

# Solved Paper 2016

## CHEMISTRY

### Class-XII

Time : 3 Hours

Max. Marks : 70

#### General Instructions :

- All questions are compulsory.
- Questions number 1 to 5 are very short answer questions and carry 1 mark each.
- Questions number 6 to 10 are short answer questions and carry 2 marks each.
- Questions number 11 to 22 are also short answer questions and carry 3 marks each.
- Question number 23 is a value based question and carry 4 marks.
- Questions number 24 to 26 are long answer questions and carry 5 marks each.
- Use log tables, if necessary. Use of calculators is **not** allowed.

#### Delhi Set

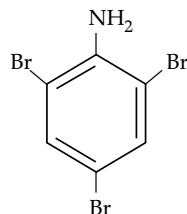
Code No. 56/1/1/D

1. Out of  $\text{CH}_3 - \text{CH} - \text{CH}_2 - \text{Cl}$  and  $\text{CH}_3 - \text{CH}_2 - \text{CH} - \text{Cl}$ , which is more reactive towards  $\text{S}_{\text{N}}1$  reaction and why? 1

Ans.  $\text{CH}_3\text{CH}_2\text{CH}(\text{Cl})\text{CH}_3$  ; secondary halide /  $2^\circ$  carbocation is more stable.  $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2016]

- \* 2. On adding NaOH to ammonium sulphate, a colourless gas with pungent odour is evolved which forms a blue coloured complex with  $\text{Cu}^{2+}$  ion. Identify the gas. 1
- \* 3. What type of magnetism is shown by a substance if magnetic moments of domains are arranged in same direction? 1
4. Write the IUPAC name of the given compound: 1



Ans. 2, 4, 6 -Tribromoaniline / 2, 4, 6 -Tribromobenzenamine 1

[CBSE Marking Scheme, 2016]

- \* 5. Write the main reason for the stability of colloidal sols. 1

6. From the given cells:

Lead storage cell, Mercury cell, Fuel cell and Dry cell.

Answer the following:

- Which cell is used in hearing aids?
- Which cell was used in Apollo Space Programme?
- Which cell is used in automobiles and inverters?
- Which cell does not have long life? 2

Ans. (i) Mercury cell (ii) Fuel cell  $\frac{1}{2} + \frac{1}{2}$   
(iii) Lead storage cell (iv) Dry cell  $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2016]

7. When chromite ore  $\text{FeCr}_2\text{O}_4$  is fused with NaOH in presence of air, a yellow coloured compound (A) is obtained which on acidification with dilute sulphuric acid gives a compound (B). Compound (B) on reaction with KCl forms an orange coloured crystalline compound (C).  
(i) Write the formulae of the compounds (A), (B) and (C).  
(ii) Write one use of compound (C). 2

OR

Complete the following chemical equations:

- $\text{MnO}_4^- + 3\text{S}_2\text{O}_3^{2-} + \text{H}_2\text{O} \rightarrow ?$
- $\text{Cr}_2\text{O}_7^{2-} + 3\text{Sn}^{2+} + 14\text{H}^+ \rightarrow ?$



and +R effect oppose each other while -I effect is the only contributing factor in cyclohexane. 1

(iii) Due to formation of planar carbocation / Carbon in carbocation formed is  $sp^2$  hybridised. 1

[CBSE Marking Scheme, 2016]

**Detailed Answer :**

(i) In chlorobenzene, due to resonance, there is a partial double bond character, so bond length is short.

(ii) The dipole moment of chlorobenzene is lower as bond length is shorter ( $\mu = q \times d$ ) due to resonance and  $sp^2$  hybridized carbon, it has less tendency to release electrons than the  $sp^3$  hybrid of C-Cl (in cyclohexyl chloride). Hence, chlorobenzene is more electronegative resulting in decrease in polarity of C-Cl bond.

\* 12. An element crystallizes in a fcc lattice with cell edge of 250 pm. Calculate the density if 300 g of this element contains  $2 \times 10^{24}$  atoms. 3

13. The rate constant for the first order decomposition of  $H_2O_2$  is given by the following equation :

$$\log k = 14.2 - \frac{1.0 \times 10^4}{T} K;$$

Calculate  $E_a$  for this reaction and rate constant  $k$  if its half-life period be 200 minutes.

(Given :  $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ ) 3

Ans.  $\log k = \frac{\log A - E_a}{2.303RT}$  1/2

$$\frac{E_a}{2.303RT} = \frac{1.0 \times 10^4 K}{T}$$

$$E_a = 1.0 \times 10^4 \times 2.303 \times 8.314 = 191471.4 \text{ J/mol} \quad 1$$

$$\frac{t_{1/2}}{2} = \frac{0.693}{k} \quad 1/2$$

$$k = \frac{0.693}{200} \text{ min}^{-1}$$

$$= 0.0034 \text{ min}^{-1} \quad 1$$

[CBSE Marking Scheme, 2016]

\* 14. (i) Differentiate between adsorption and absorption.

(ii) Out of  $MgCl_2$  and  $AlCl_3$ , which one is more effective in causing coagulation of negatively charged sol and why?

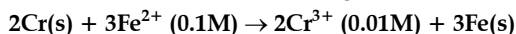
(iii) Out of sulphur sol and proteins, which one forms multi-molecular colloids? 3

\* 15. (i) Name the method of refining of metals such as germanium.

(ii) In the extraction of Al, impure  $Al_2O_3$  is dissolved in conc. NaOH to form sodium aluminate and leaving impurities behind. What is the name of this process?

(iii) What is the role of coke in the extraction of iron from its oxides? 3

16. Calculate e.m.f. of the following cell at 298 K :



$$\text{Given : } E^\circ_{(Cr^{3+} | Cr)} = -0.74 \text{ V } E^\circ_{(Fe^{2+} | Fe)} = -0.44 \text{ V}$$

$$E^\circ_{(Fe^{2+} | Fe)} = -0.44 \text{ V}$$

Ans.  $E^\circ_{cell} = E^\circ_c - E^\circ_a = (-0.44) - (-0.74) \text{ V} = 0.30 \text{ V}$  1/2

$$E_{cell} = E^\circ_{cell} - \frac{0.059}{n} \log \frac{[Cr^{3+}]^2}{[Fe^{2+}]^3} \quad 1/2$$

$$E_{cell} = E^\circ_{cell} - \frac{0.059}{6} \log \frac{[0.01]^2}{[0.1]^3} \quad 1$$

$$= 0.30 - \left( \frac{-0.059}{6} \right)$$

$$= 0.3098 \text{ V} \quad 1$$

[CBSE Marking Scheme, 2016]

17. Give reasons:

(i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine it shows the highest oxidation state of +4.

(ii) Transition metals show variable oxidation states.

(iii) Actinoids show irregularities in their electronic configurations. 3

Ans. (i) Ability of oxygen to form multiple bond /  $p\pi - d\pi$  bond. 1

(ii) Partially filled  $d$ -orbitals / due to comparable energies of  $ns$  and  $(n-1)d$ -orbitals. 1

(iii) due to relative stabilities of the  $f^0, f^7$  and  $f^{14}$  occupancies of the  $5f$ -orbitals / Comparable energies of  $7s, 6d, 5f$ -orbitals. 1

[CBSE Marking Scheme, 2016]

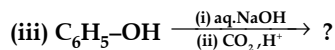
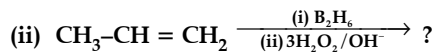
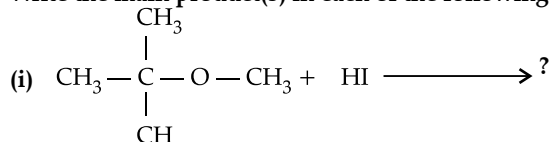
**Detailed Answer:**

(i) Same as Ans. 25 a(i) Outside Delhi, 2016.

