CBSE Examination Paper, 2018

Time Allowed : 3 hours] [*Maximum Marks* : 70

Solution based on marking scheme by CBSE.

General Instructions:

(*i*) **All** questions are compulsory.

(*ii*) Questions number **1** to **5** are very-short answer questions and carry **1** mark each.

(*iii*) Questions number **6** to **10** are short-answer questions and carry **2** marks each.

(*iv*) Questions number **11** to **22** are also short-answer questions and carry **3** marks each.

(*v*) Questions number **23** is a value based question and carries **4** marks.

(*vi*) Questions number **24** to **26** are long-answer questions and carry **5** marks each.

(*vii*) Use log tables, if necessary. Use of calculators is not allowed.

Note: All the questions in Set 2 and Set 3 are same. Only the order of question numbers is changed.

1. Analysis shows that FeO has a non-stoichiometric composition with formula $Fe_{0.95}O$. Give reason. 1

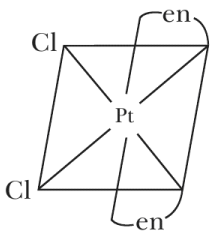
Ans. Some Fe^{2+} ions are replaced by Fe^{3+} ions by oxidation. Three Fe^{2+} ions are replaced by two Fe^{3+} ions to maintain electroneutrality, therefore it becomes non-storchiometeric with formula $Fe_{0.95}O$. It shows metal deficiency defect.

2. CO(*g*) and H_2(*g*) react to give different products in the presence of different catalysts. Which ability of the catalyst is shown by these reactions? 1

Ans. It shows the selectivity of the catalyst.

3. Write the coordination number and oxidation state of Platinum in the complex $[Pt(en)_2Cl_2]$. 1

Ans. Coordination number of Pt is 6 because 'en' is bidentate ligand, there are two bidentane ligands and two mono dentate ligands. Therefore, coordination number is 6 as shown below.



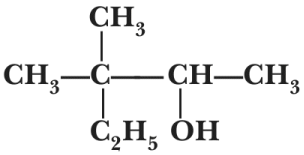
$$x + 0 - 2 = 0$$
$$x = +2$$

Oxidation state is + 2.

4. Out of chlorobenzene and benzyl chloride, which one gets easily hydrolysed by aqueous NaOH and why? 1

Ans. Benzyl chloride is easily hydrolysed because benzyl carbocation is stabilized by resonance.

5. Write the IUPAC name of the following: 1



Ans. 3, 3-dimethyl pentan-2-ol

6. Calculate the freezing point of a solution containing 60 g of glucose (molar mass = 180 g mol^{-1}) in 250 g of water. (K_f of water = 1.86 K kg mol^{-1}) 2

Ans. Mass of solute (W_B) = 60 g; Mass of solvent (W_A) = 250 g

Molar mass of solute (M_B) = 180 g mol^{-1}

K_f of water = 186 K kg mol^{-1}

$$\Delta T_f = K_f \times \frac{W_B}{M_B} \times \frac{1000}{W_A}$$

$$\Delta T_f = 1.86 \times \frac{60}{180} \times \frac{1000}{250} = 1.86 \times \frac{1}{3} \times 4 = \frac{7.44}{3} = 2.48$$

$$\Delta T_f = 2.48 \text{ K}$$

Freezing point of solution = Freezing point of water – ΔT_f

= 273.15 K – 2.48 K = 270.67 K

Freezing point of solution = 270.67 K or – 2.48°C

7. For the reaction $2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$,

the rate of formation of $NO_2(g)$ is 2.8×10^{-3} M s^{-1}. Calculate the rate of disappearance of $N_2O_5(g)$. 2

Ans. $$\text{Rate of reaction} = -\frac{d[N_2O_5]}{2dt} = +\frac{1}{4}\frac{d[NO_2]}{dt} = \frac{\Delta O_2}{\Delta t}$$

$$\text{Rate of disappearance of } N_2O_5 = -\frac{d[N_2O_5]}{2dt} = \frac{2}{4} \times 2.8 \times 10^{-3} \text{ Ms}^{-1}$$

Rate of disappearance of N_2O_5 = 1.4×10^{-3} Ms^{-1}

8. Among the hydrides of Group-15 elements, which have the **2**

(*a*) lowest boiling point?

