Visit QB365-SLMS - https://www.qb365.in/slms/ Complete Questions and Answers

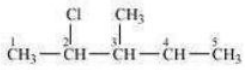
Answers Key:

Case Study Questions

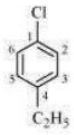
1. **(i) (a):**Terbium (65), $4f^8$; Dysprosium (Dy), $4f^9$; Ytterbium (Yb), $4f^{13}$.
   (ii) (a)
   (iii) (a)
   (iv) (b): The almost identical radii of Zr (160 pm) and Hf(159 pm), a consequence of lanthanoid contraction.
2. **(i) (c) :** Allylic chlorides are most reactive.
   (ii) (c): 2^0 - alkyl halides undergo hydrolysis by S_N1 or S_N2 mechanism.
   (iii) (a): Smaller the size of the nucleophile (i.e., CH_3O^-), more reactive it is.
   (iv) (d): Stearic hindrance due to bulky alkyl groups prevents the attack of the nucleophile in S_N2 mechanism.

5 Marks

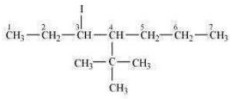
3. (i) Mole fraction: It is the ratio of the number of moles of one component to the total number of moles of all the components present in the solution. For example, if a binary solution has n_A moles of one component and n_B moles of second component, then mole fraction of component A(x_A) and B(x_B) is:
   $x_A = \frac{n_A}{n_A+n_B}$ and $x_B = \frac{n_B}{n_A+n_B}$ and $x_A + x_B = 1$
   (ii) Molality: It is the number of moles of solute dissolved per 1000 g (or 1 kg) of solvent. If n_2 moles of solute are dissolved in w_1 g of solvent, then
   Molality = $\frac{n_2}{w_1} \times 1000$
   (iii) Molarity: It is the number of moles of solute dissolved per liter of the solution. If n_2 moles of solute are dissolved in V mL of the solution, then
   Molarity = $\frac{n_2 \times 1000}{V}$
   (iv) Mass percentage: It is the amount of solute (in grams) per 100 g of the solution. If w_2 g of solute are dissolved in w_1 g of solvent, then
   Mass percentage of solute = $\frac{w_2}{w_1+w_2} \times 100$
4. (i) 2-Chloro-3-methylpentane



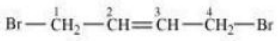
   (ii)1-Chloro-4-ethylcyclohexane



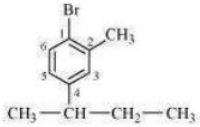
   (iii) 4-tert-Butyl-3-iodoheptane



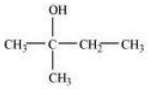
   (iv) 1,4-Dibromobut-2-ene



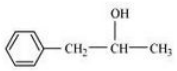
   (v)1-Bromo-4-butyl-2-methylbenzene.



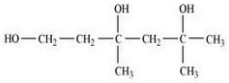
5. (i)



   (ii)



   (iii)



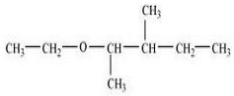
(iv)



(v)

$CH_3 - CH_2 - O - CH_2 - CH_2 - CH_3$

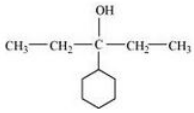
(vi)



(vii)



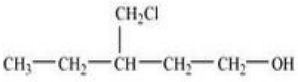
(viii)



(ix)



(x)



QB 365 TM Study Material
QUESTION BANK 365

3 Marks

6. 1 molal solution of solute means 1 mole of solute in 1000g of the solvent.

   Molar mass of water (solvent) $= 18\ \text{g mol}^{-1}$

   $\therefore$ Moles of water $= \frac{1000}{18} = 55.5$ moles.

