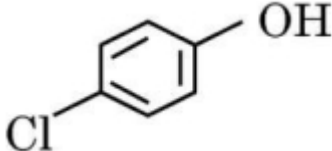# CHEMISTRY

Class 12 - Chemistry

Section A

1.

(d) a mixture of two different alkyl halides has to be used.

Explanation:

Alkyl halides on treatment with sodium metal in dry ethereal (free from moisture) solution give higher alkanes. This reaction is known as the Wurtz reaction and is used for the preparation of higher alkanes containing even a number of carbon atoms. Many side products are formed when two different alkyl halides are used. So this method is not preferred to prepare alkanes having an odd number of C atoms.

2.

(b) vitamin C

Explanation:

B group vitamins and vitamin C are soluble in water so they are grouped together as water soluble vitamins, these must be supplied regularly in diet because they are readily excreted in urine and cannot be stored (except vitamin B_{12}) in our body.

3.

(c)

Explanation:
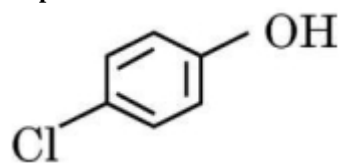
4.

(b) Iodoform test

Explanation:

$CH_3COR + I_2 + NaOH \rightarrow CHI_3 + RCOO^- Na^+$

Iodoform test is a characteristic test given by methyl ketones. CHI formed is yellow precipitate.

5.

(d) $\frac{+2}{3}\frac{d[B]}{dt}$

Explanation:

$\frac{+2}{3}\frac{d[B]}{dt}$

6. **(a)** (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

Explanation:

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

7.

(b) $CH_3CH_2NH_2$

Explanation:

$CH_3CH_2NH_2$

8.

(d) V^{3+}, V^{2+}, Fe^{3+}

Explanation:

V^{3+}, V^{2+}, Fe^{3+} ions exhibit specific colours.

Electronic configuration of V^{2+} - $[Ar]3d^3$.

Electronic configuration of V^{3+} - $[Ar]3d^2$.

Electronic configuration of Fe^{3+} - $[Ar]3d^5$.

Since these ions have partially filled d-subshells, they exhibit colour.

Electronic configuration of Sc^{3+} - $[Ar]3d^0$

Since d subshell is empty, it shows no colour.

Electronic configuration of Ti^{4+} - $[Ar]3d^0$

Since d subshell is empty, it shows no colour.

Electronic configuration of Mn^{2+} $[Ar]3d^4$

Since d subshell is partially filled, it shows colour.

Electronic configuration of Ni^{4+} $[Ar]3d^8$

Since d subshell is partially filled, it shows colour.

Electronic configuration of Zn^{2+} - $[Ar]3d^{10}$

Since d subshell is full, it shows no colour.

9.

(b) $mol\ L^{-1}s^{-1}$

Explanation:

The order of reaction will be zero because as concentration is decreased half-life is also decreasing so the unit of rate constant is $mol\ L^{-1}s^{-1}$

10.

(d) Iodine/NaOH

Explanation:

2-pentanone ($CH_3COCH_2CH_2CH_3$) will give an iodoform test (reaction with I_2 + NaOH) because of the presence CH_3CO-

group and yellow precipitate will be formed. But 3-pentanone ($CH_3CH_2COCH_2CH_3$) does not have CH_3CO- group hence will

not give the iodoform test. The reaction is as follows:

$CH_3COCH_2CH_2CH_3$ + I_2 + NaOH → CHI_3 (yellow precipitate) + $CH_3CH_2CH_2COO^-Na^+$
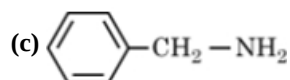
$CH_3CH_2COCH_2CH_3$ + I_2 + NaOH → No reaction
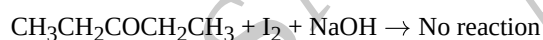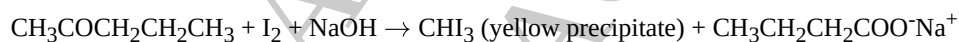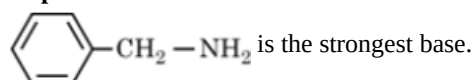
11.