(*b*) maximum basic character?

(*c*) highest bond angle?

(*d*) maximum reducing character?

Ans. (*a*) PH_3 (Phosphine) has lowest boiling point.

(*b*) NH_3 (Ammonia) has maximum basic character.

(*c*) NH_3 (Ammonia) has highest bond angle (107°)

(*d*) BiH_3 (Bismuth hydride) has maximum reducing character.

9. How do you convert the following? **2**

(*a*) Ethanal to Propanone

(*b*) Toluene to Benzoic acid

Or

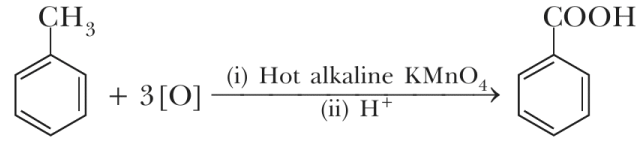
Account for the following: **2**

(*a*) Aromatic carboxylic acids do not undergo Friedel-Crafts reaction.

(*b*) pK_a value of 4-nitrobenzoic acid is lower than that of benzoic acid.

Ans. (*a*) $CH_3-\overset{\overset{O}{\|}}{C}-H \xrightarrow[(ii)\ H_2O/H^+]{(i)\ CH_3MgBr} CH_3-\overset{\overset{OH}{|}}{CH}-CH_3 \xrightarrow[573\ K]{Cu} CH_3-\overset{\overset{O}{\|}}{C}-CH_3$

Ethanal — 2-propanol — Propanone

(*b*) 

Toluene — Benzoic acid

Or

(*a*) It is because—COOH is electron with drawing group, i.e. it deactivates the benzene ring due to which aromatic carboxylic acid do not undergo Friedel Crafts reaction due to bonding between —COOH and $AlCl_3$ (Lewis acid).

(*b*) $-NO_2$ group is electron withdrawing, that is why *p*-nitro benzoic acid is more acidic than benzoic acid as *p*-nitrobenzoate ion is more stable than benzoate ion.

10. Complete and balance the following chemical equations: **2**

(*a*) $Fe^{2+} + MnO_4^- + H^+ \longrightarrow$

(*b*) $MnO_4^- + H_2O + I^- \longrightarrow$

Ans. (*a*) $5Fe^{2+} + MnO_4^- + 8H^+ \longrightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$

(*b*) $2MnO_4 + H_2O + I^- \longrightarrow 2MnO_2 + 2\,OH^- + IO_3^-$

11. Give reasons for the following: **3**

(*a*) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers.

(*b*) Aquatic animals are more comfortable in cold water than in warm water.

(*c*) Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.

Ans. (*a*) It is because osmotic pressure is measured at room temperature and has appreciable value even for very dilute solution.

(*b*) It is because cold water has more dissolved oxygen than warm water because solubility of gas in liquid decreases with increase in temperature.

(*c*) $KCl \longrightarrow K^+ + Cl^-$

KCl is strong electrolyte. It dissociate completely into ions. The number of particles are double as compared to sugar solution. Sugar is non-electrolyte, does not form ions. $i = 2$ for KCl and $i = 1$ for sugar.

12. An element 'X' (At. mass = 40 g mol^{-1}) having f.c.c. structure, has unit cell edge length of 400 pm. Calculate the density of 'X' and the number of unit cells in 4 g of 'X'. ($N_A = 6.022 \times 10^{23}$ mol^{-1}) **3**

Ans. Atomic mass (M) = 40 g mol^{-1}, $Z = 4$ for FCC

$Z = 4$ for FCC, $a = 400$ pm $= 400 \times 10^{-10}$ cm [1 pm $= 10^{-10}$ cm]

