawing group decreases the electron density over the benzene ring.

35. **Assertion:** In monohaloarenes, further electrophilic substitution occurs at ortho and para positions.

Reason: Halogen atom is a ring deactivator.

36. **Assertion:** Aryl iodides can be prepared by reaction of arenes with iodine in the presence of an oxidising agent.

Reason: Oxidising agent oxidises I_2 into HI.

37. **Assertion:** It is difficult to replace chlorine by $-OH$ in chlorobenzene in comparison to that in chloroethane.

Reason: Chlorine-carbon ($C-Cl$) bond in chlorobenzene has a partial double bond character due to resonance.

38. **Assertion:** Hydrolysis of (–)-2-bromooctane proceeds with inversion of configuration.

Reason: This reaction proceeds through the formation of a carbocation.

39. **Assertion:** Nitration of chlorobenzene leads to the formation of m-nitrochlorobenzene

Reason: $-NO_2$ group is a m-directing group.

40. **Assertion:**iodoform has appreciable antiseptic property.

Reason: Due to liberation of free iodine.

Note: Consider the following reaction and answer the questions no. 41–43.



41. (i) (a) and (e) both are nucleophiles.

(ii) In (c) carbon atom is sp^3 hybridised.

(iii) In (c) carbon atom is sp^2 hybridised.

(iv) (a) and (e) both are electrophiles.

- A) Option (i) is only correct answer.
- B) Option (i) and (ii) are correct.
- C) Option (i) and (iii) are correct.
- D) Option (iv) is the only correct option.

42. Which of the following statements are correct about this reaction?

(i) The given reaction follows SN_2 mechanism.

(ii) (b) and (d) have opposite configuration.

(iii) (b) and (d) have same configuration.

(iv) The given reaction follows SN_1 mechanism.

- A) Option (i) and (ii) both are correct.
- B) Option (ii) and (iii) both are correct.
- C) Only option (i) is correct.
- D) Only option (iv) is correct.

43. Which of the following statements are correct about the reaction intermediate?

(i) Intermediate (c) is unstable because in this carbon is attached to 5 atoms.

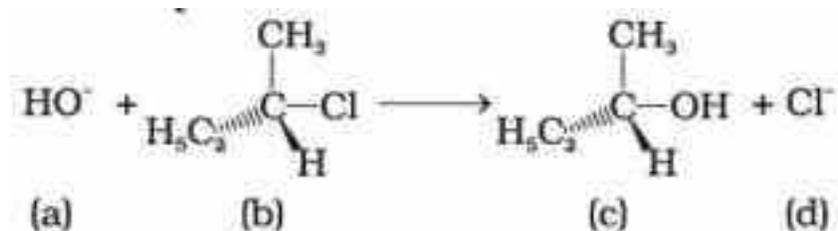
(ii) Intermediate (c) is unstable because carbon atom is sp^2 hybridised.

(iii) Intermediate (c) is stable because carbon atom is sp^2 hybridised.

(iv) Intermediate (c) is less stable than the reactant (b).

- A) Option (iv) is only correct option.
- B) Option (ii) is only correct option.
- C) Option (i) and (iv) are both correct.
- D) Option (ii) and (iii) both are correct.

Note: Answer Q. No. 44 and 45 on the basis of the following reaction.



44. Which of the following statements are correct about the mechanism of this reaction?

- (i) A carbocation will be formed as an intermediate in the reaction.
- (ii) OH⁻ will attach the substrate (b) from one side and Cl⁻ will leave it simultaneously from other side.
- (iii) An unstable intermediate will be formed in which OH⁻ and Cl⁻ will be attached by weak bonds.
- (iv) Reaction proceeds through SN1 mechanism.

- A) Only option (ii) is correct
- B) Only option (iii) is correct
- C) Both option (i) and (iv) are correct
- D) Both option (ii) and (iv) are correct

45. Which of the following statements are correct about the kinetics of this reaction?

- (i) The rate of reaction depends on the concentration of only (b).
- (ii) The rate of reaction depends on concentration of both (a) and (b).
- (iii) Molecularity of reaction is one.
- (iv) Molecularity of reaction is two.

- A) Both options (i) and (iii) are correct
- B) Both options (i) and (iv) are correct
- C) Both options (ii) and (iii) are correct
- D) Both options (iii) and (iv) are correct

46. Haloalkanes contain halogen atom (s) attached to the sp^3 hybridised carbon atom of an alkyl group. Identify haloalkane from the following compounds.

- (i) 2-Bromopentane
- (ii) Vinyl chloride (chloroethene)
- (iii) 2-chloroacetophenone
- (iv) Trichloromethane

- A) Only option (ii) is correct
- B) Only option (iii) is correct
- C) Both options (ii) and (iv) are correct
- D) Both options (i) and (iv) are correct

47. **Ethylene chloride and ethylidene chloride are isomers. Identify the correct statements.**

- (i) Both the compounds form same product on treatment with alcoholic KOH.
- (ii) Both the compounds form same product on treatment with aq.NaOH.
- (iii) Both the compounds form same product on reduction.
- (iv) Both the compounds are optically active.

- A) Both options i) and ii) are correct
- B) Both options ii) and iii) are correct
- C) Both options iii) and iv) are correct
- D) Both options i) and iii) are correct.

48. Which of the following compounds are gem-dihalides?

- (i) Ethylidene chloride
- (ii) Ethylene dichloride
- (iii) Methylene chloride
- (iv) Benzyl chloride

- A) Both options i) and iii)

- B) Both ii) and iii)
- C) Both ii) and iv)
- D) Only option iii)

49. Which of the following are secondary bromides?

- (i) $(\text{CH}_3)_2\text{CHBr}$
- (ii) $(\text{CH}_3)_3\text{CCH}_2\text{Br}$
- (iii) $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{CH}_3$
- (iv) $(\text{CH}_3)_2\text{CBrCH}_2\text{CH}_3$

- A) Both options i) and iv)
- B) Both options i) and iii)
- C) Both options ii) and i)
- D) Only option iii)

50. Which of the following compounds can be classified as aryl halides?

- (i) $p\text{-ClC}_6\text{H}_4\text{CH}_2\text{CH}(\text{CH}_3)_2$
- (ii) $p\text{-CH}_3\text{CHCl}(\text{C}_6\text{H}_4)\text{CH}_2\text{CH}_3$
- (iii) $o\text{-BrH}_2\text{C-C}_6\text{H}_4\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$
- (iv) $\text{C}_6\text{H}_5\text{-Cl}$

- A) Both options i) and iv)
- B) Only option iv)
- C) Both ii) and iii)
- D) Only option iv)

51. Alkyl halides are prepared from alcohols by treating with

- (A) $\text{HCl} + \text{ZnCl}_2$
- (B) Red P + Br_2
- (C) $\text{H}_2\text{SO}_4 + \text{KI}$
- (D) Both options (A) and (B)

52. Alkyl fluorides are synthesised by heating an alkyl chloride/bromide in presence

of _____ or _____.

- (i) CaF_2
- (ii) CoF_2
- (iii) Hg_2F_2
- (iv) NaF

- (A) Options i) and ii)
- (B) Options i) and iv)
- (C) Options ii) and iii)
- (D) Only option ii)

Passage based questions:

For Q.no. 53-57.

The substitution reaction of alkyl halide mainly occurs by SN1 or SN2 mechanism. Whatever mechanism alkyl halides follow for the substitution reaction to occur, the polarity of the carbon halogen bond is responsible for these substitution reactions.

The rate of SN1 reactions is governed by the stability of carbocation whereas for SN2 reactions steric factor is the deciding factor.