(ii) Transition metals show variable oxidation state because the energy of  $ns$  and  $(n-1)d$ -orbitals are approximately same so the electrons of both these orbitals take part in reactions.

(iii) Due to less energy difference between  $5f$ -,  $6d$ - and  $7s$ -orbitals is very small. Hence electron can rearrange for stable configuration.

18. Write the main product(s) in each of the following reactions:



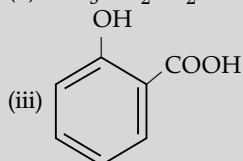
3

Ans. (a)  $\text{CH}_3\text{OH}$ ,  $(\text{CH}_3)_3\text{C-I}$

1

(ii)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

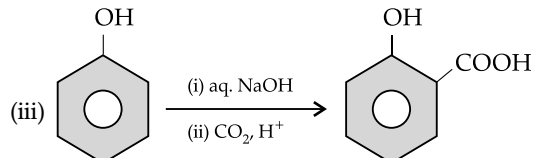
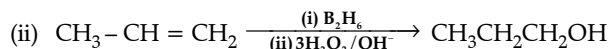
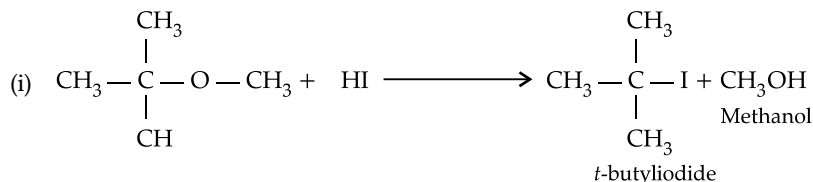
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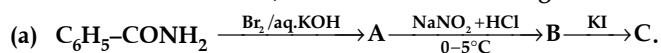
[CBSE Marking Scheme, 2016]

Detailed Answer:



2-Hydroxybenzoic acid (Salicylic acid)

19. Write the structures of A, B and C in the following :



3

Ans. (i)  $\text{C}_6\text{H}_5\text{NH}_2$ ,  $\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^-$ ,  $\text{C}_6\text{H}_5\text{I}$

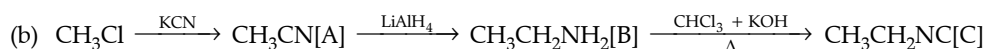
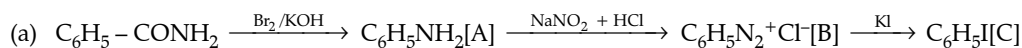
 $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$ 

(ii)  $\text{CH}_3\text{CN}$ ,  $\text{CH}_3\text{CH}_2\text{NH}_2$ ,  $\text{CH}_3\text{CH}_2\text{NC}$

 $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$ 

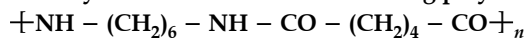
[CBSE Marking Scheme, 2016]

Detailed Answer:



\* 20. (i) What is the role of *t*-butyl peroxide in the polymerization of ethene?

(ii) Identify the monomers in the following polymer :



(iii) Arrange the following polymers in the increasing order of their intermolecular forces :

Polystyrene, Terylene and Buna-S

OR

\* Write the mechanism of free radical polymerization of ethene.

3

\* Out of Syllabus

21. (i) Write the name of two monosaccharides obtained on hydrolysis of lactose sugar.  
 (ii) Why vitamin C cannot be stored in our body?  
 (iii) What is the difference between a nucleoside and nucleotide? 3

**Ans.** (i)  $\beta$ -D glucose and  $\beta$ -D-galactose / glucose and galactose.  $\frac{1}{2} + \frac{1}{2}$   
 (ii) water soluble, excreted out of the body. 1  
 (iii) In nucleotide, phosphoric acid/phosphate group attached to the nucleoside / structures of both nucleotide and

nucleoside / nucleotide = base + sugar + phosphate group, nucleoside = base + sugar. 1  
 [CBSE Marking Scheme, 2016]

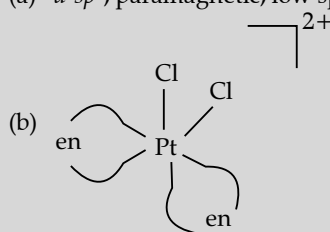
**Detailed Answer:**

- (i)  $\beta$ -D glucose and  $\beta$ -D-Galactose.  
 (ii) It is water soluble, hence it is excreted through urine.  
 (iii) **Nucleoside:** It is formed when pentose sugar combines with nitrogen base.  
**Nucleotide:** When Nucleoside combines with phosphate group.

22. (a) For the complex  $[\text{Fe}(\text{CN})_6]^{3-}$ , write the hybridization, magnetic character and spin nature of the complex. (At. number: Fe = 26).

- (b) Draw one of the geometrical isomers of the complex  $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$  which is optically active. 3

**Ans.** (a)  $d^2sp^3$ , paramagnetic, low spin. 1 +  $\frac{1}{2}$  +  $\frac{1}{2}$



1

[CBSE Marking Scheme, 2016]

**Detailed Answer:**

- (a)  $[\text{Fe}(\text{CN})_6]^{3-}$

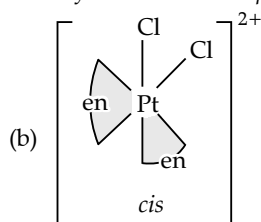
Fe in ground state

Fe(III) —

Since  $\text{CN}^-$  is strong field ligand, pairing takes place.

Fe —

Hybridization —  $d^2sp^3$  (octahedral), Magnetic character — Paramagnetic, Spin nature — Low spin complex



The cis form of the complex  $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$  is optically active.

- \* 23. Due to hectic and busy schedule, Mr. Angad made his life full of tensions and anxiety. He started taking sleeping pills to overcome the depression without consulting the doctor. Mr. Deepak, a close friend of Mr. Angad, advised him to stop taking sleeping pills and suggested to change his lifestyle by doing yoga, meditation and some physical exercises. Mr. Angad followed his friend's advice and after few days he started feeling better.

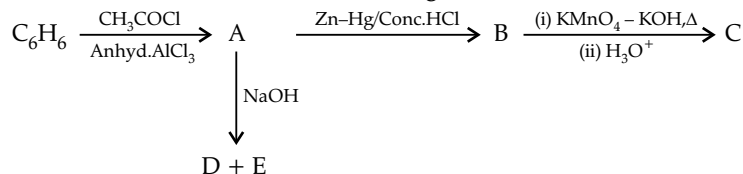
After reading the above passage, answer the following :

- (a) What are the values (at least two) displayed by Mr. Deepak?  
 (b) Why is it not advisable to take sleeping pills without consulting doctor?  
 (c) What are tranquilisers ? Give two examples.