$d = ?$ $N_A = 6.022 \times 10^{23}$ mol^{-1}

$$d = \frac{Z \times M}{a^3 \times N_A} = \frac{4 \times 40}{(400)^3 \times 10^{-30} \times 6.023 \times 10^{23}}$$

$$d = \frac{160}{64 \times 10^6 \times 10^{-30} \times 10^{23} \times 6.023} = \frac{1600}{64 \times 6.023} = \frac{1600}{385.472}$$

$$d = 4.15 \text{ g cm}^{-3}$$

$$\text{Number of unit cells per mole} = \frac{\text{Total number of atoms } (N_A)}{\text{Number of atoms per unit cell } (Z)}$$

$$= \frac{6.023 \times 10^{23}}{4} = 1.504 \times 10^{23} \text{ unit cell per mol}$$

40 g of 'X' contains 1.504 × 1023 unit cells

4 g of 'X' contains $\frac{1.504 \times 10^{23}}{40} \times 4 = 1.504 \times 10^{22}$ unit cell.

13. A first order reaction is 50% completed in 40 minutes at 300 K and in 20 minutes at 320 K. Calculate the activation energy of the reaction. (Given: log 2 = 0.3010, log 4 = 0.6021, $R = 8.314$ JK^{-1} mol^{-1}) **3**

Ans.

$$k_1 = \frac{0.693}{t_{1/2}} = \frac{0.693}{40} \text{ min}^{-1}$$

$$k_2 = \frac{0.693}{t_{1/2}} = \frac{0.693}{20} \text{ min}^{-1}$$

$$\log \frac{k_2}{k_1} = \frac{Ea}{2.303\,R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$\log \frac{\frac{0.693}{20}}{\frac{0.693}{40}} = \frac{Ea}{2.303 \times 8.314}\left(\frac{1}{300} - \frac{1}{320}\right)$$

$$\log 2 = \frac{Ea}{19.147}\left(\frac{320 - 300}{320 \times 300}\right)$$

$$Ea = \frac{96000 \times 19.147 \times \log 2}{20} \text{ J mol}^{-1}$$

$$Ea = \frac{96000 \times 19.147 \times 0.3010}{20 \times 1000} \text{ kJ mol}^{-1}$$

$$Ea = \frac{48 \times 19.147 \times 0.3010}{10} = \frac{276.635}{10} = 27.66 \text{ kJ mol}^{-1}$$

14. What happens when **3**

(*a*) a freshly prepared precipitate of $Fe(OH)_3$ is shaken with a small amount of $FeCl_3$ solution?

(*b*) persistent dialysis of a colloidal solution is carried out?

(*c*) an emulsion is centrifuged?

Ans. (*a*) Colloidal solution of $Fe(OH)_3$ will be formed because peptisation takes place.

(*b*) Coagulation will take place due to removal of traces of electrolyte which stabilize colloidal solution.

(*c*) Demulsification will take place, i.e. emulsion breaks into constituent liquids.

15. Write the chemical reactions involved in the process of extraction of Gold. Explain the role of dilute NaCN and Zn in this process. **3**

Ans. $4Au + 8NaCn + 2H_2O + O_2 \longrightarrow 4Na[Au(CN)_2] + 4NaOH$

NaCN forms a complex with impure Gold, sodium dicyanido aurate (I) while Zn acts as a reducing agent.

$2Na[Au(CN)_2] + Zn \longrightarrow Na_2[Zn(CN)_4] + 2Au$

16. Give reasons: **3**

(*a*) E^0 value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Fe^{3+}/Fe^{2+}.

(*b*) Iron has higher enthalpy of atomization than that of copper.

(*c*) Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured.

Ans. (*a*) It is because $Mn^{2+}(3d^5)$ is more stable than $Mn^{3+}(3d^4)$, and 3rd I.E is high, high energy is needed to convert Mn^{2+} to Mn^{3+}.

(*b*) It is because iron has large number of unpaired electrons in *d*-orbitals and form stronger metallic bond than 'Cu' which has completely filled *d*-orbital ($3d^{10}$) and hence enthalpy of atomization is higher than that of copper.

(*c*) Sc^{3+} does not have unpaired electron whereas Ti^{3+} has one unpaired electron, it can undergo *d-d* transition by absorbing light from visible region and radiate complementary colour.