(d) anhydrous $ZnCl_2$ and conc. HCl.

Explanation:

"Lucas' reagent" is a solution of anhydrous zinc chloride in concentrated hydrochloric acid.

12.

(c)

Explanation:

 is the strongest base.

13.

(c) A is true but R is false.

Explanation:

The two strands in a DNA molecule are not exactly similar but are complementary.

14.

(d) Both assertion and reason are incorrect.

Explanation:

Both assertion and reason are incorrect.

15.

(c) A is true but R is false.

Explanation:

A is true but R is false.

16.

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

Explanation:

Both A and R are true but R is not the correct explanation of A.

Section B

17. In both the complexes, Fe is in +2 state with the configuration $3d^6$, i.e. it has four unpaired electrons. As H_2O and CN^- possess different crystal field splitting energy (Δ_o), they absorb different components of visible light (VIBGYOR) for d- d transition. Hence, the transmitted colours are different.

18.   i. Due to comparable radii.

   ii. In Mn_2O_3, Mn is in +3 (lower) oxidation state while in Mn_2O_7, Mn is in higher oxidation state (+7).

   iii. Because its stable oxidation state is +3.

19. Answer the following:

   (i)   a. 9 times

         b. A reaction that appears to be of higher order but follows first-order kinetics is known as pseudo first order reaction. Example: Hydrolysis of an ester

   (ii) The properties of products formed are entirely different from that of the reactants, therefore, chemical reactions are irreversible.

20. **Van't Hoff factor:** Van't hoff factor 'i' is a correction factor defined as the ratio between the actual concentration of particles produced when the substance is dissolved and the concentration of a substance as calculated from its mass.

$i = \dfrac{\text{Observed value of colligative property}}{\text{Normal value of colligative property}}$

OR

Hypertonic solution has higher concentration than body fluids whereas hypotonic solution has lower concentration than body fluids. That is if a solution has more osmotic pressure than some other solution, it is called hypertonic. On the other hand, a solution having less osmotic pressure than the other solution is called hypotonic. For example Pure NaCl solution with salt concentration less than 0.91%(m/v) is said to be hypotonic. So red blood cells placed in this solution would swell or burst as water flows into the cells. But if the concentration of NaCl is more than 0.91%(m/v), the solution is hypertonic. Here the red blood cells placed in this solution would shrink as water flows out of the cell.

21.   i. Carboxyl group of aldehydes or ketones is reduced to CH_2 group on treating with hydrazine followed by heating with potassium hydroxide in high boiling solvent such as ethylene glycol. It is known as Wolf-kishner reduction.

$$CH_3 - \underset{\underset{CH_3}{|}}{C} = O \xrightarrow[KOH/glycol, \Delta]{H_2N-NH_2} CH_3 - CH_2 - CH_3$$
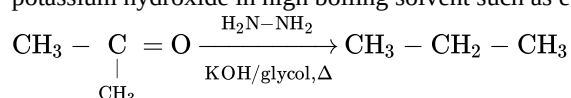
   ii. Aldehydes and ketones having at least one methyl group linked to carboxyl carbon atom are oxidised by sodium hypohalite ($NaOH/I_2$) to sodium salts of corresponding carboxylic acids having one carbon atom less than that of carboxyl compound. This is known as haloform reaction.

$$C_6H_5 - CO - CH_3 \xrightarrow{NaOH/I_2} C_6H_5 - \underset{\underset{ONa}{|}}{CO} + CHI_3$$
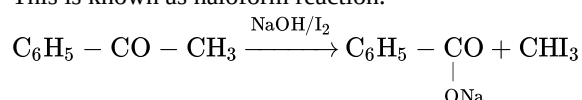
iii. Carboxylic acids lose carbon dioxide when their sodium salts are heated with sodalime (NaOH and CaO in the ratio of 3 : 1). It is known as decarboxylation reaction.