4

- \* 24. (a) Account for the following:  
 (i) Ozone is thermodynamically unstable.  
 (ii) Solid  $\text{PCl}_5$  is ionic in nature.  
 (iii) Fluorine forms only one oxoacid HO<sub>n</sub>F.  
 (b) Draw the structure of  
 (i)  $\text{BrF}_5$   
 (ii)  $\text{XeF}_4$  5
- OR
- \* (i) Compare the oxidising action of  $\text{F}_2$  and  $\text{Cl}_2$  by considering parameters such as bond dissociation enthalpy, electron gain enthalpy and hydration enthalpy.  
 (ii) Write the conditions to maximize the yield of  $\text{H}_2\text{SO}_4$  by contact process.  
 (iii) Arrange the following in the increasing order of property mentioned :  
 (a)  $\text{H}_3\text{PO}_3$ ,  $\text{H}_3\text{PO}_4$ ,  $\text{H}_3\text{PO}_2$  (Reducing character).  
 (b)  $\text{NH}_3$ ,  $\text{PH}_3$ ,  $\text{AsH}_3$ ,  $\text{SbH}_3$ ,  $\text{BiH}_3$  (Base strength).

25. Write the structures of A, B, C, D and E in the following reactions:



OR

- (a) Write the chemical equation for the reaction involved in Cannizzaro reaction.  
 (b) Draw the structure of the semicarbazone of ethanal.  
 (c) Why  $\text{pK}_a$  of  $\text{F}-\text{CH}_2-\text{COOH}$  is lower than that of  $\text{Cl}-\text{CH}_2-\text{COOH}$  ?  
 (d) Write the product in the following reaction  
 $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_2\text{CN} \xrightarrow[\text{(ii) H}_2\text{O}]{\text{(i) DIBAL-H}} ?$   
 (e) How can you distinguish between propanal and propanone ?

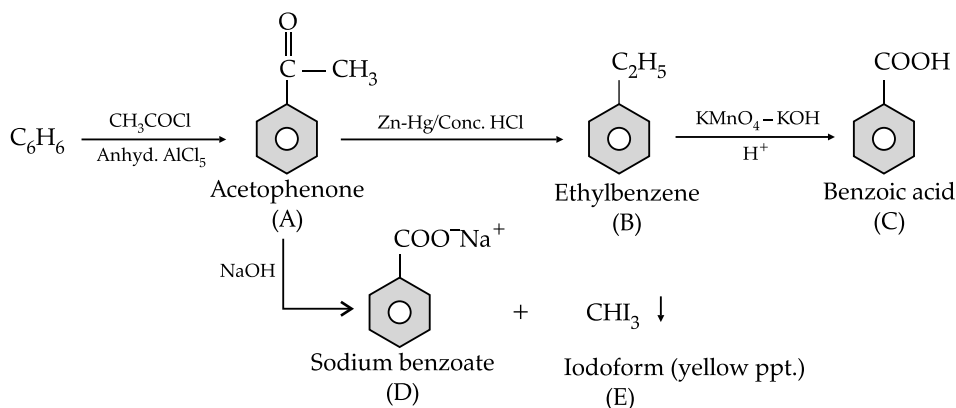
OR

- (a)  $\text{HCHO} + \text{HCHO} \xrightarrow{\text{conc. NaOH}} \text{HCOONa} + \text{CH}_3\text{OH}$   
 (or any other example) 1  
 (b)  $\text{CH}_3\text{CH}=\text{N}-\text{NHCONH}_2$  1  
 (c) Stronger -I effect of fluorine, stronger acid less  $\text{pK}_a$  / strong electron withdrawing power of fluorine. 1  
 (d)  $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CHO}$  1  
 (e) Silver mirror formed on adding ammonical silver nitrate to propanal and not with propanone. 1  
 (or any other correct test)

Ans. A- $\text{C}_6\text{H}_5\text{COCH}_3$	1
B- $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_3$	1
C- $\text{C}_6\text{H}_5\text{COOH}$	1
D, E - $\text{C}_6\text{H}_5\text{COONa}$ , $\text{CHI}_3$	1 + 1

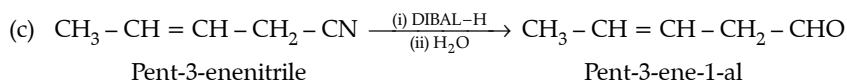
[CBSE Marking Scheme, 2016]

Detailed Answer:

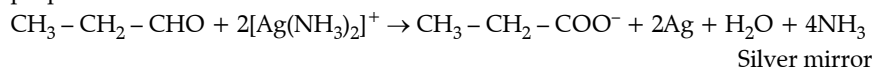


OR

- (a)  $2\text{HCHO} \xrightarrow{50\% \text{NaOH}} \text{CH}_3\text{OH} + \text{HCOONa}$   
 (b)  $\text{CH}_3-\text{CH}=\text{N}-\text{NH}-\text{CO}-\text{NH}_2$   
 (c) In  $\text{FCH}_2-\text{COOH}$ , fluorine is more electron withdrawing than chlorine in  $\text{ClCH}_2-\text{COOH}$ , so  $\text{FCH}_2-\text{COOH}$ , fluorine is more acidic than  $\text{ClCH}_2\text{COOH}$  hence its  $\text{pK}_a$  value is lesser than  $\text{ClCH}_2\text{COOH}$ .



- (e) Propanal and propanone can be differentiated by Tollens' reagent i.e., propanal will give silver mirror but propanone will not.



26. (a) Calculate the freezing point of solution when 1.9 g of  $\text{MgCl}_2$  ( $M = 95 \text{ g mol}^{-1}$ ) was dissolved in 50 g of water, assuming  $\text{MgCl}_2$  undergoes complete ionization. ( $K_f$  for water =  $1.86 \text{ K kg mol}^{-1}$ )

- (b) (i) Out of 1 M glucose and 2 M glucose, which one has a higher boiling point and why?

- (ii) What happens when the external pressure applied becomes more than the osmotic pressure of solution? 5

OR

- (a) When 2.56 g of sulphur was dissolved in 100 g of  $\text{CS}_2$ , the freezing point lowered by 0.383 K. Calculate the formula of sulphur ( $S_x$ ). ( $K_f$  for  $\text{CS}_2 = 3.83 \text{ K kg mol}^{-1}$ , Atomic mass of Sulphur =  $32 \text{ g mol}^{-1}$ ).

- (b) Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we place blood cells in a solution containing;

- (i) 1.2% sodium chloride solution?  
(ii) 0.4% sodium chloride solution?

Ans. (a)  $\Delta T_f = i \frac{K_f W_b \times 1000}{M_b \times W_a}$  1

$$\Delta T_f = 3 \times \left( \frac{1.86 \times 1.9}{95 \times 50} \right) \times 1000$$

$$= 2.23 \text{ K}$$

$$T_f - \Delta T_f = 273.15 - 2.23 \text{ or } 273 - 2.23$$

$$T_f = 270.92 \text{ K or } 270.77 \text{ K} \quad 1$$

- (b) (i) 2M glucose ; More number of particles / less vapour pressure.  $\frac{1}{2} + \frac{1}{2}$

- (ii) Reverse osmosis. 1

OR

(a)  $\Delta T_f = \frac{K_f W_b \times 1000}{M_b \times W_a}$  1

$$0.383 = \left( \frac{3.83 \times 2.56}{M \times 100} \right) \times 1000$$

$$M = 256$$

$$S \times x = 256$$

$$32 \times x = 256 \quad 1$$

$$x = 8$$

- (b) (i) Shrinks 1

- (ii) Swells 1

[CBSE Marking Scheme, 2016]

**Detailed Answer:**

(a)  $W_B$  (solution) = 1.9 g ws

$$W(\text{H}_2\text{O}) = 50 \text{ g}$$

$$M(\text{MgCl}_2) = 95 \text{ g/mol}$$

$$i = 3(\text{for MgCl}_2)$$

$$m = \frac{W_B \text{ in kg}}{\text{Molar mass} \times \text{mass of solvent}}$$

$$\Delta T_f = iK_f m$$

$$\Delta T_f = 3 \times 1.86 \times \frac{1.9}{95} \times \frac{1000}{50} (\text{kg})$$

$$\Delta T_f = 2.232 \text{ K}$$

$$\Delta T_f = \Delta T_f^\circ - T_f$$

Also,  $\Delta T_f = \Delta T_f^\circ - T_f$

$$T_f = T_f^\circ - \Delta T_f = 273.15 - 2.232$$

$$= 270.918 \text{ K}$$

- (b) (i) 2 M glucose, because more will be the concentration molality, more will be the elevation in boiling point.