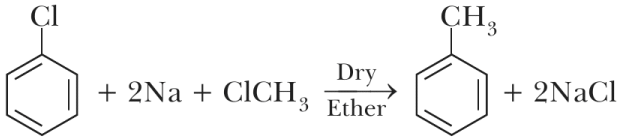
17. (*a*) Identify the chiral molecule in the following pair: **3**

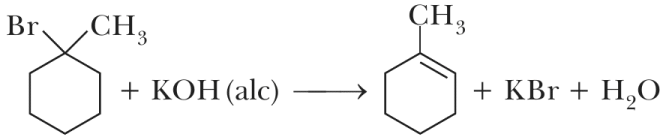
(*i*) (*ii*)

(*b*) Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether.

(*c*) Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1-methylcyclohexane with alcoholic KOH.

Ans. (*a*)  is chiral molecule.

(*b*) 

(*c*) 

1-Bromo-1-methyl cyclohexane — 1-methyl cyclohexene

18. (A), (B) and (C) are three non-cyclic functional isomers of a carbonyl compound with molecular formula C_4H_8O. Isomers (A) and (C) give positive Tollens' test whereas isomer (B) does not give Tollens' test but gives positive Iodoform test. Isomers (A) and (B) on reduction with Zn(Hg)/conc. HCl give the same product (D). **3**

(*a*) Write the structures of (A), (B), (C) and (D).

(*b*) Out of (A), (B) and (C) isomers, which one is least reactive towards addition of HCN?

Ans. (*a*) $CH_3—CH_2—CH_2—\overset{\overset{O}{\|}}{C}—H$ $CH_3—\overset{\overset{O}{\|}}{C}—CH_2—CH_3$ $CH_3—\underset{\underset{CH_3}{|}}{CH}—\overset{\overset{O}{\|}}{C}—H$

'A' 'B' 'C'

Butanal 2-Butanone 2-Methyl propanal

$CH_3—CH_2—CH_2—CH_3$

'D'

n-Butane

'A' and 'C' give Tollen's reagent test because these have aldehyde groups 'B' gives iodoform test because it is methyl ketone.

$$CH_3—\overset{\overset{O}{\|}}{C}—CH_2—CH_3 + 3I_2 + 4NaOH \longrightarrow CHI_3 + CH_3CH_2COONa + 3NaI + 3H_2O$$

$$CH_3—CH_2—CH_2—\overset{\overset{O}{\|}}{C}—H \xrightarrow{Zn(Hg)/Conc\ HCL} CH_3—CH_2—CH_2—CH_3 + H_2O$$

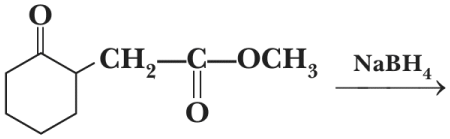
'A' 'D'

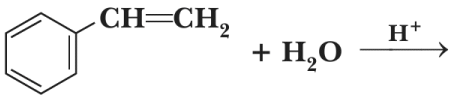
$$CH_3—\overset{\overset{O}{\|}}{C}—CH_2—CH_3 \xrightarrow{Zn(Hg)/Conc\ HCl} CH_3—CH_2—CH_2—CH_3$$

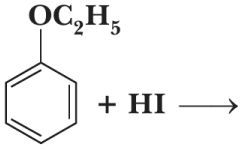
'B' *n*-Butane

(*b*) $CH_3—\overset{\overset{O}{\|}}{C}—CH_2—CH_3$ is least reactive towards addition of HCN due to stearic hindrance (crowding), nucleophile cannot attack easily.

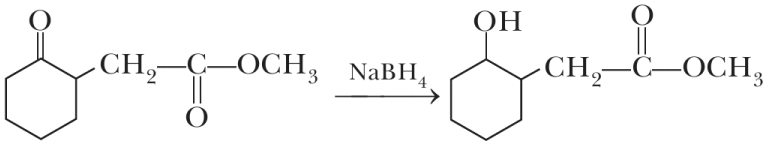
19. Write the structures of the main products in the following reactions: **3**

(*a*) 

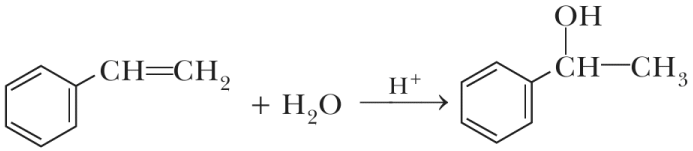
(*b*) 