If the starting material is a chiral compound, we may end up with an inverted product or racemic mixture depending upon the type of mechanism followed by alkyl halide. Cleavage of ethers with HI is also governed by steric factor and stability of carbocation, which indicates that in organic chemistry, these two major factors help us in deciding the kind of product formed.

53. A primary alkyl halide would prefer to undergo

- (a) SN1 reaction
- (b) SN2 reaction
- (c) Elimination
- (d) Racemisation

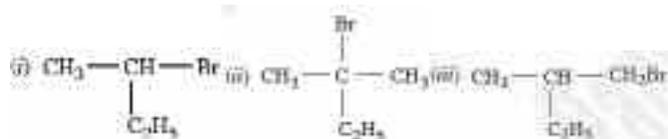
54. Which of the following alkyl halides will undergo SN1 reaction most readily ?

- (a) $(\text{CH}_3)_3\text{C-F}$
- (b) $(\text{CH}_3)_3\text{C-Cl}$
- (c) $(\text{CH}_3)_3\text{C-Br}$
- (d) $(\text{CH}_3)_3\text{C-I}$

55. Reaction of $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$ with aqueous sodium hydroxide follows

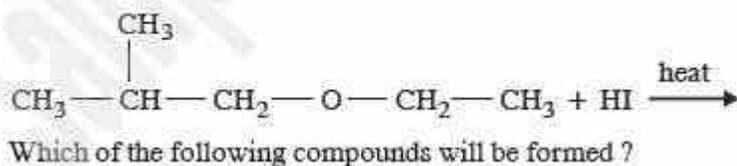
- (a) SN1 mechanism
- (b) SN2 mechanism
- (c) Any of the above two depending upon the temperature of reaction
- (d) Saytzeff rule

56. Which of the following compounds will give racemic mixture on nucleophilic substitution of OH⁻ ion ?



- (a) (i)
 (b) (i), (ii), (iii)
 (c) (ii), (iii)
 (d) (i), (iii)

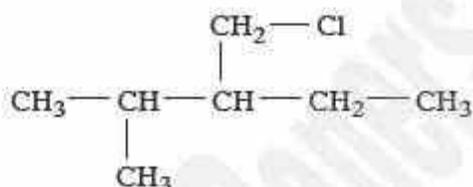
57. In the reaction :



- (a) $\text{CH}_3-\overset{\text{CH}_3}{\underset{|}{\text{CH}}}-\text{CH}_3 + \text{CH}_3\text{CH}_2\text{OH}$
 (b) $\text{CH}_3-\overset{\text{CH}_3}{\underset{|}{\text{CH}}}-\text{CH}_2\text{OH} + \text{CH}_3\text{CH}_3$
 (c) $\text{CH}_3-\overset{\text{CH}_3}{\underset{|}{\text{CH}}}-\text{CH}_2\text{OH} + \text{CH}_3\text{CH}_2\text{I}$
 (d) $\text{CH}_3-\overset{\text{CH}_3}{\underset{|}{\text{CH}}}-\text{CH}_2\text{I} + \text{CH}_3\text{CH}_2\text{OH}$

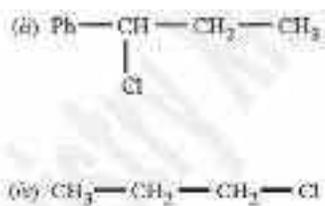
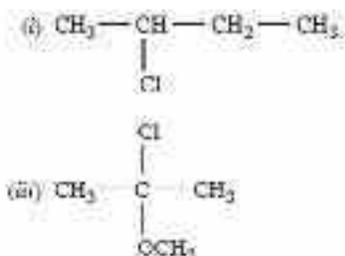
58. IUPAC name of the following compound is ,

IUPAC name of the following compound is ,



- (a) 1-Chloro-2-isopropylbutane
- (b) 3-Chloromethyl-2-methylpentane
- (c) 3-Chloromethyl-4-methylpentane
- (d) 1-Chloro-2-(1-methylethyl)butane

59. The correct order of reactivity in SN1 reaction for the following compounds is..



- (a) (i) > (ii) > (iii) > (iv)
- (b) (ii) > (i) > (iii) > (iv)
- (c) (iii) > (ii) > (i) > (iv)
- (d) (iv) > (iii) > (ii) > (i)

60. Which of the following possesses highest melting point?

- (a) Chlorobenzene
- (b) m-dichlorobenzene
- (c) o-dichlorobenzene
- (d) p-dichlorobenzene

Alcohols, Phenols and Ethers

1. Diethyl ether reacts, in spite of its usual inert nature, with :

- (a) Dilute sulphuric acid
- (b) Dilute sodium hydroxide
- (c) Boron trifluoride
- (d) Metallic sodium

2. Formation of diethyl ether from ethanol is based on a :

- (a) Dehydrogenation reaction
- (b) Hydrogenation reaction
- (c) Dehydration reaction
- (d) Heterolytic fission reaction

3. When vapours of an alcohol are passed over hot reduced copper, alcohol is converted into alkene, the alcohol is

- (a) Primary (b) Secondary (c) Tertiary (d) None of above

4. Ethylene reacts with Baeyer's reagent to give

- (a) ethane (b) ethyl alcohol (c) ethylene glycol (d) None of these

5. Alcohols of low molecular weight are

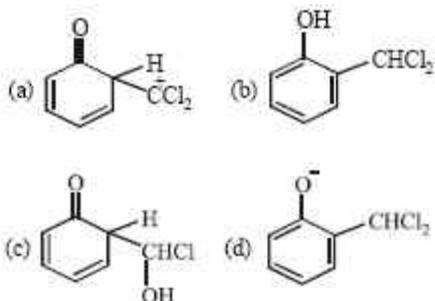
- (a) Soluble in water
- (b) Soluble in water on heating
- (c) Insoluble in water
- (d) Insoluble in all solvents

6. When ethyl alcohol reacts with acetic acid, the products formed are

- (a) Sodium ethoxide + hydrogen
- (b) Ethyl acetate + water
- (c) Ethyl acetate + soap

(d) Ethyl alcohol + water

7. When phenol is reacted with CHCl_3 and NaOH followed by acidification, salicylaldehyde is obtained. Which of the following species are involved in the above mentioned reaction as intermediate?



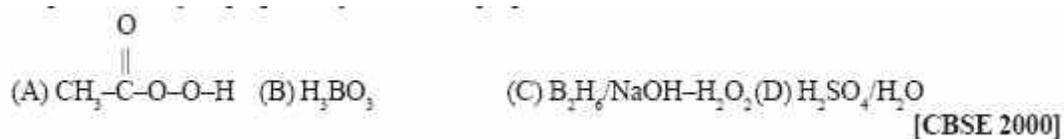
8. Which statement is not correct about alcohol?