- (ii) Reverse osmosis takes place.

OR

(a)  $\Delta T_f = iK_f m$

$$\Delta T_f = K_f \times \frac{W_B}{W_A (\text{Kg})} \times \frac{1}{W_A} (\text{Kg})$$

$$M_B = \frac{K_f}{\Delta T_f \times W_A (\text{Kg})}$$

$$= \frac{3.83 \times 2.56 \times 1000}{0.383 \times 100 (\text{kg})}$$

$$= 256 \text{ g/mol}$$

$$M_B = n \times \text{Atomic mass}$$

$$n = \frac{M_B}{\text{Atomic mass}}$$

$$= \frac{256}{32} = 8$$

$\therefore S_8$

- (b) (i) Water moves out from blood cell, hence will shrink. (ii) Water will enter into blood cell, hence will swell.

**Delhi Set II****Code No. 56/1/2/D**

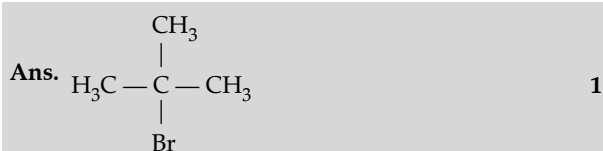
Note : All questions are from Set I.

**Delhi Set III****Code No. 56/1/3/D**

Note : All questions are from Set I &amp; II.

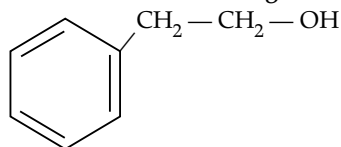
**Outside Delhi Set I****Code No. 56/1/C**

1. Write the structure of an isomer of compound  $C_4H_9Br$  which is most reactive towards  $S_N1$  reaction. 1



[CBSE Marking Scheme, 2016]

- \* 2.  $Pb(NO_3)_2$  on heating gives a brown gas which undergoes dimerization on cooling? Identify the gas. 1
- \* 3. Give an example each of a molecular solid and an ionic solid. 1
4. Write the IUPAC name of the given compound: 1



Ans. 2 - Phenylethanol. 1  
[CBSE Marking Scheme, 2016]

- \* 5. What is the reason for the stability of colloidal sols? 1
6. (i) Gas (A) is more soluble in water than Gas (B) at the same temperature. Which one of the two gases will have the higher value of  $K_H$  (Henry's constant) and why? 1
- (ii) In non-ideal solution, what type of deviation shows the formation of maximum boiling azeotropes? 2

Ans. (i) Gas B, Higher the value of  $K_H$ , lower is the solubility of gas /  $p = K_H \times \frac{1}{2} + \frac{1}{2}$

(ii) Negative deviation from Raoult's law 1  
[CBSE Marking Scheme, 2016]

**Detailed Answer:**

- (i) Gas B will have the higher value of  $K_H$  (Henry's constant) as lower is the solubility of the gas in the liquid higher is the value of  $K_H$ .

- (ii) In non-ideal solution, negative deviation shows the formation of maximum boiling azeotropes.

- \* 7. Write the structures of the following : 2

(i)  $BrF_3$  (ii)  $XeF_4$ . 2  
OR

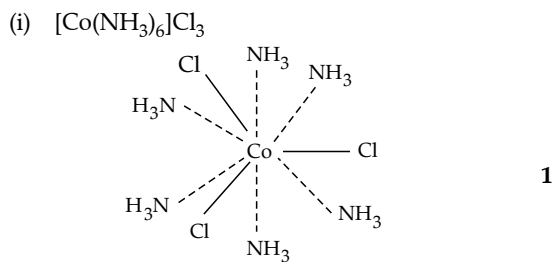
What happens when :

- (i)  $SO_2$  gas is passed through an aqueous solution of  $Fe^{3+}$  salt ?
- (ii)  $XeF_4$  reacts with  $SbF_5$  ?

8. When a co-ordination compound  $CoCl_3 \cdot 6NH_3$  is mixed with  $AgNO_3$ , 3 moles of  $AgCl$  are precipitated per mole of the compound. Write

- (i) Structural formula of the complex, 2
- (ii) IUPAC name of the complex. 2

Ans. (i)  $[Co(NH_3)_6]Cl_3$  1  
(ii) Hexaamminecobalt (III) chloride. 1  
[CBSE Marking Scheme, 2016]

**Detailed Answer :**

9. For a reaction:  $H_2 + Cl_2 \xrightarrow{h\nu} 2HCl$

Rate =  $k$ 

- (i) Write the order and molecularity of this reaction, 2

(ii) Write the unit of  $k$ . 2

Ans. (i) Zero order reaction, Molecularity is 2 / bimolecular reaction.  $\frac{1}{2} + \frac{1}{2}$

(ii)  $mol L^{-1} s^{-1}$ . 1

[CBSE Marking Scheme, 2016]

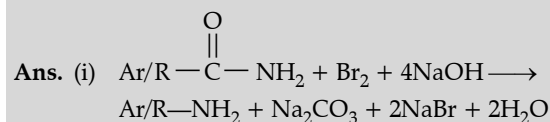


10. Write the chemical equations involved in the following reactions:

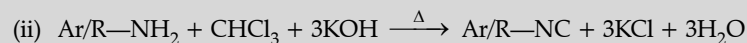
(i) Hoffmann-bromamide degradation reaction,

(ii) Carbylamine reaction.

2



1



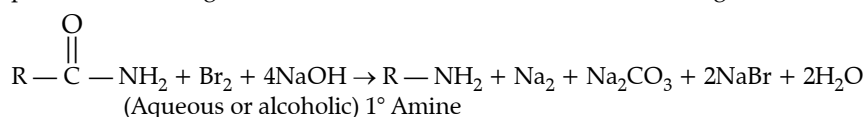
1

(where R = alkyl group, Ar = aryl group)

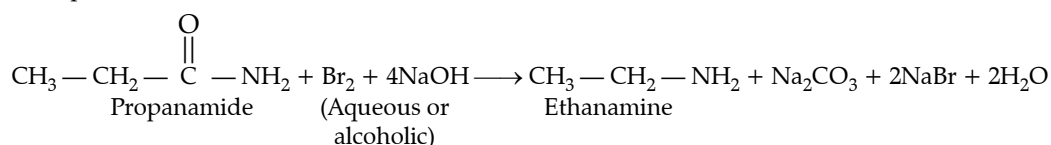
[CBSE Marking Scheme, 2016]

Detailed Answer:

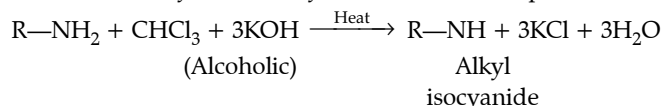
(i) **Hoffmann – bromamide degradation reaction:** When an amide is treated with bromine in aqueous or ethanolic solution of sodium hydroxide, a primary amine with one carbon atom less than the original amide is produced. This degradation is known as Hoffmann bromamide degradation reaction.