   $\therefore$ Mole fraction of solute $= \frac{1}{1+55\cdot5} = 0\cdot0177$

   Now, $\frac{P^\circ - P_s}{P^\circ} = x_2$

   $\frac{12\cdot3 - P_s}{12\cdot3} = 0\cdot0177 \Rightarrow P_s = 12\cdot08\text{kPa}$

7. (a)$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \longrightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

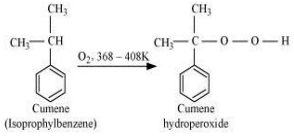
   $2Na_2CrO_4 + 2H+ \longrightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$

   $Na_2Cr_2O_7 + 2KCI \longrightarrow K_2Cr_2O_7 + 2NaCI$

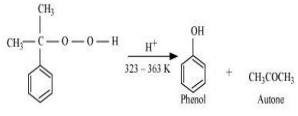
   (b)$2MnO_2 + 4KOH + O_2 \xrightarrow{\Delta} 2K_2MnO_4 + 2H_2$

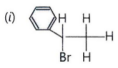
   $\underset{\text{Magnate ion}}{MnO_4^{2-}} \xrightarrow{electrolysis} \underset{\text{Permagnate ion}}{MnO_4^-} + e^-$

8. To prepare phenol, cumene is first oxidized in the presence of air of cumene hydro-peroxide.



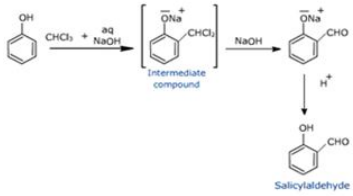
   Then, cumene hydroxide is treated with dilute acid to prepare phenol and acetone as by-products.





9.

10. (i) Reimer-Tiemann reaction

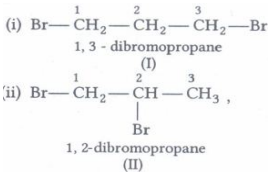


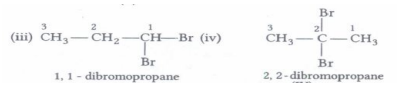
(ii) Williamson syntheses:

$$\underset{\text{Alkylhalide}}{R-X} + \underset{\text{Sodium alkoxide}}{\overset{+}{N}a-\bar{O}-R'} \longrightarrow R-O-R' + NaX$$

$$\underset{\text{Alkyl halide}}{CH_3-CH_2-Br} + \underset{\text{Sodium alkoxide}}{\overset{+}{N}a-\bar{O}-CH_2-CH_3} \longrightarrow \underset{\text{Diethyl ether}}{CH_3-CH_2-O-CH_2-CH_3} + NaBr$$

11. The structures of different dihalogen derivatives of propane are :





12. A particular reaction can be feasible if e.m.f. of the cell based on the E° values is positive. Keeping this in mind, let us predict the feasibility of the reactions.

(A) $I^-_{(aq)} + Fe^{3+}{}_{(aq)} \rightarrow Fe^{2+}(aq) + \frac{1}{2}I_{2(g)}$

E^o_{cell} = 0.77 - 0.54 = 0.23 V (feasible)

(B) Cu(s) + $2Ag^+_{(aq)} \rightarrow Cu^{2+}{}_{(aq)} + 2Ag_{(s)}$

E^o_{cell} = (0.80 - 0.34) = 0.46 V (feasible)

(C) $Br^-_{(aq)} + Fe^{3+}_{(aq)} \rightarrow Fe^{2+}_{(aq)} + \frac{1}{2}Br_{2(g)}$

E^o_{cell} = 0.77 - (1.08) = -0.31 V (not feasible)

(D) $3Ag_{(s)} + Fe^{3+}_{(aq)} \rightarrow 3Ag^+_{(aq)} + Fe_{(s)}$

E^o_{cell} = (0.77 - 0.80) = -0.03 V (not feasible)

(E) $2Fe^{2+}{}_{(aq)} + Br_{2(g)} \rightarrow 2Fe^{3+}{}_{(aq)} + 2Br_{(aq)}$

E^o_{cell} = 1.08 −0.77= 0.31 V (feasible)

QB 365 TM Study Material
QUESTION BANK 365

2 Marks

13. Henry's Law: It states that the partial vapour pressure of gas in vapour phase(g) is directly proportional to the mole fraction of the gas in the solution.