- (a) Molecular weight of alcohol is higher than water.
- (b) Alcohol of less no. of carbon atoms is less soluble in water than alcohol of more no. of carbon atoms
- (c) Alcohol evaporates quickly.
- (d) All of these

9. When 3, 3-dimethyl 2-butanol is heated with $\text{Conc. H}_2\text{SO}_4$, the major product obtained is :

- (A) 2, 3-dimethylbut-1-ene
- (B) 2,3-dimethylpent-1-ene
- (C) 2,3-dimethylbut-2-ene
- (D) trans isomer of 2,3-dimethyl-2-butene

10. Propan-1-ol may be prepared by reaction of propene with :



11. n-Propyl alcohol and isopropyl alcohol can be chemically distinguished by which reagent :

- (A) PCl_5
- (B) reduction
- (C) iodoform test
- (D) ozonolysis

12. Which of the following will not form a yellow precipitate on heating with an alkaline solution of iodine :

- (A) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$
- (B) $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$
- (C) CH_3OH
- (D) $\text{CH}_3\text{CH}_2\text{OH}$

13. The $-\text{OH}$ group of an alcohol or the $-\text{COOH}$ group of a carboxylic acid can be replaced by $-\text{Cl}$ using:

- (A) phosphorus pentachloride
- (B) hypochlorous acid
- (C) chlorine
- (D) hydrochloric acid

14. $\text{C}_2\text{H}_5\text{OH}$ and CH_3OH can be differentiated by :

- (A) $\text{I}_2 + \text{NaOH}$
- (B) $\text{I}_2 + \text{HCl}$
- (C) H_2O
- (D) NH_3

15. Methanol and water can be separated from a mixture by :

- (A) distillation
- (B) fractional distillation
- (C) evaporation
- (D) separating funnel

16. Chlorine and ethyl alcohol react to produce :

- (A) ethyl chloride
- (B) ethyl tetrachloride
- (C) chloroform

(D) chloral

17. Dehydration of alcohol is an example of :

(A) redox reaction

(B) elimination reaction

(C) substitution reaction

(D) addition reaction

18. The compound used as anti-freeze is :

(A) Methanol

(B) Ethanol

(C) Propanol

(D) Glycol

19. The alcohol manufactured from water gas is :

(A) ethanol

(B) methanol

(C) isobutanol

(D) butanol

20. The boiling point of alcohol is higher than that of ether due to :

(A) hydrogen bonding

(B) large size of alcohol

(C) presence of -OH group

(D) high molecular weight

21. Excess of ethanol and conc. H_2SO_4 on heating upto 140°C . to produce :

(A) diethyl ether

(B) diethylsulphate

(C) ethyl hydrogen sulphate

(D) ethylene

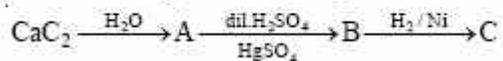
22. When alcohol reacts with concentrated H_2SO_4 , intermediate species formed is :

- (A) carbocation
- (B) alkoxy ion
- (C) alkyl hydrogen sulphate
- (D) none of these

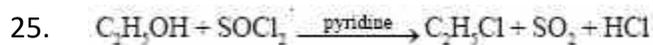
23. An alcohol gave Lucas test in about 5 minutes. When the alcohol was treated with hot concentrated H_2SO_4 it gave an alkene of molecular formula C_4H_8 which on ozonolysis gave $\text{C}_2\text{H}_4\text{O}$. The structure of alcohol is :

- (A) $\text{CH}_3\text{CHOHCH}_2\text{CH}_3$
- (B) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
- (C) $\text{CH}_3\text{CHOHCH}_2\text{CH}_2\text{CH}_3$
- (D) $(\text{CH}_3)_3\text{C-OH}$

24. In the reaction given below, the product C is :



- (A) $\text{C}_2\text{H}_5\text{OH}$
- (B) CH_3CHO
- (C) CH_3OH
- (D) CH_3COOH



The above reaction is known as:

- (A) Williamson's synthesis
- (B) Hoffmann's reaction
- (C) Mendius reaction
- (D) Darzen's process

26. The most suitable reagent for the conversion of

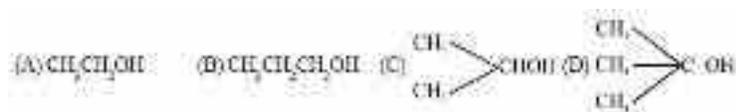
$RCH_2OH \rightarrow RCHO$ is :

- (A) $KMnO_4$
- (B) $K_2Cr_2O_7$
- (C) CrO_3
- (D) PCC (pyridiniumchloro chromate)

27. Isopropyl alcohol on oxidation produces:

- (A) Ether
- (B) Acetaldehyde
- (C) Acetone
- (D) Ethylene

28. The compound which is dehydrated most easily is:



29. The reaction of Lucas reagent is fastest with:

- (A) $CH_3(CH_2)_2OH$
- (B) $(CH_3)_3COH$
- (C) $(CH_3)_2CHOH$
- (D) CH_3CH_2OH

30. 3-Methyl-2-butanol on treatment with HCl gives predominantly:

- (A) 2-chloro-3-methyl butane
- (B) 2, 2-dimethylpentene
- (C) 2-chloro-2-methylbutane
- (D) None of these

31. Ethyl alcohol exhibits acidic nature on reaction with:

- (A) acidified $K_2Cr_2O_7$
- (B) sodium metal
- (C) HCl

(D) CH_3COOH

32. Action of nitrous acid on ethyl amine gives:

(A) CH_3NO_2

(B) NH_3

(C) C_2H_6

(D) $\text{C}_2\text{H}_5\text{OH}$

33. $\text{C}_2\text{H}_5\text{OH} \xrightarrow[443\text{K}]{\text{conc. H}_2\text{SO}_4} \text{Z}$

In the above reaction Z is identified as:

(A) $\text{C}_2\text{H}_5 - \text{O} - \text{C}_2\text{H}_5$

(B) $\text{C}_2\text{H}_5\text{CHO}$

(C) $\text{CH}_2 = \text{CH}_2$

(D) $\text{C}_2\text{H}_5\text{OSO}_4$

34. Which of the following is dihydric alcohol?

(A) Glycerol

(B) Ethylene glycol

(C) Catechol

(D) Resorcinol

35. Ethoxyethane with dilute H_2SO_4 gives:

(A) $\text{C}_2\text{H}_5\text{OH}$, CH_3HSO_4

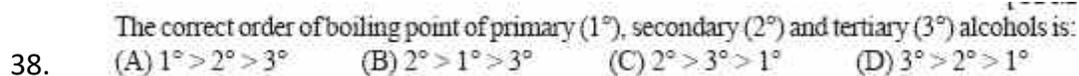
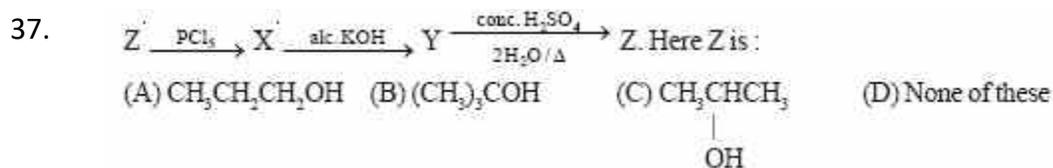
(B) $\text{C}_2\text{H}_5\text{OH}$

(C) CH_3OH , $\text{C}_2\text{H}_5\text{HSO}_4$

(D) CH_3OH , C_2H_4

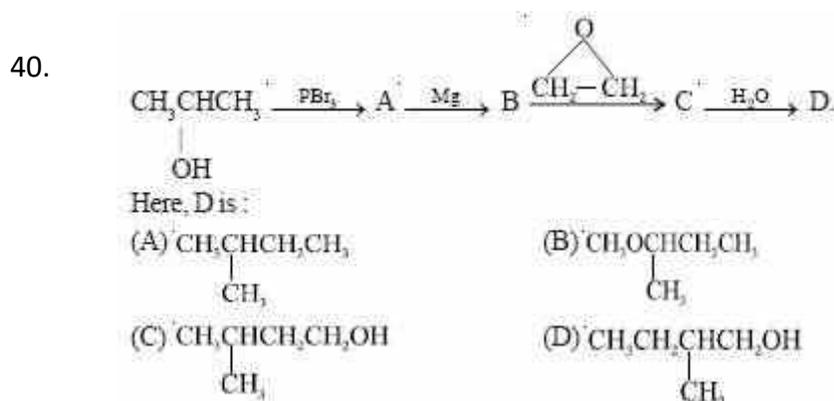
36. Compound not reacting with alkaline KMnO_4 is:

(A) $\text{CH}_3 - \underset{\text{CH}_3}{\overset{\text{OH}}{\text{C}}} - \text{CH}_3$ (B) $\text{CH}_3 - \overset{\text{OH}}{\text{C}} - \text{CH}_3$ (C) $(\text{CH}_3)_3\text{CCH}_2\text{OH}$ (D) none of these



39. Which one of the following is not true with heated copper at 300°C ?

- (A) secondary alcohol \rightarrow ketone
 (B) tertiary alcohol \rightarrow olefin
 (C) phenol \rightarrow benzyl alcohol
 (D) primary alcohol \rightarrow aldehyde



Assertion / Reason Type Questions

- (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 a correct explanation of A.
 (C) A is true but R is false.
 (D) A is false but R is true.