$$CH_3COONa \xrightarrow[\Delta]{NaOH/CaO} CH_4 + Na_2CO_3$$
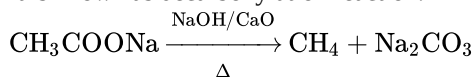
Section C

22. It is clear that, $E^\circ_{Zn^{2+}/Zn} = -0.763V < E^\circ_{Ag^+/Ag} = +0.80V$

Therefore, cell can be represented as Zn(s) | Zn^{2+}(aq) (1M) II Ag^+(aq) | Ag(s)

$\therefore E^\circ_{Cell} = E^\circ_{Cathode} - E^\circ_{Anode}$ = 0.80 - (-0.76) = 1.56 ; E_{cell} = 1.48V (given)

By applying Nernst equation, we get

$E_{cell} = E^\circ_{cell} - \frac{0.0591}{2}\log\frac{[Zn^{2+}]}{[Ag^+]^2}$

$1.48 = 1.56 - \frac{0.0591}{2}\log\frac{1}{[Ag^+]^2}$

$0.08 = 0.0295\log\frac{1}{[Ag^+]^2}$

$\frac{0.08}{0.0295} = -2\log[Ag^+]$

$-\frac{0.08}{0.0295 \times 2} = \log[Ag^+]$

$\log[Ag^+] = -1.356$

$[Ag^+]$ = Antilog [-1.356]

Therefore, $[Ag^+]$ = 0.0441 = 4.4 × 10^{-2} M

23. First, find the value of k by using formula,

$k = \frac{0693}{t_{1/2}}$, then the value of $\frac{[R]}{[R]_0}$

Given , $t_{1/2} = 5 \times 10^4$ s and t = 2h = $2 \times 60 \times 60$s

$k = \frac{0.693}{t_{1/2}} = \frac{0.693}{5 \times 10^4}$
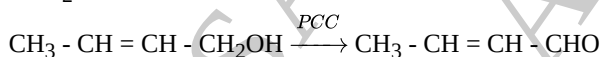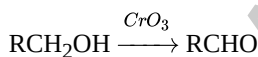
$k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$

$\frac{0.693}{5 \times 10^4} = \frac{2.303}{2 \times 60 \times 60}\log\frac{[R]_0}{[R]}$

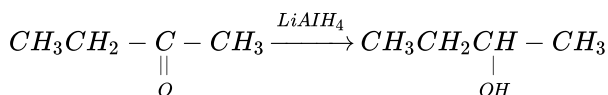$\log\frac{[R]_0}{[R]} = \frac{0.693 \times 2 \times 60 \times 60}{5 \times 10^4 \times 2.303} = 0.0433$

$\frac{[R]_0}{[R]} = antilog(0.0433) = antilog(0.0433)$

$\frac{[R]_0}{[R]} = 1.105 \Rightarrow \frac{[R]}{[R]_0} = \frac{1 \times 100}{1.105}\% = 90.497\%$

24. i. CrO_3 or PCC (Pyridinium chlorochromate)

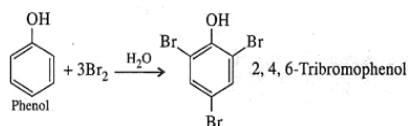$RCH_2OH \xrightarrow{CrO_3} RCHO$

$CH_3 - CH = CH - CH_2OH \xrightarrow{PCC} CH_3 - CH = CH - CHO$

ii. Ni/H_2 or $LiAIH_4$

$$\underset{\text{Butan - 2 - one}}{CH_3CH_2 - \underset{\underset{O}{||}}{C} - CH_3} \xrightarrow{LiAIH_4} \underset{\text{Butan - 2 - ol}}{CH_3CH_2\underset{\underset{OH}{|}}{CH} - CH_3}$$

iii. Aqueous bromine or bromine water:

OR

The reagents used for the given conversions are as follows:

i. Propene to propan-1-ol

  a. HBr/ peroxide

  b. aq KOH
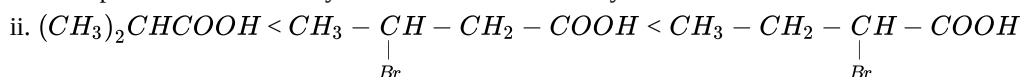
ii. Ethanol to but-1-yne

  a. P, iodine heat (b) alc. KOH, heat

b. bromine, CCl_4 (d) $NaNH_2$/liq NH_3 (2 equiv) (e) excess methyl iodide

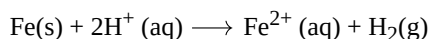   iii. 1-Bromopropane to 2-bromopropane

     a. Alc. KOH heat

     b. HBr Markovnikoff's addition

25.   i. Acetophenone < Benzaldehyde < Acetone < Acetaldehyde

    ii. $(CH_3)_2CHCOOH < CH_3 - \underset{\underset{Br}{|}}{CH} - CH_2 - COOH < CH_3 - CH_2 - \underset{\underset{Br}{|}}{CH} - COOH$

   iii. $CH_3CHO < CH_3CH_2OH < CH_3COOH$

26. According to the equation,

Fe(s) + 2H$^+$ (aq) $\longrightarrow$ Fe^{2+} (aq) + H$_2$(g)

$E^\circ_{cell} = E^\circ_{cell} - E^\circ_{anode}$

E°_{cell} = 0 - (-0.44) V

E°_{cell} = + 0.44V

By applying Nernst Equation

$E_{cell} = E^\circ_{cell} - \frac{0.0591}{2}\log\frac{[Fe^{2+}]}{[H^+]^2}$

$E_{cell} = 0.44\frac{-0.0591}{2}\log\frac{0.001}{1^2}$

$E_{cell} = 0.44 - \frac{0.0591}{2}\log 10^{-3}$

E_{cell} = 0.44 + 0.089V

E_{cell} = +0.53V

27.   i. In the S_N^2 mechanism, the reactivity of halides for the same alkyl group increases in the order R-F << R-Cl < R-Br < R-I. This happens because as the size increases, the halide ion becomes a better leaving group. Therefore, CH_3I will react faster than CH_3Br in S_N^2 reactions with OH$^-$.

   ii. The S_N^2 mechanism involves the attack of the nucleophile at the atom bearing the leaving group. But, in case of $(CH_3)_3CCl$,the attack of the nucleophile at the carbon atom is hindered because of the presence of bulky substituents on the carbon atom bearing the leaving group. On the other hand, there are no bulky substituents on the carbon atom bearing the leaving group in CH_3Cl. Hence, CH_3Cl reacts faster than $(CH_3)_3CCl$ in S_N^2 reaction with OH$^-$.

28.   i. Given, current (I) = 2A, time (t) = 15 min

Quantity of electricity passed will be

Q = It = 2 × 15 × 60 = 1800 C

Electrolysis of $AgNO_3$

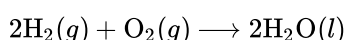Ag$^+$ + e $\longrightarrow$ Ag(s) (Atomic mass of Ag = 108 g mol^{-1})

As, 96500 C deposit 108 g of Ag

$\therefore$ 1800 C will deposit = $\frac{108 \times 1800}{96500}$ = 2.014g of Ag

   ii. **Fuel cell:** The galvanic cells in which chemical energy of combustion of fuels like hydrogen, methane, etc. is converted into electrical energy is called fuel cell.

The overall reaction of H_2-O_2 cell is

$2H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$

<div align="center">

Section D

</div>

29.   i. Manganese (Z = 25) shows maximum number of O.S. This is because its outer EC is $3d^54s^2$. As 3d and 4s are close in energy, it has maximum number of e-1 s to loose or share. Hence, it shows O.S. from +2 to +7 which is the maximum number.

   ii. A transition metal exhibits higher oxidation states in oxides and fluorides because oxygen and fluorine are highly electronegative elements, small in size and strongest oxidising agents.

   iii. This is due to the increasing stability of the lower species to which they are reduced.