Example,



(ii) **Carbylamine reaction:** It is used as a test for detection of primary amines. When aliphatic or aromatic primary amines are heated with chloroform and alcoholic potassium hydroxide, carbylamines or isocyanides having foul smell are formed. Secondary and tertiary amines do not respond to this test.



\* 11. An element crystallizes in a bcc lattice with cell edge of 500 pm. The density of the element is  $7.5 \text{ g cm}^{-3}$ . How many atoms are present in 300 g of the element? 3

12. For the first order thermal decomposition reaction, the following data were obtained :

Time / sec	Total pressure / atm
0	0.30
300	0.50

Calculate the rate constant

(Given :  $\log 2 = 0.3010$ ,  $\log 3 = 0.4771$ ,  $\log 4 = 0.6021$ ) 3

Ans. Given : Initial pressure,

$$P_0 = 0.30 \text{ atm}$$

$$P_t = 0.50 \text{ atm}$$

$$t = 300 \text{ s}$$

$$\text{Rate constant, } k = \frac{2.303}{t} \log \frac{P_0}{2P_0 - P_t} \quad 1$$

$$= \frac{2.303}{300} \log \frac{0.30}{2 \times 0.30 - 0.50}$$

$$= \frac{2.303}{300} \log \frac{0.30}{0.60 - 0.50}$$

$$= \frac{2.303}{300} \log \frac{0.30}{0.10}$$

$$= \frac{2.303}{300} \log 3 \quad 1$$

$$= \frac{2.303}{300} \times 0.4771$$

$$= \frac{1.099}{300}$$

$$= 0.00366 \text{ s}^{-1}$$

$$= 3.6 \times 10^{-3} \text{ s}^{-1}$$

(deduct  $\frac{1}{2}$  mark if unit is not written) 1

[CBSE Marking Scheme, 2016]

\* 13. Define the following terms:

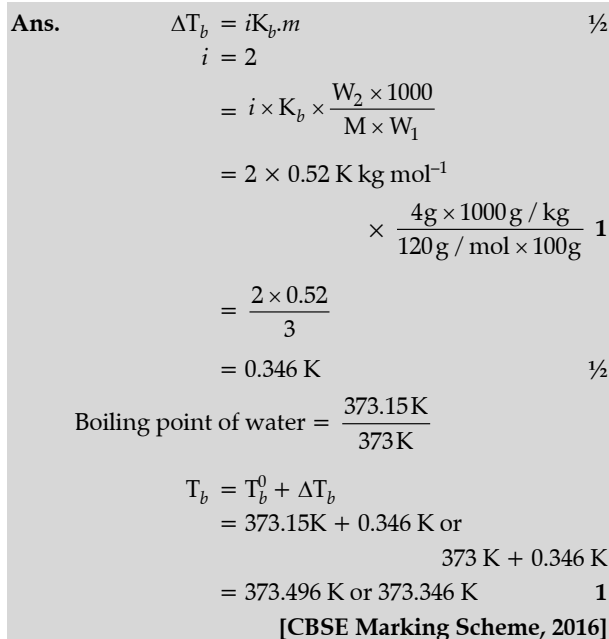
(i) Lyophilic colloid,

(ii) Zeta potential,

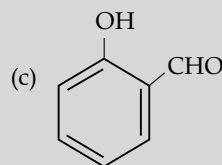
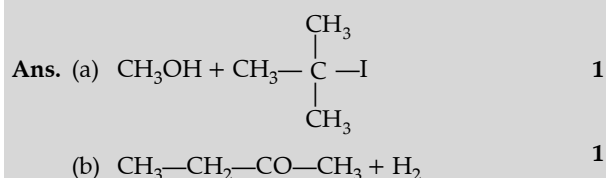
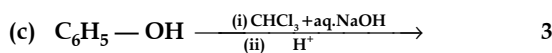
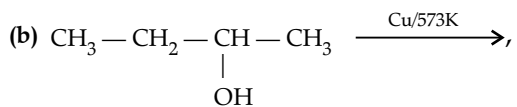
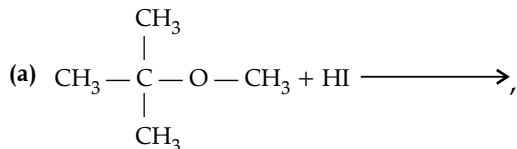
(iii) Associated colloids.

3

- \* 14. (i) Name the method of refining of nickel.  
 (ii) What is the role of cryolite in the extraction of aluminium?  
 (iii) What is the role of limestone in the extraction of iron from its oxides? 3
15. Calculate the boiling point of solution when 4 g of  $\text{MgSO}_4$  ( $M = 120 \text{ g mol}^{-1}$ ) was dissolved in 100 g of water, assuming  $\text{MgSO}_4$  undergoes complete ionization.  
 ( $K_b$  for water =  $0.52 \text{ K kg mol}^{-1}$ ) 3



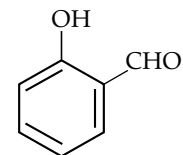
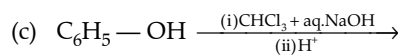
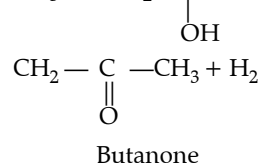
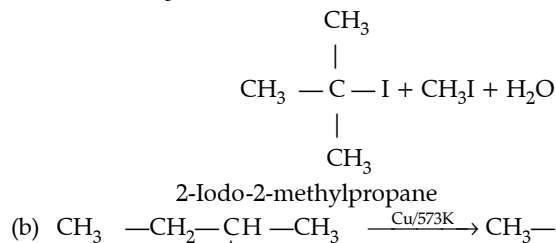
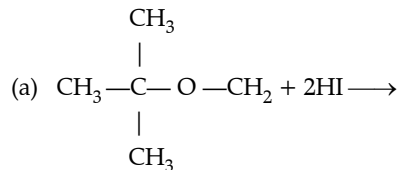
- \* 16. Give reasons:  
 (i)  $\text{SO}_2$  is reducing while  $\text{TeO}_2$  is an oxidizing agent.  
 (ii) Nitrogen does not form pentahalide.  
 (iii)  $\text{ICl}$  is more reactive than  $\text{I}_2$ . 3
17. Write the final product(s) in each of the following reactions :



1

[CBSE Marking Scheme, 2016]

Detailed Answer:



Salicylaldehyde

18. Give reasons for the following:

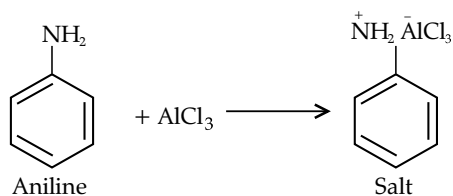
- (i) Aniline does not undergo Friedel-Crafts reaction,  
 (ii)  $(\text{CH}_3)_2\text{NH}$  is more basic than  $(\text{CH}_3)_3\text{N}$  in an aqueous solution,  
 (iii) Primary amines have higher boiling point than tertiary amines. 3

- Ans. (i) Aniline is a Lewis base while  $\text{AlCl}_3$  is Lewis acid. They combine to form a salt. 1  
 (ii) Due to combined + I and solvation effects. 1  
 (iii) Due to presence of H-bonding in primary amines. 1

[CBSE Marking Scheme, 2016]

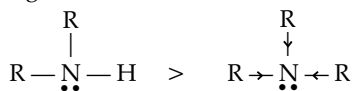
Detailed Answer:

- (i) A Friedel Crafts reactions is carried out in the presence of  $\text{AlCl}_3$ . But  $\text{AlCl}_3$  is used as catalyst and is acidic in nature whereas aniline is a strong base. Thus, aniline reacts with  $\text{AlCl}_3$  to form a salt.