41. Assertion (A) : CF_3OH is more acidic than CH_3OH .

Reason (R) : Strong electron-withdrawing effects of the three fluorine atoms in CF_3 -group delocalize the negative charge on oxygen.

42. Assertion (A) : CH_3OH is more acidic than t-butyl

Reason (R) : Three methyl electron-attracting groups in t-butyl alcohol decrease electron-density.

43. Assertion (A) : Alcohol can be protonated by a strong halogen acid to form an oxonium ion.

Reason (R) : Water is a good leaving group, it can leave spontaneously when the alcohol is tertiary to form a stable carbocation.

44. Assertion (A) : Alcohols are soluble in water

Reason (R) : Intermolecular hydrogen-bonding increases boiling point of alcohols.

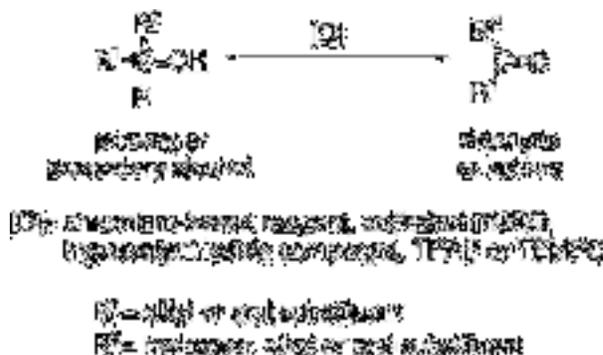
45. Assertion (A) : CH_3OH and $\text{CH}_3\text{CH}_2\text{OH}$ can be distinguished by haloform test.

Reason (R) : Haloform test is given by 2° alcohol.

Passage Based Questions

Read the passage given below and answer the following questions:

Oxidation of alcohols to aldehydes is partial oxidation; aldehydes are further oxidized to carboxylic acids. Conditions required for making aldehydes are heat and distillation. In aldehyde formation, the temperature of the reaction should be kept above the boiling point of the aldehyde and below the boiling point of the alcohol. Reagents useful for the transformation of primary alcohols to aldehydes are normally also suitable for the oxidation of secondary alcohols to ketones.



(46) Ethanol can be converted into ethanal by:

- a) Catalytic hydrogenation
- b) Treatment with LiAlH_4
- c) Treatment with pyridiniumchlorochromate
- d) Treatment with KMnO_4

(47) The compound that gives a tribromo derivative on treatment with bromine water is:

- a) m-Cresol
- b) Benzyl alcohol
- c) o-Cresol
- d) p-Cresol

48. Which of the following species can act as the strongest base?

- a) Hydroxide
- b) Alkoxide
- c) Phenoxide
- d) m-Nitro phenoxide

49. Arrange the following compounds in increasing order of boiling point: Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol.

- a) Propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol
- b) Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol
- c) Pentan-1-ol, butan-2-ol, butan-1-ol, propan-1-ol
- d) Pentan-1-ol, butan-1-ol, butan-2-ol, propan-1-ol

Read the passage given below and answer the following questions:

The dehydration of phenols and alkylation of phenols by alcohols over thorium were studied at 400–500 °C and atmospheric pressure. Phenol and cresols, when dehydrated gave diaryl ethers as main products. With para-substituted phenols such as p-methoxy, p-t-butyl, p-chloro, and p-nitrophenol no ether formation was noticed. Alkylation of phenols by alcohols gave a mixture of O- and C-alkylated products under the same reaction conditions. O-alkylation and C-alkylation are parallel reactions.

In addition to acting as an antiseptic, phenol is also a useful precursor in many chemical syntheses to produce pharmaceuticals, food preservatives, polymers, resins and adhesives. Phenolics are also present in a number of biological systems and natural products such as neurotransmitters, flavoring agents, and vitamins to name a few.

50. What is the IUPAC name of m-Cresol?

- (a) 2-Methylphenol
- (b) 3-Methylphenol
- (c) 4-Methylphenol
- (d) 2,4-Dimethylphenol

51. p-Nitrophenol is more acidic due to:-

- (a) +R & +I effect (b) -R & +I effect
(c) -I & +R effect (d) -I & -R effect

52. When Phenol is reacted with CHCl_3 and Aq. KOH it gives:-

- (a) Salicylaldehyde (b) Crotonaldehyde
(c) Salicyclic acid (d) Cinnamic acid

53. The reaction used to prepare Salicyclic acid from Phenol and CO_2 at 5-atm. is-

- (a) Williamson's reaction (b) Kolbe's reaction
(c) Reimer Tieman reaction (d) Friedel - Craft reaction

Read the passage given below and answer the following questions:

Alcohols, phenols, and ethers are widely used in our day-to-day life. Alcohols are classified as mono, di, tri, or polyhydric alcohols. Monohydric alcohols are further classified as primary, secondary, tertiary, allylic, vinylic, and benzylic alcohols. Alcohols can be prepared by various methods e.g. acid-catalyzed hydration of alkenes, reduction of carbonyl compounds, reduction of carboxylic acids, and the reaction of Grignard's reagent with carbonyl compounds. On comparing the acidity of phenols and alcohols we find that phenol is more acidic because it gives H^+ ion more easily and phenoxide ion gets stability due to resonance. Alcohols can be transformed into carbonyl compounds by oxidation and dehydrogenation process. Phenols and aromatic ethers are o- & p- directing towards electrophilic substitution reactions.

54. With dilute HNO_3 at low temperature (298K), phenol gives:

- (a) O- nitro phenol
(b) O- & p- nitro phenol
(c) m- nitro phenol
(d) picric acid

55. Ethanol on dehydrogenation using Cu based catalyst gives a carbonyl compound "X". The compound "X" can also be obtained by the ozonolysis of

- (a) But-1-ene
- (b) Ethene
- (c) But-2-ene
- (d) Propene

56. Correct increasing order of acidic strength is:

- (a) Ethanol < Phenol < p-Cresol
- (b) Phenol < Ethanol < p-Cresol
- (c) p-Cresol < Phenol < p-nitro phenol
- (d) p-nitro phenol < Phenol < p-Cresol

57. Reaction of Propanone with $\text{CH}_3\text{-Mg-Br}$ followed by hydrolysis gives:

- (a) Butan-2-ol
- (b) 2-Methylpropanol
- (c) Propan-2-ol
- (d) 2-Methyl-2-propanol

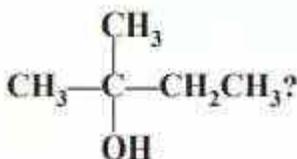
58. An alcohol (in excess) when heated with conc. H_2SO_4 at 413K gives an ether X, which on reacting with an excess of HI gives only Ethyl iodide. The alcohol and ether would be:

- (a) Ethanol & Ethoxy ethane
- (b) Propanol & Ethoxy ethane
- (c) Propanol & Methoxy ethane
- (d) Ethanol & Methoxy ethane

Read the given passage and answer the questions that follow:

Alcohols and phenols are the most important compounds used in our daily life. Alcohols are prepared by hydration of alkenes, fermentation of glucose, reduction of aldehydes, ketones, carboxylic acids, and esters. Alcohols are soluble in water. Boiling points increase with the increase in molar mass and decrease with branching. Alcohols on dehydration give alkene at 443K, follow carbocation mechanism. Excess of alcohol at 413K on dehydration with conc. H_2SO_4 also follows the carbocation mechanism but gives diethyl ether. Alcohols undergo nucleophilic substitution reactions, esterification with carboxylic acids, and derivatives like amides, acid halides, acid anhydride. Phenol is prepared from cumene, diazonium salts, anisole, and chlorobenzene. Phenol is used to prepare salicylaldehyde, salicylic acid, aspirin, methyl salicylate, p-benzoquinone. Phenol undergoes electrophilic substitution reaction at o & p-position. Ethers are functional isomers of alcohols, have low boiling points. Ethers are used as solvents. Unsymmetrical ethers are prepared by Williamson synthesis. Ethers react with HI and undergo SN_1 or SN_2 mechanism depending upon the stability of carbocation formed. Aromatic ethers like anisole undergo electrophilic substitution at o & p-position.

59. Write IUPAC name of



- a) 2-methylbutan-2-ol
- b) 2-ethylpropan-2-ol
- c) 1,1-dimethylpropan-1-ol
- d) None of the above

60. Which among the following will undergo dehydration fastest?

- a) tert-butylalcohol
- b) sec-butylalcohol
- c) n-Butylalcohol
- d) All of the above mentioned compounds undergoes dehydration reaction with same speed.

SOLUTIONS

1. Mole fraction of glycerine $C_3H_5(OH)_3$ in solution containing 36 g of water and 46 g of glycerine is

- (a) 0.46
- (b) 0.40
- (c) 0.20
- (d) 0.36

2. 30 g of urea ($M = 60 \text{ g mol}^{-1}$) is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.

- (a) 33.55 mm Hg
- (b) 43.66 mm Hg
- (c) 23.54 mm Hg
- (d) 14.12 mm Hg

3. Which of the following condition is not satisfied by an ideal solution?

- (a) $\Delta H_{\text{mixing}} = 0$
- (b) $\Delta V_{\text{mixing}} = 0$
- (c) Raoult's Law is obeyed
- (d) Formation of an azeotropic mixture

4. The boiling point of an azeotropic mixture of water and ethanol is less than that of water and ethanol. The mixture shows

- (a) no deviation from Raoult's Law.
- (b) positive deviation from Raoult's Law.
- (c) negative deviation from Raoult's Law.
- (d) that the solution is unsaturated.

5. Osmotic pressure of a solution is 0.0821 atm at a temperature of 300 K. The concentration in moles/litre will be

- (a) 0.33
- (b) 0.666
- (c) 0.3×10^{-2}
- (d) 3

6. People add sodium chloride to water while boiling eggs. This is to

- (a) decrease the boiling point.
- (b) increase the boiling point.
- (c) prevent the breaking of eggs.
- (d) make eggs tasty.

7. . The molal elevation constant depends upon
- (a) nature of solute.
 - (b) nature of the solvent.
 - (c) vapour pressure of the solution.
 - (d) enthalpy change.
8. If 2 gm of NaOH is present in 200 ml of its solution, its molarity will be
- (a) 0.25
 - (b) 0.5
 - (c) 5
 - (d) 10
9. The atmospheric pollution is generally measured in the units of
- (a) mass percentage
 - (b) volume percentage
 - (c) volume fraction
 - (d) ppm
10. A 5% solution of cane-sugar (molecular weight = 342) is isotonic with 1% solution of substance A. The molecular weight of X in g/ mol is
- (a) 342
 - (b) 171.2
 - (c) 68.4
 - (d) 136.8
11. 234.2 gm of sugar syrup contains 34.2 gm of sugar. What is the molal concentration of the solution.
- (a) 0.1 m
 - (b) 0.5 m
 - (c) 5.5 m
 - (d) 55 m
12. H_2S is a toxic gas used in qualitative analysis. If solubility of H_2S in water at STP is 0.195 m. what is the value of K_H ?
- (a) 0.0263 bar
 - (b) 69.16 bar
 - (c) 192 bar
 - (d) 282 bar
13. Henry's law constant for molality of methane in benzene at 298 K is 4.27×10^5 mm Hg. The mole fraction of methane in benzene at 298 K under 760 mm Hg is
- (a) 1.78×10^{-3}
 - (b) 17.43
 - (c) 0.114
 - (d) 2.814
14. How much oxygen is dissolved in 100 ml water at 298 K if partial pressure of

oxygen is 0.5 atm and $K = 1.4 \times 10^{-3}$ mol/L/atm?

- (a) 22.4 mg
- (b) 22.4 g
- (c) 2.24 g
- (d) 2.24 mg

15. The law which indicates the relationship between solubility of a gas in liquid and pressure is

- (a) Raoult's law
- (b) Henry's law
- (c) Lowering of vapour pressure
- (d) Van't Hoff law

16. Among the following substances the lowest vapour pressure is exerted by

- (a) water
- (b) alcohol
- (c) ether
- (d) mercury

17. Vapour pressure of a pure liquid X is 2 atm at 300 K. It is lowered to 1 atm on dissolving 1 g of Y in 20 g of liquid X. If molar mass of X is 200, what is the molar mass of Y?

- (a) 20
- (b) 50
- (c) 100
- (d) 200

18. Partial pressure of a solution component is directly proportional to its mole fraction. This is known as

- (a) Henry's law
- (b) Raoult's law
- (c) Distribution law
- (d) Ostwald's dilution law

19. 3 moles of P and 2 moles of Q are mixed, what will be their total vapour pressure in the solution if their partial vapour pressures are 80 and 60 torr respectively?

- (a) 80 torr
- (b) 140 torr
- (c) 72 torr
- (d) 70 torr

20. Which of the following solutions shows positive deviation from Raoult's law?

- (a) Acetone + Aniline
- (b) Acetone + Ethanol
- (c) Water + Nitric acid
- (d) Chloroform + Benzene

21. 30 g of urea ($M = 60 \text{ g mol}^{-1}$) is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.

- (a) 33.55 mm Hg
- (b) 43.66 mm Hg
- (c) 23.54 mm Hg
- (d) 14.12 mm Hg

22. . A 5 percent solution (by mass) of cane-sugar (M.W. 342) is isotonic with 0.877% solution of substance X. Find the molecular weight of X.

- (a) 60 g /mol
- (b) 54 g/mol
- (c) 24 g /mol
- (d) 120 g/mol

23. A plant cell shrinks when it is kept in a

- (a) hypotonic solution
- (b) hypertonic solution
- (c) isotonic solution
- (d) pure water

24. The relative lowering in vapour pressure is proportional to the ratio of number of

- (a) solute molecules to solvent molecules
- (b) solvent molecules to solute molecules
- (c) solute molecules to the total number of molecules in solution
- (d) solvent molecules to the total number of molecules in solution

25. A solution containing 10.2 g glycerine per litre is isotonic with a 2% solution of glucose. What is the molecular mass of glycerine?

- (a) 91.8 g
- (b) 1198 g
- (c) 83.9 g
- (d) 890.3 g

26. What weight of glycerol should be added to 600 g of water in order to lower its freezing point by 10°C ?

- (a) 496 g
- (b) 297 g
- (c) 310 g
- (d) 426 g

27. The osmotic pressure of a solution can be increased by

- (a) increasing the volume
- (b) increasing the number of solute molecules
- (c) decreasing the temperature
- (d) removing semipermeable membrane

28. What mass of ethylene glycol (molar mass = 62.0 g mol^{-1}) must be added to 5.50 kg of water to lower the freezing point of water from 0°C to -10.0°C ? (K_f for water = $1.86 \text{ K kg mol}^{-1}$)?