     OR

     When a metal is in a high oxidation state, its oxide is acidic and when a metal is in a low oxidation state its oxide is basic.

30. i. $P_A = x_A \times P_A^\circ$

    $32 = x_A \times 40$

    $x_A = \frac{32}{40}$

    $x_A = 0.8$

  ii. For pure octane, $x = 0$

    $\therefore$ p(sol.)(mm Hg) = P (octane) = $35 + 65 \times 0 = 35$ mm of Hg
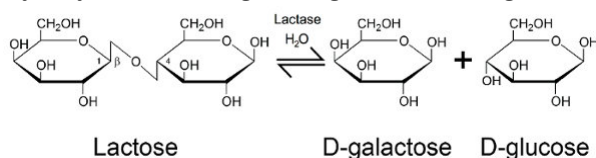
  iii. The value of ΔV_{mixing} and ΔH_{mixing} is negative.

  iv. It is an example of Non-ideal solution.

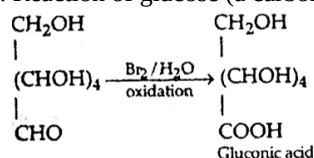<h3 style="text-align:center">Section E</h3>

31. Attempt any five of the following:

    (i) Hydrolysis of Lactose gives D-galactose and D-glucose.
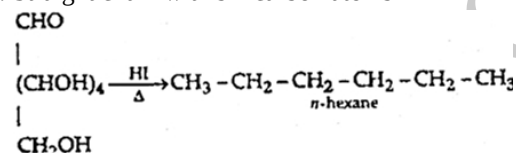

    (ii) Glucose and Fructose

    (iii) i. Reaction of glucose (a carbonyl group)

      ii. Straight chain with six carbon atoms

    (iv) **Starch:** It is a branched chain polymer of α-glucose and consists of two components: Amylose(water soluble) and Amylopectin (water insoluble).

      Cellulose: It is a straight chain polysaccharide composed only of β-D-glucose units which are joined by glycosidic linkage between C_1 of one glucose unit and C_4 of the next glucose unit.

    (v) B_6 / Pyridoxine

    (vi) i. Adenine, Guanine

      ii. 1. Vitamin D

          2. Vitamin B_{12}

    (vii) When a protein is subjected to a change in temperature or chemical change then it loses its biological activity.

    2° and 3° structures are destroyed but 1° structure remains intact.
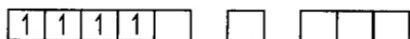
32. $[Mn(CN)_6]^{3-}$

  Mn = [Ar] $3d^5 4s^2$

  Mn^{3+} = [Ar] $3d^4$
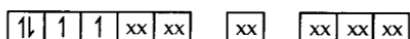
  xx are electrons donated by ligand CN^-

  a. Type of hybridisation - d^2sp^3

  b. Magnetic moment value

    $= \sqrt{n(n+2)} = \sqrt{2(2+2)} = 2.87$ BM

    (n = no. of unpaired electrons)

c. Type of complex - inner orbital

<div align="center">OR</div>

a. Oxidation state of $K_3[CO(C_2O_4)_3]^{3-}$ = +3

When central metal is present in +3 oxidation state, oxalate ligands acts as strong ligand and cause pairing of electrons of d - orbital which leads to the formation of the inner orbital complex with d^2sp^3 hybridization.