Due to the positive charge on the N-atom, electrophilic substitution in the benzene ring is deactivated. Hence, aniline does not undergo Friedel-Crafts reaction.

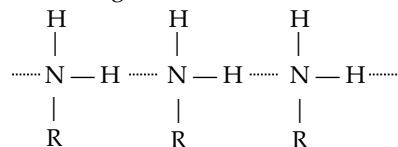
- (ii)  $(\text{CH}_3)_2\text{NH}$  is more basic than  $(\text{CH}_3)_3\text{N}$  in an aqueous solution. + I effect will increase in alkyl group that results in increasing the case of donation of lone pair electron. Amine accepts a proton and form cation which will be stabilised in water by solvation. Higher the solvation by hydrogen bonding, higher will be the basic strength.



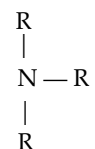
Therefore, with increase in methyl group, hydrogen bonding and stabilisation by

solvation decreases. This net effect results in decreases of basic strength from secondary to tertiary amine.

- (iii) In tertiary amines, there are no H-atoms whereas in primary amines, two H-atoms are present. Due to the presence of H-atoms, primary amines undergo extensive intermolecular H-bonding.



Primary amine



Tertiary amine

As a result, extra energy is required to separate the molecules of primary amine. Therefore, primary amines have higher boiling point than tertiary amines.

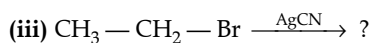
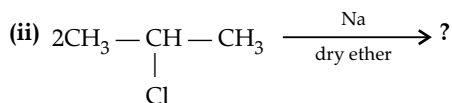
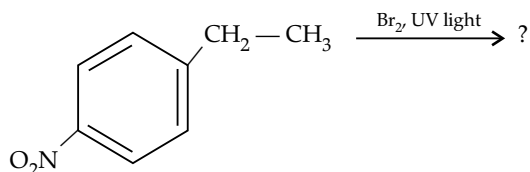
### 19. How do you convert:

- (i) Chlorobenzene to biphenyl, (ii) Propene to 1-iodopropane, (iii) 2-bromobutane to but-2-ene.

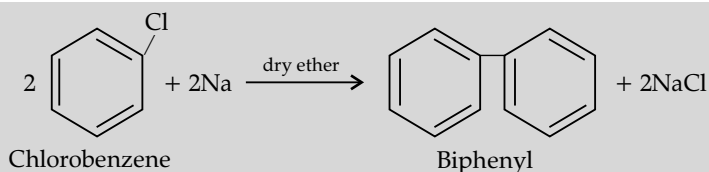
OR

Write the major product (s) in the following:

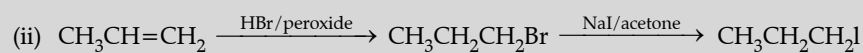
(i)



Ans. (i)



1

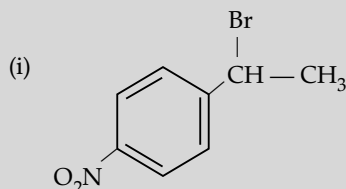


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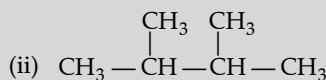


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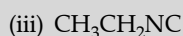
OR



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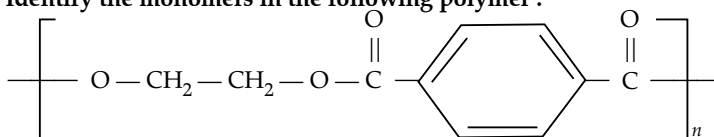


1

[CBSE Marking Scheme, 2016]

\* 20. (i) What is the role of sulphur in the vulcanization of rubber ?

(ii) Identify the monomers in the following polymer :



(iii) Arrange the following polymers in the increasing order of their intermolecular forces:

3

Terylene, polythene and neoprene.

21. (i) Write the structural difference between starch and cellulose.

(ii) What type of linkage is present in nucleic acids ?

(iii) Give one example each for fibrous protein and globular protein.

3

(ii) Phosphodiester linkage between the 5' and 3' atoms is present in Nucleic acids.

(iii) Example of fibrous protein—Collagen, keratin, myosin.

(Any one)

Example of globular protein — Insulin, haemoglobin, egg albumin

(Any one)

Ans. (i) Starch – Polymer of  $\alpha$  - D - glucose units / Polymer of  $\alpha$  - glucose units.Cellulose – Polymer of  $\beta$ -D - glucose units / Polymer of  $\beta$  - glucose units.

1

(ii) Phosphodiester linkage

1

(iii) Fibrous protein – Keratin / myosin / collagen.

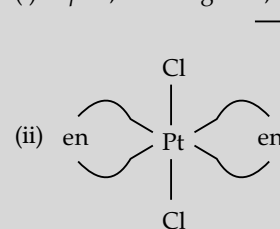
Globular protein – Haemoglobin / insulin.

 $\frac{1}{2} + \frac{1}{2}$ 

[CBSE Marking Scheme, 2016]

22. (a) For the complex  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ , write the hybridization, magnetic character and spin of the complex. (At. number : Fe = 26)(b) Draw one of the geometrical isomers of the complex  $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$  which is optically inactive.

3

Ans. (i)  $sp^3d^2$ , Paramagnetic, high spin1 +  $\frac{1}{2}$  +  $\frac{1}{2}$ 

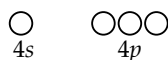
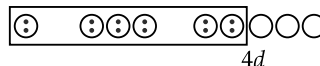
1

[CBSE Marking Scheme, 2016]

Detailed Answer :

(i) In starch, the glucose monomers are in alpha configuration while in cellulose, the glucose monomers are in beta configuration. Starch is a polymer consisting of amylose and amylopectin while cellulose is a long chain composed only of  $\beta$ -D-glucose units.

Detailed Answer:

(a)  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ [Fe(III)ion ( $d^5$ ) 
 $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ 
 $sp^3d^2$  hybridisation

Since  $\text{H}_2\text{O}$  is a weak field ligand it cannot participate in pairing of electrons. Therefore, the number of unpaired electrons is 5.

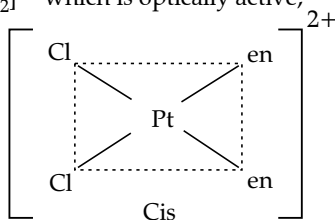
$$\mu = \sqrt{n(n+2)} = \sqrt{5(5+2)} = \sqrt{35} = 5.92 \text{ BM.}$$

Thus, it is strongly paramagnetic (due to presence of unpaired electrons).

In  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ , outer d-orbitals are used in hybridization and it is high spin or spin free complex.