- (a) 1.833 Kg
- (b) 8.833 Kg
- (c) 9.663 Kg
- (d) 10.863 Kg

29 15.0 g of an unknown molecular material was dissolved in 450 g of water. The resulting solution was found to freeze at -0.34°C . What is the molar mass of this material? (K_f for water = $1.86 \text{ K kg mol}^{-1}$)

- (a) 198 g
- (b) 182 g
- (c) 236 g
- (d) 298 g

30 . A solution prepared by dissolving 1.25 g of oil of winter green (methyl salicylate) in 99.0 g of benzene has a boiling point of 80.31°C . Determine the molar mass of this compound. (B.P. of pure benzene = 80.10°C and K_b for benzene = $2.53^\circ \text{C kg mol}^{-1}$)

- (a) 126g/mol
- (b) 234 g/mol
- (c) 152 g/mol
- (d) 345 g/mol

31. Sprinkling of salt helps in clearing the snow covered roads in hills. The phenomenon involved in the process is

- (a) lowering in vapour pressure of snow
- (b) depression in freezing point of snow
- (c) melting of ice due to increase in temperature by putting salt
- (d) increase in freezing point of snow

32. For carrying reverse osmosis for desalination of water the material used for making semipermeable membrane is

- (a) potassium nitrate
- (b) parchment membrane
- (c) cellulose acetate
- (d) cell membrane

33. Which of the following units is useful in relating concentration of solution with its vapour pressure?

- (a) Mole fraction
- (b) Parts per million
- (c) Mass percentage
- (d) Molality.

34. At equilibrium the rate of dissociation of a solid solute in a volatile liquid solvent is

- (a) less than the rate of crystallisation
- (b) greater than the rate of crystallisation

- (c) equal to the rate of crystallisation
- (d) zero

Q.35. Maximum amount of a solid solute that can be dissolved in a specified amount of a given liquid solvent does not depend upon _____.

- (a) Temperature
- (b) Nature of solute
- (c) Pressure
- (d) Nature of solvent

36. Value of Henry's constant K_H _____.

- (a) increases with increase in temperature.
- (b) decreases with increase in temperature.
- (c) remains constant.
- (d) first increases then decreases.

37 If N_2 gas is bubbled through water at 293K, how many millimoles of N_2 gas would dissolve in 1 litre of water? Assume that N_2 exerts a partial pressure of 0.987 bar.

Given that Henry's law constant for N_2 at 293K is 76.48 k bar.

- (a) 0.716 m mol
- (b) 0.616 m mol
- (c) 0.740 m mol
- (d) 0.356 m mol

38. The partial pressure of ethane over a saturated solution containing 6.56×10^{-2} g of ethane is 1 bar. If the solution contains 5.0×10^{-2} g of ethane, then what will be the partial pressure of the gas?

- (a) 0.762 bar
- (b) 0.665 bar
- (c) 0.452 bar
- (d) 0.369 bar

39 Some ethylene glycol, $HOCH_2CH_2OH$, is added to your car's cooling system along with 5 kg of water. If the freezing point of a water-glycol solution is $-15.0^\circ C$, what is the boiling point of the solution?

($K_b = 0.52 \text{ K kg mol}^{-1}$ and $K_f = 1.86 \text{ K kg mol}^{-1}$ for water)

- a. $3.29^\circ C$
- b. $4.19^\circ C$
- c. $1.19^\circ C$
- d. $3.56^\circ C$

40. The value of Henry's constant K_H is _____.

- (a) greater for gases with higher solubility.
- (b) greater for gases with lower solubility.
- (c) constant for all gases.
- (d) not related to the solubility of gases.

41. A beaker contains a solution of substance 'A'. Precipitation of substance 'A' takes place when small amount of 'A' is added to the solution. The solution is _____.

- (a) saturated

- (b) supersaturated
- (c) unsaturated
- (d) concentrated

42. Maximum amount of a solid solute that can be dissolved in a specified amount of a given liquid solvent does not depend upon _____.

- (a) Temperature
- (b) Nature of solute
- (c) Pressure
- (d) Nature of solvent

43. Azeotropic mixture of HCl and H₂O has

- (a) 48% HCl
- (b) 22.2% HCl
- (c) 36% HCl
- (d) 20.2% HCl

44 A 500 g tooth paste sample has 0.2 g fluoride concentration. What is the concentration of fluorine in terms of ppm level?

- (a) 250
- (b) 200
- (c) 400
- (d) 1000

45. An aqueous solution freezes out -0.186°C ($K_f = 1.86^{\circ}$, $k_b = 0.512$). What is the elevation in boiling point?

- (a) 0.186
- (b) 0.512
- (c) 0.86
- (d) 0.0512

46 Equimolar solutions in the same solvent have

- (a) Same B.Ptbutdifferent F.Pt
- (b) Same F. Pt, but different B.Pts.
- (c) Same Boiling and same freezing point
- (d) Different boiling and different freezing points.

47The mole fraction of the solute in one molal aqueous solution is

- (a) 0.027
- (b) 0.036
- (c) 0.018
- (d) 0.019

48. If an aqueous solution of glucose is allowed to freeze, then crystals of which substance will be separated and first?

- (a) glucose
- (b) water
- (c) both of these
- (d) none of these

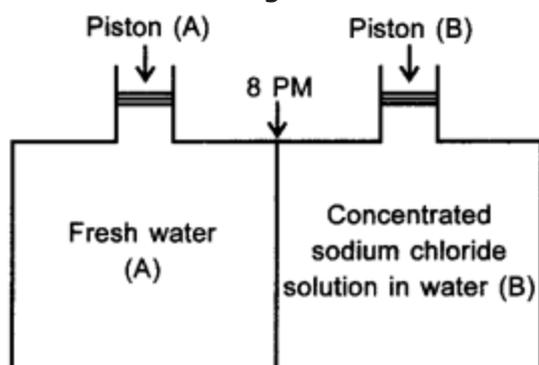
49. If two substances A and B have $P^0_A : P^0_B = 1 : 2$ and have mole fraction in solution $1 : 2$, then mole fraction of A in vapours will be

- (a) 0.33
- (b) 0.25
- (c) 0.52
- (d) 0.2

50. Two solutions of a substance (non-electrolyte) are mixed in the following manner: 480 mL of 1.5 M of first solution + 520 mL of 1.2 M second solution. What is the molarity of the final mixture?

- (a) 1.20 M
- (b) 1.50 M
- (c) 1.344 M
- (d) 2.70 M

51. Consider the figure and mark the correct option. [NCERT Exemplar]



- (a) water will move from side (A) to side (B) if a pressure lower than osmotic pressure is applied on piston (B).
- (b) water will move from side (B) to side (A) if a pressure greater than osmotic , pressure is applied on piston (B).
- (c) water will move from side (B) to side (A) if a pressure equal to osmotic pressure is applied on piston (B).
- (d) water will move from side (A) to side (B) if pressure equal to osmotic pressure is applied on piston (A).