coordination no. = -6

d-orbital occupation $CO^{3+} = 3d^6 = t_{2g}^6 e_g^0$

unpaired electron = 0

b. Oxidation state of $(NH_4)_2^+ [COF_4]^{2-}$ = +3

coordination no. = 4

$CO^{2+} = 3d^7$

$= e^4 t_2^3$ no. of unpaired electron = 3

c. Cis - $[Cr[en]_2]^+Cl^-$

Oxidation state x = +3 coordination no. = - 6

$Cr^{3+} = 3d^3$

$= t_{2g}^3$ no. of unpaired electron = 3

d. $[MN(H_2O)_6]^{2+} SO_4^{2-}$

Oxidation state x = + 2 coordination no. = 6

$Mn^{2+} = 3d^5$

$= t_2^3 geg^3$

$= t_2^3 geg^2$ no. of unpaired electron = 5

33. Primary, secondary and tertiary amines can be identified and distinguished by Hinsberg's test. In this test, the amines are allowed to react with Hinsberg's reagent (benzene sulphonyl chloride $C_6H_5SO_2Cl$).

i. Primary amines react with benzenesulphonyl chloride to form N-alkyl benzenesulphonamide which is soluble in alkali.
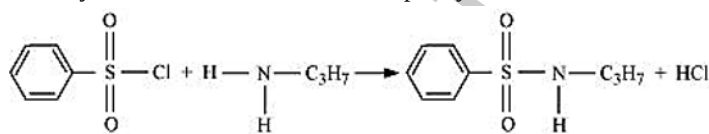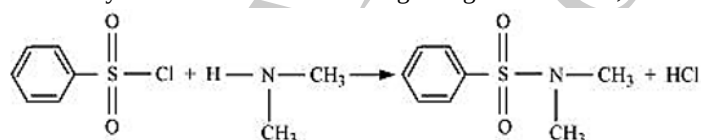

Benzenesulphonyl chloride   Propanamine   *N*-Propylbenzenesulphonamide

ii. Secondary amines react with Hinsberg's reagent to form N, N-dialkyl benzene sulphonamide which is insoluble in alkali.
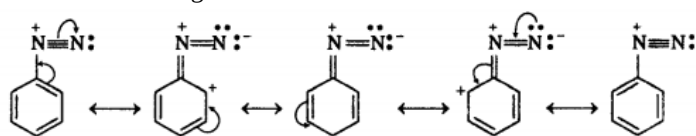

Benzenesulphonyl chloride   Dimethylamine   *N, N*-Dimethylbenzenesulphonamide (insoluble in alkali)

iii. Tertiary amines do not react with Hinsberg's reagent.
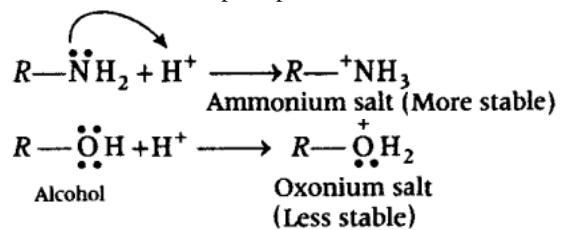
<div align="center">OR</div>

i. The diazonium salts of aromatic amines are more stable than those of aliphatic amines due to dispersal of the positive charge on the benzene ring as shown below.

ii. Amines are more basic than alcohols of comparable masses because

a. N-atom being less electronegative can easily donate its lone pair of electrons to a proton than more electronegative 0-atom which hold electrons more tightly than N. Hence, amines are more basic than alcohols.

b. When an amine accepts a proton, the ammonium salt is formed and when alcohol accepts a proton oxonium salt is formed.

$$R—\overset{\displaystyle ..}{\underset{\displaystyle ..}{N}}H_2 + H^+ \longrightarrow R—{}^+NH_3$$
Ammonium salt (More stable)

$$R—\overset{\displaystyle ..}{\underset{\displaystyle ..}{O}}H + H^+ \longrightarrow R—\overset{+}{\underset{\displaystyle ..}{O}}H_2$$
Alcohol   Oxonium salt
(Less stable)

c. Since N being less electronegative can accommodate the positive charge better than the more electronegative O-atom, therefore, ammonium salts are more stable than oxonium salts. As a result, amines are more basic than alcohols.