Applications of Henry's Law:

(i) To minimise the painful effects accompanying the decompression of deep sea divers, oxygen diluted with less soluble helium gas is used as breathing gas.

(ii) To increase the solubility of CO_2 in soft, drinks and soda water, the bottle is sealed under high pressure.

14. It is because F_2 and O_2 are strong oxidising agents due to high electronegativity and lattice energy of fluoridesand oxide is high.

15. $Q = 1 \times t = 0.5 \times 2 \times 60 \times 60 = 3600\ C$

$1.602 \times 10^{-19} C$ is charge on 1 electron 3600 C is charge on $\frac{1}{1.602 \times 10^{-19}} \times 3600 = \frac{3600}{1.602} \times 10^{19} = 2.25 \times 10^{22}$ electrons.

16. In the S_N2 mechanism, the reactivity of halides for same halides group increase down the group. Because increase in size increase, the halide becomes a better leaving group. Therefore, CH_3I will react faster than CH_3Br in S_N2 reactions with OH^-.

17. The reactions showing acidic nature of phenol are:

(i) Reaction with sodium. Phenol reacts with active metals like sodium to liberate H_2 gas.



(ii) Reaction with NaOH. Phenol dissolves in NaOH to form sod. phenoxide and water.



Comparison of acidic character of phenol and ethanol. Phenol is more acidic than ethanol. This is due to the reason that phenoxide ion left after the loss of a proton from phenol is stabilized by resonance (Refer to structures,VI to X on page 11/25) while ethoxide ion (left after loss of a proton from ethanol) is not.

Multiple Choice Question

18. (d) 0.1428 M
19. Methanol being more volatile than water, the solution of methanol in water will have more vapour pressure than water (a case of positive deviation).
20. (c) 68.4
21. In a ideal solution, solute does not undergo dissociation or association. Hence, van't Hoff factor = 1.
22. At equilibrium, rate of dissolution = rate of crystallisation.
23. (a) K kg mol^{-1} or K $(molality)^{-1}$
24. (c) $i_A = i_B = i_C$
25. Zinc amalgam is a solution of zinc in mercury where zinc is solute in solid state and mercury is solvent in liquid state.
26. 22 carat gold is a solid solution (solid–solid mixture) in which gold is mixed with other metals such as copper or silver.
27. Electrochemical cells are also called galvanic or voltaic cells, after the names of Luigi Galvani and Alessandro Volta who were the first to perform experiments on the conversion of chemical energy into electrical energy.
28. (d) NaCl
29. (c) 2
30. Methane and methanol (CH_3OH) can also be used as fuel in place of hydrogen in fuel cells due to its high efficiency.
31. **Explanation:**
    The electronic configuration of Ce is $[Xe]4f^15d^16s^2$. Lanthanides are very less electronegative. Their electronegative value is nearly equal to s-block elements. So, they can lose electrons to form a cation. When cerium loses $4e^-$, it will acquire fully filled electronic configuration of Xenon (2, 8, 18, 18, 8). Hence, Ce is well known in +4 oxidation state.
32. **Explanation:**
    The term inner transition metals refers to the elements that are placed below the main body of the periodic table. This group includes Lanthanoids (elements 57 to
    71, starting from lanthanum) and Actinoids (elements 89 to 103, starting from actinium). These elements are called inner transition metals because they involve the filling of the f-orbitals (4f for lanthanoids and 5f for actinoids), as opposed to the d-orbitals in the transition metals (which are sometimes called outer transition metals).
33. **Explanation:**
    The Mn atom in $KMnO_4$ has +7 oxidation state with electronic configuration [Ar] $3d^0 4s^0$. Since, no unpaired electrons are present, d-d transitions are not possible. The molecule should, therefore, be colourless. It is intense purple due to L →M (ligand to meta) charge transfer 2p(L) of O to 3d(M) of Mn.

QB365 Study Material
QUESTION BANK 365