52. A solution containing 10 g per dm^3 of urea (molar mass 60 g mol^{-1}) is isotonic with 5% solution of non-volatile solute, M_B of solute is

- (a) 300 g mol^{-1}

- (b) 350 g mol^{-1}
- (c) 200 g mol^{-1}
- (d) 250 g mol^{-1}

53. Conc. H_2SO_4 is 98 % H_2SO_4 by mass has $d = 1.84 \text{ g cm}^{-3}$. Volume of acid required to make one litre of 0.1 M H_2SO_4 is

- (a) 5.55 mL
- (b) 10 mL
- (c) 20 mL
- (d) 30 mL

54 At 100°C , the vapour pressure of a solution of 6.5 g of solute in 100 g of water is 732 mm. If K_b is 0.52 K/m , the boiling point of solution will be

- (a) 102°C
- (b) 103°C
- (c) 101°C
- (d) 100°C

55. 18 g of glucose, $\text{C}_6\text{H}_{12}\text{O}_6$ (Molar mass – 180 g mol^{-1}) is dissolved in 1 kg of water in a sauce pan. At what temperature will this solution boil? (K_b for water = $0.52 \text{ K kg mol}^{-1}$, boiling point of pure water = 373.15 K)

- (a) 373.202 K
- (b) 300.05K
- (c) 273K
- (d) 324.302 K

56. Calculate the mass of compound (molar mass = 256 g mol^{-1}) to be dissolved in 75 g of benzene to lower its freezing point by 0.48 K ($K_f = 5.12 \text{ K kg mol}^{-1}$).

- (a) 5.6 g
- (b) 1.8 g
- (c) 0.6 g
- (d) 1.3 g

57. Assertion- ΔH_{mix} ΔV_{mix} are zero for an ideal solution.

Reason- The interactions between the particles of the components of a solution are almost identical as between particles in the liquids.

- (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
- (c) If the Assertion is correct but Reason is incorrect.
- (d) If the Assertion is incorrect but Reason is correct

58 Assertion- NaCl is used to clear snow on the roads.

Reason- NaCl depresses the freezing point of water.

- (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
- (c) If the Assertion is correct but Reason is incorrect.
- (d) If the Assertion is incorrect but Reason is correct

59 Assertion- Camphor is usually used in molecular mass determination.

Reason- Camphor has low cryoscopic constant and therefore, causes greater depression in freezing point.

- (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
- (c) If the Assertion is correct but Reason is incorrect.
- (d) If the Assertion is incorrect but Reason is correct

60. 100 mg of a protein is dissolved in just enough water to make 10.0 mL of solution. If this solution has an osmotic pressure of 13.3 mm Hg at 25°C, what is the molar mass of the protein?

($R = 0.0821 \text{ L atm mol}^{-1} \text{ K}^{-1}$ and $760 \text{ mm Hg} = 1 \text{ atm.}$)

- (a) $13980.4 \text{ g mol}^{-1}$
- (b) $19980.6 \text{ g mol}^{-1}$
- (c) $21980.8 \text{ g mol}^{-1}$
- (d) $16980.4 \text{ g mol}^{-1}$

SOLIDS

Q.1. Which of the following statements about amorphous solids is incorrect ?

- (a) They melt over a range of temperature
- (b) They are anisotropic
- (c) There is no orderly arrangement of particles
- (d) They are rigid and incompressible

Q.2. Which of the following statement is not true about amorphous solids ?

- (a) On heating they may become crystalline at certain temperature.
- (b) They may become crystalline on keeping for long time.
- (c) Amorphous solids can be moulded by heating.
- (d) They are anisotropic in nature.

Q.3. Which of the following is not a characteristic property of solids?

- (a) Intermolecular distances are short.
- (b) Intermolecular forces are weak.

- (c) Constituent particles have fixed positions.
- (d) Solids oscillate about their mean positions.

Q.4. Most crystals show good cleavage because their atoms, ions or molecules are

- (a) weakly bonded together
- (b) strongly bonded together
- (c) spherically symmetrical
- (d) arranged in planes

Q.5. The coordination number of Y will be in the XY types of crystal:

- (a) 6
- (b) 8
- (c) 12
- (d) 4

Q.6. Which of the following is an amorphous solid ?

- (a) Graphite (C)
- (b) Quartz glass (SiO_2)
- (c) Chrome alum
- (d) Silicon carbide (SiC)

Q.7. Which of the following is not a crystalline solid?

- (a) KCl
- (b) CsCl
- (c) Glass
- (d) Rhombic S

Q.8. Alkali halides do not show Frenkel defect because

- (a) cations and anions have almost equal size
- (b) there is a large difference in size of cations and anions
- (c) cations and anions have low coordination number
- (d) anions cannot be accommodated in voids

Q.9. The fraction of the total volume occupied by the atoms present in a simple cube is

- (a) $\pi/4$
- (b) $\pi/6$
- (c) $\pi/3\sqrt{2}$
- (d) $\pi/4\sqrt{2}$

Q.10. Edge length of unit cell of chromium metal is 287 pm with bcc arrangement. The atomic radius is of the order

- (a) 287 pm
- (b) 574 pm

- (c) 124.27 pm
- (d) 143.5 pm

Q.11. The edge length of fee cell is 508 pm. If radius of cation is 110 pm, the radius of anion is

- (a) 110 pm
- (b) 220 pm
- (c) 285 pm
- (d) 144 pm

Q.12. The density of a metal which crystallises in bcc lattice with unit cell edge length 300 pm and molar mass 50 g mol^{-1} will be

- (a) 10 g cm^{-3}
- (b) 14.2 g cm^{-3}
- (c) 6.15 g cm^{-3}
- (d) 9.32 g cm^{-3}

Q.13. How many lithium atoms are present in a unit cell with edge length 3.5 \AA and density 0.53 g cm^{-3} ? (Atomic mass of Li = 6.94):

- (a) 2
- (b) 1
- (c) 4
- (d) 6

Q.14. The distance between Na^+ and Cl^- ions in NaCl with a density 2.165 g cm^{-3} is

- (a) 564 pm
- (b) 282 pm
- (c) 234 pm
- (d) 538 pm

Q.15. An element with atomic mass 100 has a bcc structure and edge length 400 pm. The density of element is

- (a) 10.37 g cm^{-3}
- (b) 5.19 g cm^{-3}
- (c) 7.29 g cm^{-3}
- (d) 2.14 g cm^{-3}

Q.16. Which of the following crystals does not exhibit Frenkel defect?

- (a) AgBr
- (b) AgCl
- (c) KBr
- (d) ZnS

Q.17. What type of stoichiometric defect is shown by ZnS?

- (a) Schottky defect
- (b) Frenkel defect

- (c) Both Frenkel and Schottky defects
- (d) Non-stoichiometric defect

Q.18. NaCl type crystal (with coordination no. 6 : 6) can be converted into CsCl type crystal (with coordination no. 8 : 8) by applying

- (a) high temperature
- (b) high pressure
- (c) high temperature and high pressure
- (d) low temperature and low pressure

Q.19. How many chloride ions are surrounding sodium ion in sodium chloride crystal ?

- (a) 4
- (b) 8
- (c) 6
- (d) 12

Q.20 In NaCl structure

- (a) all octahedral and tetrahedral sites are occupied
- (b) only octahedral sites are occupied
- (c) only tetrahedral sites are occupied
- (d) neither octahedral nor tetrahedral sites are occupied

Q.21. Silver halides generally show

- (a) Schottky defect
- (b) Frenkel defect
- (c) Both Frenkel and Schottky defects
- (d) cation excess defect

Q.22. Which of the following will have metal deficiency defect?

- (a) NaCl
- (b) FeO
- (c) KCl
- (d) ZnO

Q.23. In which pair most efficient packing is present?

- (a) hcp and bcc
- (b) hcp and ccp
- (c) bcc and ccp
- (d) bcc and simple cubic cell

Q.24. What is the effect of Frenkel defect on the density of ionic solids?

- (a) The density of the crystal increases
- (b) The density of the crystal decreases

- (c) The density of the crystal remains unchanged
- (d) There is no relationship between density of a crystal and defect present in it

Q.25. In a Schottky defect

- (a) an ion moves to interstitial position between the lattice points
- (b) electrons are trapped in a lattice site
- (c) some lattice sites are vacant
- (d) some extra cations are present in interstitial space

Q.26. Iodine molecules are held in the crystals lattice by _____.