\* Out of Syllabus

(b) Geometrical isomer of  $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$  which is optically active,

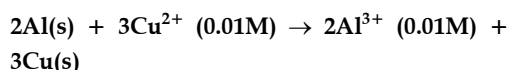


- \* 23. Due to hectic and busy schedule, Mr. Singh started taking junk food in the lunch break and slowly became habitual of eating food irregularly to excel in his field. One day during meeting he felt severe chest pain and fell down. Mr. Khanna, a close friend of Mr. Singh took him to doctor immediately. The doctor diagnosed that Mr. Singh was suffering from acidity and prescribed some medicines. Mr. Khanna advised him to eat home made food and change his lifestyle by doing yoga, meditation and some physical exercises. Mr. Singh followed his friend's advice and after few days he started feeling better.

After reading the above passage, answer the following :

- What are the values (at least two) displayed by Mr. Khanna ?
- What are antacids ? Give one example.
- Would it be advisable to take antacids for a long period of time ? Give reason. 4

24. (a) Calculate  $E^\circ_{\text{cell}}$  for the following reaction at 298K :



Given :  $E^\circ_{\text{cell}} = 1.98 \text{ V}$

- (b) Using the  $E^\circ$  values of A and B, predict which is better for coating the surface of iron [ $E^\circ_{(\text{Fe}^{2+}/\text{Fe})} = -0.44\text{V}$ ] to prevent corrosion and why ?

Given :  $E^\circ_{(\text{A}^{2+}/\text{A})} = -2.37\text{V}$  :

$$E^\circ_{(\text{B}^{2+}/\text{B})} = -0.14\text{V}$$

OR

- (a) The conductivity of 0.001 mol  $\text{L}^{-1}$  solution of  $\text{CH}_3\text{COOH}$  is  $3.905 \times 10^{-5} \text{ S cm}^{-1}$ . Calculate its molar conductivity and degree of dissociation ( $\alpha$ ).

Given  $\lambda^0(\text{H}^+) = 349.6 \text{ S cm}^2 \text{ mol}^{-1}$  and  $\lambda^0(\text{CH}_3\text{COO}^-) = 40.9 \text{ S cm}^2 \text{ mol}^{-1}$

- (b) Define electrochemical cell. What happens if external potential applied becomes greater than  $E^\circ_{\text{cell}}$  of electrochemical cell ?

Ans. (a) 
$$E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.0591}{n} \log \frac{[\text{Al}^{3+}]^2}{[\text{Cu}^{2+}]^3} \quad 1$$

$$E^\circ_{\text{cell}} = E_{\text{cell}} + \frac{0.0591}{n} \log \frac{[\text{Al}^{3+}]^2}{[\text{Cu}^{2+}]^3}$$

$$E^\circ_{\text{cell}} = 1.98 \text{ V} + \frac{0.0591}{6} \log \frac{(0.01)^2}{(0.01)^3} \quad 1$$

$$E^\circ_{\text{cell}} = 1.98 \text{ V} + \frac{0.0591}{6} \log 10^2$$

$$E^\circ_{\text{cell}} = 1.98 \text{ V} + \frac{0.0591}{6} \times 2 \times \log 10$$

$$[\because \log 10 = 1]$$

$$E^\circ_{\text{cell}} = 1.98 \text{ V} + \frac{0.0591 \text{ V}}{6} \times 2$$

$$E^\circ_{\text{cell}} = 1.98 \text{ V} + 0.0197 \text{ V}$$

$$E^\circ_{\text{cell}} = 1.9997 \text{ V} \quad 1$$

- (b) A, because its  $E^\circ$  value is more negative

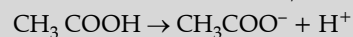
1 + 1

OR

(a)  $\Lambda_m = \kappa \times 1000/C$

$$= \frac{3.905 \times 10^{-5} \times 1000}{0.001}$$

$$= 39.05 \text{ S cm}^2/\text{mol} \quad 1$$



$$\Lambda^0_{\text{CH}_3\text{COOH}} = \lambda^0_{\text{CH}_3\text{COO}^-} + \lambda^0_{\text{H}^+}$$

$$= 40.9 + 349.6$$

$$\Lambda^0_{\text{CH}_3\text{COOH}} = 390.5 \text{ S cm}^2/\text{mol} \quad 1$$

$$\alpha = \frac{\Lambda_m}{\Lambda^0_m}$$

$$= \frac{39.05}{390.5}$$

$$= 0.1 \quad 1$$

- (b) Device used for the production of electricity from energy released during spontaneous chemical reaction and the use of electrical energy to bring about a chemical change. 1

The reaction gets reversed / It starts acting as an electrolytic cell & vice - versa. 1

[CBSE Marking Scheme, 2016]

25. (a) Account for the following:

- (i) Mn shows the highest oxidation state of + 7 with oxygen but with fluorine it shows the highest oxidation state of + 4.  
 (ii)  $\text{Cr}^{2+}$  is a strong reducing agent.  
 (iii)  $\text{Cu}^{2+}$  salts are coloured while  $\text{Zn}^{2+}$  salts are white.

(b) Complete the following equations:

- (i)  $2\text{MnO}_2 + 4\text{KOH} + \text{O}_2 \xrightarrow{\Delta}$ ,  
 (ii)  $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{I}^- \rightarrow$  5  
 OR

The elements of 3d-transition series are given as :

Sc Ti V Cr Mn Fe Co Ni Cu Zn

Answer the following:

- (i) Write the element which shows maximum number of oxidation states. Give reason.  
 (ii) Which element has the highest m.p. ?  
 (iii) Which element shows only + 3 oxidation state ?  
 (iv) Which element is a strong oxidizing agent in + 3 oxidation state and why ?

- Ans. (a) (i) Ability of oxygen to form multiple bond with Mn metal. 1  
 (ii)  $\text{Cr}^{2+}$  is oxidized to  $\text{Cr}^{3+}$  which has stable  $d^3 / t_{2g}^3$  orbital configuration. 1  
 (iii)  $\text{Cu}^{2+}$  has unpaired electron while  $\text{Zn}^{2+}$  has no unpaired electron. 1  
 (b) (i)  $2\text{MnO}_2 + 4\text{KOH} + \text{O}_2 \xrightarrow{\Delta} 2\text{K}_2\text{MnO}_4 + 2\text{H}_2\text{O}$  1  
 (ii)  $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{I}^- \longrightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O} + 3\text{I}_2$   
 (balanced equation is required) 1

OR

- (i) Mn. It has maximum unpaired electrons.  $\frac{1}{2} + 1$   
 (ii) Cr 1  
 (iii) Sc 1  
 (iv) Manganese.  $\text{Mn}^{3+}$  to  $\text{Mn}^{2+}$  results in the stable half filled ( $d^5$ ) configuration.  $\frac{1}{2} + 1$

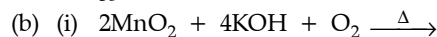
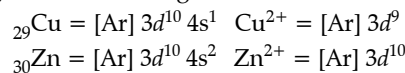
[CBSE Marking Scheme, 2016]

Detailed Answer:

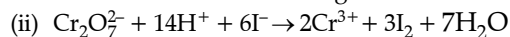
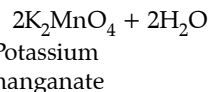
- (a) (i) Mn exhibits highest oxidation states (upto + 7) in the oxides, for example  $\text{Mn}_2\text{O}_7$  in comparison to Mn fluorides,  $\text{MnF}_4$  as oxygen is able to form multiple bond with metal. And also fluorine does not have  $d$ -orbital.  
 (ii)  $\text{Cr}^{2+}$  is a strong reducing agent as its electrode potential is more negative. Also, it can lose one electron to become  $\text{Cr}^{3+}$  which

has half-filled  $d$ -orbital which is its stable state.