(*c*) 

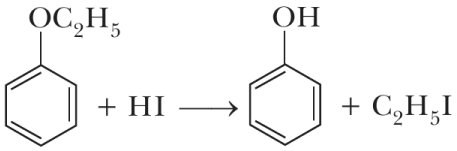
Ans. (*a*)



(*b*)



(*c*)



20. **(*a*) Why is bithional added to soap?**
(*b*) What is tincture of iodine? Write its one use.
(*c*) Among the following, which one acts as a food preservative?
Aspartame, Aspirin, Sodium Benzoate, Paracetamol **3**

Ans. (*a*) It acts as antiseptic.
(*b*) Iodine dissolved in alcohol is called tincture of iodine. It is used an antiseptic.
(*c*) Sodium benzoate acts as food preservative.

21. **Define the following with an example of each:** **3**
(*a*) Polysaccharides **(*b*) Denatured protein**
(*c*) Essential amino acids

Or

(*a*) Write the product when D-glucose reacts with conc. HNO_3.
(*b*) Amino acids show amphoteric behaviour. Why?
(*c*) Write one difference between α-helix and β-pleated structures of proteins. **3**

Ans. (*a*) Those carbohydrate which on hydrolysis give large number of monosaccharides are called polysaccharide e.g. starch.
(*b*) The protein whose secondary and tertiary structure is ruptured but primary structure remains the same is called denatured proein e.g. Hard boiled egg contains denatured protein.
(*c*) Those amino acids which are not synthesized by our body and must be part of our diet are called essential amino acids e.g. Valine.

Or

(*a*)

Glucose Saccharic acid

(*b*) Those amino acids which have both acidic (—COOH) as well as basic ($—NH_2$) groups in their structure due to which they react with both acids as well as bases, i.e. show amphoteric behaviour. They form zwitter ion.

(*c*)	α-helix has a polypeptide chain which forms all possible H-bonds by twisting into right handed screw. It has intra-molecular H-bonding.	β-pleated structure has all polypeptide chains which are stretched to maximum extent and then laid side by side by intermolecular H-bonding.

22. (*a*) Write the formula of the following coordination compound:
Iron(III) hexacyanoferrate(II)
(*b*) What type of isomerism is exhibited by the complex $[Co(NH_3)_5Cl]SO_4$?
(*c*) Write the hybridisation and number of unpaired electrons in the complex $[CoF_6]^{3-}$. (Atomic No. of Co = 27) **3**

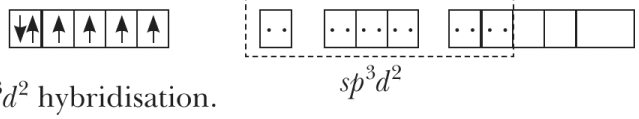
Ans. (*a*) $Fe_4[Fe(CN)_6]_3$

(*b*) Ionisation isomerism

(*c*) Co(27) [Ar] $4s^2\ 3d^7$

Co^{3+} (27) [Ar] $4s^0\ 3d^6$

F^- is weak field ligand, does not cause passing of elections

$[CoF_6]^{3-}$ 

sp^3d^2

It has sp^3d^2 hybridisation.

It has four unpaired electrons.

23. Shyam went to a grocery shop to purchase some food items. The shopkeeper packed all the items in polythene bags and gave them to Shyam. But Shyam refused to accept the polythene bags and asked the shopkeeper to pack the items in paper bags. He informed the shopkeeper about the heavy penalty imposed by the government for using polythene bags. The shopkeeper promised that he would use paper bags in future in place of polythene bags.
Answer the following: **4**

(*a*) Write the values (at least two) shown by Shyam.
(*b*) Write one structural difference between low-density polythene and high-density polythene.
(*c*) Why did Shyam refuse to accept the items in polythene bags?
(*d*) What is a biodegradable polymer? Give an example.

Ans. (*a*) Shyam is concerned about environment and also aware of harmful effects of polythene in environment. He is law abiding citizen, caring, socially alert.