- (a) london forces
- (b) dipole-dipole interactions
- (c) covalent bonds
- (d) coulombic forces

Q.27. 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 interactions.
- (d) Anisotropic nature.

Q.28. In face-centred cubic lattice, a unit cell is shared equally by how many unit cells

- (a) 2
- (b) 4
- (c) 6
- (d) 8

Q.29. Coordination number in ccp and hep arrangements of metal atoms are respectively.

- (a) 6, 6
- (b) 12, 6
- (c) 8, 6
- (d) 12, 12

Q 30. A compound formed by elements A and B crystallises in the cubic structure where A atoms are at comers of a cube and B atoms are at face centres. The formula of the compound is

- (a) AB_3
- (b) A_2B
- (c) AB_2
- (d) A_2B_3

Q.31. The number of atoms per unit cell of bcc structure is

- (a) 1
- (b) 2

- (c) 4
- (d) 6

Q.32. How many space lattices are possible in a crystal?

- (a) 23
- (b) 7
- (c) 230
- (d) 14

Q.33. The number of atoms in bcc arrangement is

- (a) 1
- (b) 2
- (c) 4
- (d) 6.

Q.34. In face-centered cubic unit cell, edge length is

- (a) $4/\sqrt{3}r$
- (b) $4/\sqrt{2}r$
- (c) $2r$
- (d) $\sqrt{3}/2r$

Q.35. Metallic lustre is explained by

- (a) diffusion of metal ions
- (b) oscillation of loose electrons
- (c) excitation of free protons
- (d) existence of bcc lattice..

Q.36. In a face-centered cubic lattice, unit cell is shared equally by how many unit cells?

- (a) 4
- (b) 2
- (c) 6
- (d) 8

Q.37. The percentage of iron present as Fe (III) in $\text{Fe}_{0.93} \text{O}_{1.0}$ is

- (a) 17.7%
- (b) 7.84%
- (c) 11.5%
- (d) 9.6%

Q.38 Which of the following fee structure contains cations in alternate tetrahedral voids?

- (a) NaCl
- (b) ZnS
- (c) Na_2O
- (d) CaF_2

Q.39 The numbers of tetrahedral voids in the unit cell of a face centered cubic lattice

of similar atoms is

- (a) 4
- (b) 6
- (c) 8
- (d) 10

Q.40 The hardest substance among the following is

- (a) Be_2C
- (b) Graphite
- (c) Titanium
- (d) SiC
- (e) B_4C

Q.41 How many unit cells are present in a cube-shaped ideal crystal of NaCl of mass 1.00 g? (Atomic mass of Na = 23, Cl = 35.5)

- (a) 5.14×10^{21}
- (b) 1.28×10^{21}
- (c) 1.71×10^{21}
- (d) 2.57×10^{21}

Q.42 What is the coordination number of Cl^- in NaCl crystals

- (a) 8
- (b) 6
- (c) 4
- (d) 3

Q.43 The pycnometric density of sodium chloride crystal is $2.165 \times 10^3 \text{ kg m}^{-3}$, while its X-ray density is $2.178 \times 10^3 \text{ kg m}^{-3}$. The fraction of the unoccupied sites in sodium chloride crystal is

- (a) 5.96
- (b) 15.96×10^{-2}
- (c) 5.96×10^{-1}
- (d) 5.96×10^{-3}

Q.44 If Z is the number of atoms in the unit cell that represents the closest packing sequence....ABC ABC....the number of tetrahedral voids in the unit cell is equal to

- (a) Z
- (b) 2Z
- (c) Z/2
- (d) Z/4

Q.45 Which has no rotation of symmetry?

- (a) Hexagonal
- (b) Orthorhombic
- (c) Cubic
- (d) Triclinic

Q.46 If the distance between Na^+ and Cl^- ions in sodium chloride crystal is X pm the length of the edge of the unit cell is

- (a) $4X$ pm
- (b) $X/4$ pm
- (c) $X/2$ pm
- (d) $2X$ pm

Q.47. **Assertion** : Stability of a crystal is reflected in the magnitude of its melting.

Reason : The stability of a crystal depends upon the strength of the interparticle attractive force.

- (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
- (c) If the Assertion is correct but Reason is incorrect.
- (d) If the Assertion is incorrect but Reason is correct.

Q.48. Assertion : Some compounds have both Schottky and Frenkel defects.

Reason : Both defects change the density of the solid.

- (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
- (c) If the Assertion is correct but Reason is incorrect.
- (d) If the Assertion is incorrect but Reason is correct

Q.49 The interionic distance for cesium chloride crystal will be

- (a) a
- (b) $a/2$
- (c) $\sqrt{3} a/2$
- (d) $2a/\sqrt{3}$.

Q.50 The liquified metal expanding on solidification is

- (a) Ga
- (b) Al

- (c) Zn
- (d) Cu

Q.51 The number of unit cells in 58.5 g of NaCl is nearly

- (a) 6×10^{20}
- (b) 3×10^{22}
- (c) 1.5×10^{23}
- (d) 0.5×10^{24}

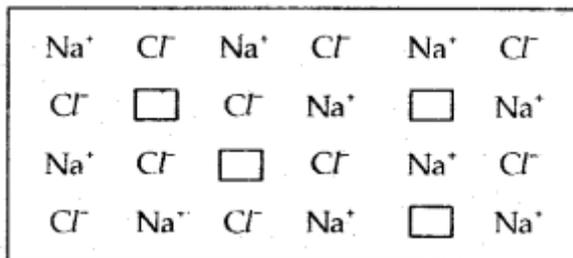
Q.52 The number of octahedral sites per sphere in fcc structure is

- (a) 8
- (b) 4
- (c) 2
- (d) 1

Q.53 The crystal system of a compound with unit cell dimensions $a = 0.387$, $b = 0.387$ and $c = 0.504$ nm and $\alpha = \beta = 90^\circ$ and $\gamma = 120^\circ$ is

- (a) Cubic
- (b) Hexagonal
- (c) Orthorhombic
- (d) rhombohedral

Q.54 Which type of crystal defect is indicated in the diagram below?



- (a) Frenkel defect
- (b) Schottky defect
- (c) Interstitial defect
- (d) Frenkel and Schottky defects.

55. **Assertion:** Graphite is a good conductor of electricity however diamond belongs to the category of insulators.

Reason: Graphite is soft in nature on the other hand diamond is very hard and brittle..

- (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

- (c) If the Assertion is correct but Reason is incorrect.
- (d) If the Assertion is incorrect but Reason is correct

56 **Assertion:** NaCl crystal is sometimes yellow in colour.

Reason: Na^+ in the crystal absorbs electrons from the air and hence gives yellow colour.

- (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
- (c) If the Assertion is correct but Reason is incorrect.
- (d) If the Assertion is incorrect but Reason is correct

57 The lattice site in a pure crystal cannot be occupied by _____.

- (a) molecule
- (b) ion
- (c) electron
- (d) atom

58. Graphite cannot be classified as _____.

- (a) conducting solid
- (b) network solid
- (c) covalent solid
- (d) ionic solid

59. **The correct order of the packing efficiency in different types of unit cells is _____.**

- (a) $\text{fcc} < \text{bcc} < \text{simple cubic}$
- (b) $\text{fcc} > \text{bcc} > \text{simple cubic}$
- (c) $\text{fcc} < \text{bcc} > \text{simple cubic}$
- (d) $\text{bcc} < \text{fcc} > \text{simple cubics}$

60. **The percentage of empty space in a body centred cubic arrangement is**

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