(iii) Electronic configuration :



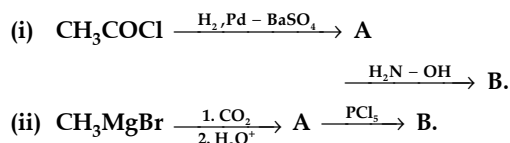
Manganese Potassium  
dioxide hydroxide



OR

- (i) Manganese exhibits greatest number of oxidation states as it is able to acquire half filled to completely filled configurations. Thus Mn can lose or share electrons from both the orbitals.  
 (ii) Cr has the highest melting point. As the number unpaired electrons increases upto  $d^5$  configuration, it results in the increase in the strength of metallic bonds. To break the metallic bond, significant energy is required thus Cr with highest number of unpaired electrons (6) has the highest melting point.  
 (iii) Sc shows only +3 oxidation state as it has too few electrons to lose thus, loses one electron from  $3d$ -electron to attain + 3 oxidation state.  
 (iv) Co is the strongest oxidising agent as the E value for the redox couple  $\text{M}^{3+} / \text{M}^{2+}$  is highest.

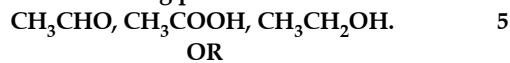
26. (a) Write the structures of A and B in the following reactions :



(b) Distinguish between :

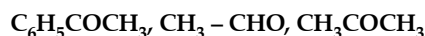
- (i)  $\text{C}_6\text{H}_5 - \text{COCH}_3$  and  $\text{C}_6\text{H}_5 - \text{CHO}$ ,  
 (ii)  $\text{CH}_3\text{COOH}$  and  $\text{HCOOH}$ .

(c) Arrange the following in the increasing order of their boiling points :



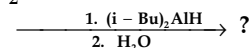
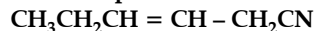
(a) Write the chemical reaction involved in Wolff-Kishner reduction.

(b) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction :



(c) Why carboxylic acid does not give reactions of carbonyl group ?

(d) Write the product in the following reaction.

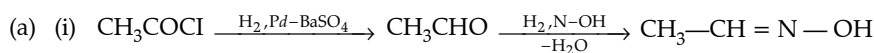


(e) A and B are two functional isomers of compound  $C_3H_6O$ . On heating with NaOH and  $I_2$ , isomer B forms yellow

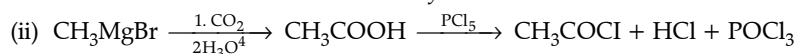
precipitate of iodoform whereas isomer A does not form any precipitate. Write the formulae of A and B.

- Ans. (a) (i) A :  $CH_3CHO$ , B :  $CH_3CH=N-OH$  1/2 + 1/2  
 (ii) A :  $CH_3COOH$ , B :  $CH_3COCl$  1/2 + 1/2  
 (b) (i) Heat both compounds with NaOH and  $I_2$ ,  $C_6H_5COCH_3$  forms yellow ppt. of  $CHI_3$  whereas  $C_6H_5CHO$  does not. 1  
 (ii) Add ammonical solution of silver nitrate (Tollens' reagent) to both the compounds,  $HCOOH$  gives silver mirror but  $CH_3COOH$  does not.  
 (or any other suitable test) 1  
 (c)  $CH_3CHO < CH_3CH_2OH < CH_3COOH$  1
- OR
- (a)  $\text{>C=O} \xrightarrow[-H_2O]{NH_2NH_2} \text{>C=NNH}_2 \xrightarrow[heat]{KOH/ethylene\ glycol} \text{>CH}_2 + N_2$  1  
 (b)  $C_6H_5COCH_3 < CH_3COCH_3 < CH_3CHO$  1  
 (c) Because of resonance in carboxylic group, the carbonyl group, loses a double bond character. 1  
 (d)  $CH_3CH_2CH=CH-CH_2CHO$  1  
 (e) A :  $CH_3CH_2CHO$  1/2  
 B :  $CH_3COCH_3$  1/2

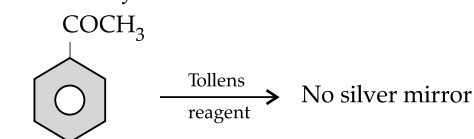
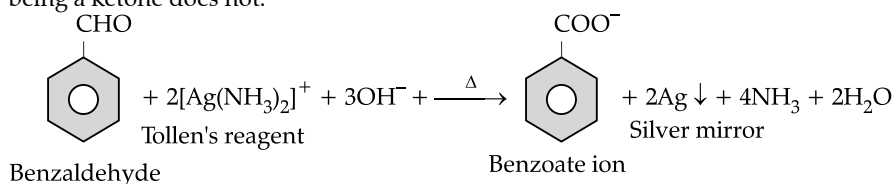
[CBSE Marking Scheme, 2016]

**Detailed Answer:**

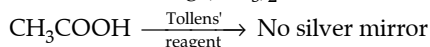
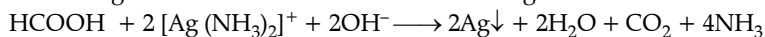
[A] [B]  
 Acetaldehyde Acetaldoxime



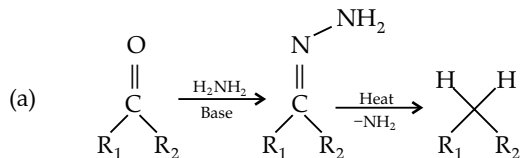
(b) (i)  $C_6H_5CHO$  being an aldehyde reduces Tollens' reagent to shining silver mirror whereas  $C_6H_5COCH_3$  being a ketone does not.



(ii)  $HCOOH$  gives silver mirror test with Tollens' reagent whereas ethanoic acid does not.

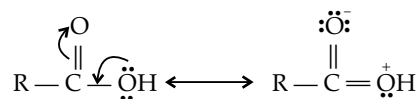


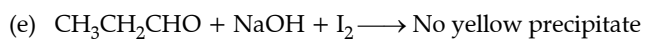
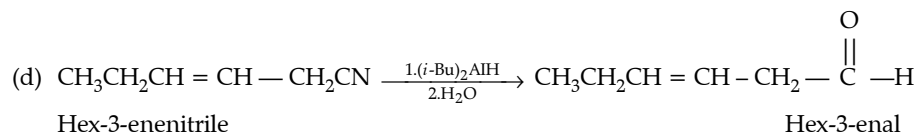
OR



(b)  $C_6H_5COCH_3 < CH_3-COCH_3 < CH_3-CHO$

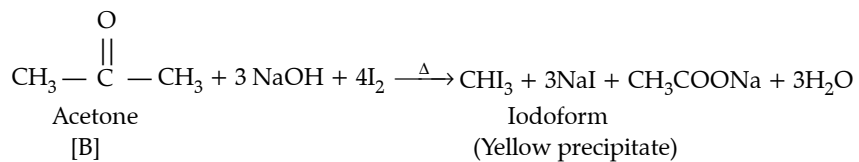
(c) Carboxylic acids do not give reactions of carbonyl groups as it enters into resonance with lone pair of  $-COOH$  groups thereby making the carbon atoms less electrophilic.





Propanal

[A]



**Outside Delhi Set II**

**Code No. 56/2/C**

**Note :** All questions are from Set I.

**Outside Delhi Set III**

**Code No. 56/3/C**

**Note :** All questions are from Set I & II.