(*b*) Low density polythene is highly branched where as high density polythene is straight chain polymer.

(*c*) It is because polythene is non-biodegradable and creates pollution of environment.

(*d*) Those polymers which are decomposed by micro-organisms and do not create pollution are known as bidegradable polymer, e.g. PHBV.

24. (*a*) Give reasons:

(*i*) H_3PO_3 undergoes disproportionation reaction but H_3PO_4 does not.

(*ii*) When Cl_2 reacts with excess of F_2, ClF_3 is formed and not FCl_3.

(*iii*) Dioxygen is a gas while Sulphur is a solid at room temperature.

(*b*) Draw the structures of the following:

(*i*) XeF_4 (*ii*) $HClO_3$ 5

Or

(*a*) When concentrated sulphuric acid was added to an unknown salt present in a test tube a brown gas (A) was evolved. This gas intensified when copper turnings were added to this test tube. On cooling, the gas (A) changed into a colourless solid (B).

(*i*) Identify (A) and (B).

(*ii*) Write the structures of (A) and (B).

(*iii*) Why does gas (A) change to solid on cooling?

(*b*) Arrange the following in the decreasing order of their reducing character: HF, HCl, HBr, HI

(*c*) Complete the following reaction:

$XeF_4 + SbF_5 \longrightarrow$ 5

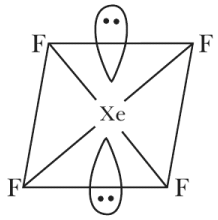
Ans. (*a*) (*i*) In H_3PO_3, 'P' is in +3 oxidation state, it can change to higher as well as lower oxidation state i.e. undergoes oxidation as well as reduction (disproportionation) whereas in H_3PO_4, 'P' is in +5 oxidation state it can only change to lower oxidation state hence cannot undergo disproportionation.

(*ii*) ClF_3 exists because Cl has d-orbitals where as FCl_3 doesnot exist as 'F' does not have d-orbitals. 'F' cannot show +3 oxidation state.

(*iii*) Dioxygen has less surface area, less Vander Waal's forces of attraction, hence, it is gas because it is diatomic due to presence of $p\pi$-$p\pi$ bond.

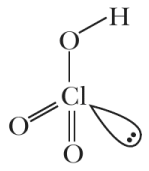
Sulphur is octa-atomic (S_8) molecule, more surface area, more inter-molecular forces of attraction, therefore, is solid at room temperature.

(*b*) (*i*)



Square planar

(*ii*)



Pyramidal

Or

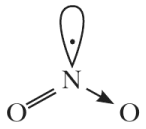
(*a*) (*i*) 'A' is NO_2 (Nitrogen dioxide), 'B' is N_2O_4 (Dinitrogen tetroxide)

$2NaNO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + 2HNO_3$

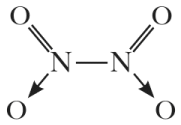
$Cu(s) + 4HNO_3\,(conc) \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

$2NO_2(g) \rightleftharpoons N_2O_4(s)$

(*ii*)



'A'



'B'

(*iii*) It is because NO_2 forms dimer which has high molecular weight, more surface area, more intermolecular forces of attraction, hence solid.

(*b*) HI > HBr > HCl > HF is decreasing order of reducing power.

(*c*) $XeF_4 + SbF_5 \longrightarrow [XeF_3]^+\,[SbF_6]^-$

25. (*a*) Write the cell reaction and calculate the e.m.f. of the following cell at 298 K:

Sn (s) | Sn^{2+} (0.004 M) || H^+ (0.020 M) | H_2 (g) (1 bar) | Pt (s)

(Given: $E^0_{Sn^{2+}/Sn} = -0.14$ V)

(*b*) Give reasons:

(*i*) On the basis of E^0 values, O_2 gas should be liberated at anode but it is Cl_2 gas which is liberated in the electrolysis of aqueous NaCl.

(*ii*) Conductivity of CH_3COOH decreases on dilution. 5

Or

(*a*) For the reaction

$2AgCl\,(s) + H_2\,(g)\,(1\ atm) \longrightarrow 2Ag\,(s) + 2H^+\,(0.1\ M) + 2Cl^-\,(0.1\ M)$,

$\Delta G^0 = -43600$ J at 25°C.

Calculate the emf of the cell.

[$\log 10^{-n} = -n$]

(*b*) Define fuel cell and write its two advantages. 5

Ans. (*a*) At anode: $Sn(s) \longrightarrow Sn^{2+}(aq) + 2e^-$

At cathode: $2H^+(aq) + 2e^- \longrightarrow H_2(g)$

Overall reaction: $Sn(s) + 2H^+(aq) \longrightarrow Sn^{2+}(aq) + H_2(g)$

$$n = 2$$

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

$$= [E^\circ_{H^+/H_2} - E^\circ_{Sn^{2+}/Sn}] - \frac{0.0591}{2} \log \frac{0.004}{(0.02)^2}$$

$$= [0 - (-0.14\ V)] - \frac{0.0591}{2} \log \frac{4 \times 10^{-3}}{4 \times 10^{-4}}$$

$$= +0.14\ V - \frac{0.0591}{2} \log 10 = 0.14\ V - \frac{0.0591}{2}$$

$$= 0.14\ V - 0.0295$$

$$E_{cell} = 0.1105\ V$$

(*b*) (*i*) It is due to over voltage of O_2 Secondly, in OH^-, oxgyen is more electronegative cannot lose electrons to form O_2 as compared to Cl^- which can easily lose electron to form $Cl_2(g)$.

(*ii*) It is because number of ions per unit volume decreases on dilution so conductivity will decreases with decrease in concentration and hence conductivity of CH_3COOH decreases on dilution.

Or

(*a*) At anode $H_2 \longrightarrow 2H^+ + 2e^-$

At cathode $2e^- + 2AgCl(s) \longrightarrow 2Ag(s) + 2Cl^-$

Overall reaction: $2AgCl(s) + H_2(g) \longrightarrow 2Ag(s) + 2H^+ + 2Cl^-$

$$n = 2$$

$$\Delta G^\circ = -nE^\circ F$$

$$-43600\ J = -2 \times E^\circ \times 96.500\ C$$

$$E^\circ = \frac{43600\ J}{2 \times 96500\ C} = \frac{436\ C \times V}{1930\ C} = 0.226\ V$$

$$E^\circ = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[H^+]^2 [Cl^-]^2}{[H_2]}$$

$$= -0.226\ V - \frac{0.0591}{2} \log (0.1)^2 (0.1)^2$$

$$= 0.226\ V - \frac{0.0591}{2} \log 10^{-4}$$

$$= 0.226\ V - \frac{0.0591}{2} \times -4 \qquad [\log 10 = 1]$$

$$= 0.226\ V + 0.1182 = 0.3442\ V$$

(*b*) Fuel cell is a cell in which chemical energy of fuel is directly converted into electrical energy e.g. H_2—O_2 fuel cell.

Advantages: (*i*) Its efficiency is high.

(*ii*) It does not create pollution.

26. (*a*) **Write the reactions involved in the following:**

(*i*) **Hofmann bromamide degradation reaction**

(*ii*) **Diazotisation**

(*iii*) **Gabriel phthalimide synthesis**

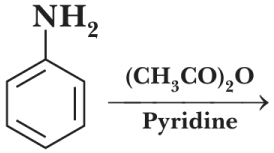
(*b*) **Give reasons:**

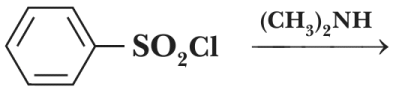
(*i*) **$(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution.**

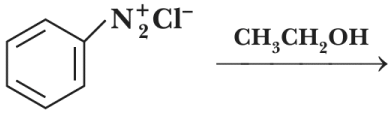
(*ii*) **Aromatic diazonium salts are more stable than aliphatic diazonium salts.** **3+2=5**

Or

(*a*) **Write the structures of the main products of the following reactions:**

(*i*) 

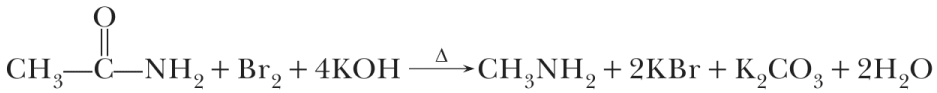
(*ii*) 

(*iii*) 

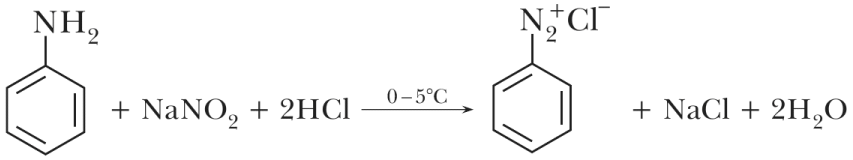
(*b*) **Give a simple chemical test to distinguish between Aniline and N,N-dimethylaniline.**

(*c*) **Arrange the following in the increasing order of their pK_b values:**
$C_6H_5NH_2$, $C_2H_5NH_2$, $C_6H_5NHCH_3$ **5**

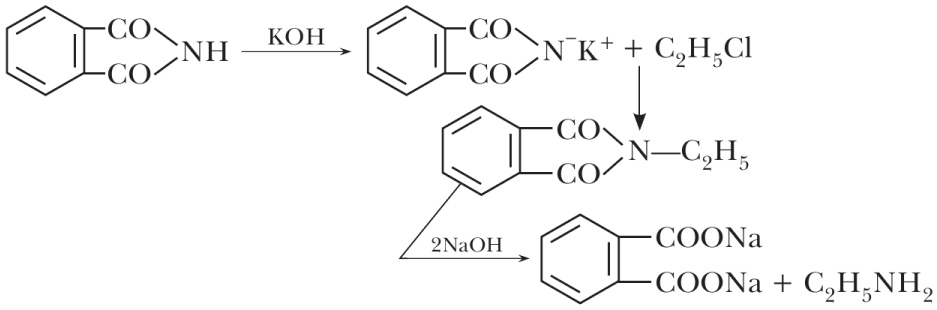
Ans. (*a*) (*i*) Hofmann bromamide degradation reaction



(*ii*) Diazotisation



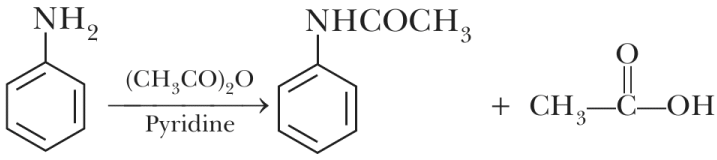
(*iii*) Gabriel phthalimide synthesis

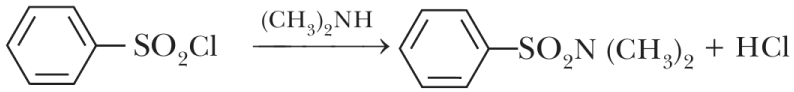


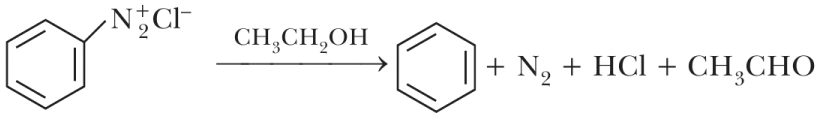
(*b*) (*i*) It is because in $(CH_3)_3$ N, lone pair of electron is less readily available due to stearic hinderance as compared to $(CH_3)_2NH$.

(*ii*) It is because aromatic diazonium ion is stabilized by resonance.

Or

(*a*) (*i*) 

(*ii*) 

(*iii*) 

(*b*) Carbylamine test: Add $CHCl_3$ and KOH to each of them, aniline will give offensive smelling compound whereas N, N-Dimethyl aniline will not react.

Or

Azodye test: Add $NaNO_2$ and conc. HCl to each. Cool to 0–5°C. Add alkaline solution of phenol. Aniline will give orange azodye where as N, N-dimethyl aniline will not react.

(*c*) $C_2H_5NH_2 < C_6H_5NHCH_3 < C_6H_5NH_2$ is increasing order of their pK_b due to decreasing order of basic character.