2015

Question: 1
Name a drug used in case of mental depression. [1]

Answer:
Equanil

Question: 2
Carefully examine the diagram and name the process involved: [1]

Answer:
The process involved is reverse osmosis because the solvent molecules move from higher concentration to lower concentration.

Question: 3
Write Nernst equation for the electrode reaction. M^{n+} (aq) + ne $^- \rightarrow$ M (s) . [1]

Answer.

$$E_{Mn+/M} = E^0_{Mn+/M} + \frac{2.303RT}{nF} \log \frac{[M^{n+}]}{[M]}$$

Question: 4
Arrange the following sets of compounds in order of their increasing boiling points:
Pentan – 1 – ol, butan – 1 – ol, butan – 2 – ol, ethanol, propan – 1 – ol, methanol. [1]

Answer:
Methanol, ethanol, propan-1-ol, butan-1-ol, pentan-1-ol.

Question: 5
How does BF_3 act as a catalyst in industrial processes?

Answer:
In BF_3 only six electrons are present in the valence sheet of boron. It has a great tendency to accept a pair of electrons. Thus, due to its Lewis acid character, BF_3 is used as a catalyst in Friedal Craft reaction and many industrial processes.

Question: 6
What type of hybridization is associated with N in NH_3? What is the expected bond angle in H_3? [1]

Answer:
The N atom in NH_3 is sp^3 hybridized. The expected bond angle is 107^0.

Question: 7
i. How does chemical adsorption of a gas on a solid vary with temperature? [1]

Answer:
The rate of chemical adsorption first increases and then decreases as the temperature increases.

ii. Write chemical reaction to transform butan-1-ol to butanoic acid. [1]

Answer:

$$CH_3\,CH_2\,CH_2\,CH_2\,OH \xrightarrow[Jones\ reagent]{CRO_3\ H_2SO_4} CH_3\,CH_2\,CH_2\,COOH$$

Question: 8

What are non – ideal solutions? Explain as to why non – ideal solutions deviate from Raoult's law. [2]

Answer:

The solutions which do not obey Raoult's law and are accompanied by change in enthalpy and change in volume during their formation are called non-ideal solutions.

i. The liquid pairs for which A-B interactions are weaker than A-A or B-B attractive forces, the escaping tendency and hence vapor pressure is greater than that for ideal solutions. So they show positive deviations from Roult's law.

ii. For liquid pairs for which A-B interactions are stronger than A-A or B-B attractive forces, the escaping tendency and hence vapor pressure is less than that for ideal solution. So they show negative deviations from Raoult's law.

Question: 9

If the close packed cations in an AB type solid have a radius of 75 pm. What would be the maximum and minimum sizes of the anions filling the voids? [2]

Answer:

For closed packed AB type solid,

$$0.414 \le \frac{r^+}{r^-} \le 0.732$$

$$0.414 \le \frac{75pm}{r^-} \le 0.732$$

$$\text{or } \frac{1}{0.414} \ge r^- \ge \frac{75pm}{0.732}$$

$$\text{or } 181.15pm \ge r^- \ge 102.46pm$$

Thus size of the anion lies between 102.46 pm and 181.15 pm

Question: 10

Give an example of a fuel cell and write the anode and cathode reactions for it. [2]

Answer:

$H_2 – O_2$ is an example of fuel cell. The electrode reactions in this cell are

$$\text{At anode: } 2H_2(g) + 4OH^-(aq) \rightarrow 4H_2O(l) + 4e^-$$

$$\text{At cathode: } O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$$

OR

Why are halogens colored? [2]

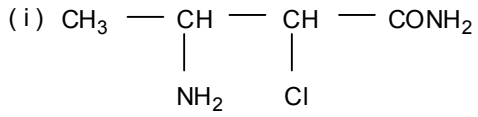
Answer:

Halogen molecules absorb light in the visible region by means of which the outer are electrons are excited to higher energy level. The amount of energy required for the excitation decreases progressively from fluorine to iodine as the size of the atom increases.

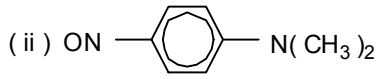
Hence there is a progressive deepening of color from Fluorine (F) to Iodine (I).

Question: 11

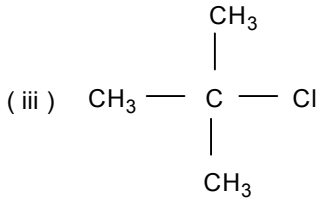
Write the IUPAC names for:

(i) 

Answer:
3-amino –2-chloro butanamide

(ii) 

Answer:
p-Nitroso-N, N-dimethylaniline

(iii) 

Answer:
2-chloro – 2 - methylpropane

Question: 12
Identify the type of inter – molecular forces that exist between the following pairs: [2]

i. Na^+ ion and water molecules

Answer:
Ion-dipole attraction

ii. Ag^+ ion and I^- ion

Answer:
Ion-induced dipole attraction

iii. Argon and Argon

Answer:
Dispersion forces

iv. HF and H_2O

Answer:
H-bonding

Question: 13
Distinguish between multimolecular and macromolecular colloids. Give one example of each type. [2]

Answer:

Multimolecular colloids	Macromolecular colloids
1. The particles of this type of colloids are aggregate of atoms or molecules with diameter less than 1 nm. Examples: Solution of sulphur	1. The particles of this type of colloids are themselves large molecules of colloidal dimension. Examples: Starch, proteins

consists of colloidal particles which are aggregate of 58 molecules 2. The atoms of molecules are held together with Van der Waal's forces.	 2. Covalent bonds are present in one chain and different chains have the force like H-bonds, dipole-dipole interaction and salt bridge etc.

Question: 14

Explain why hydrophilic sols are relatively more stable than hydrophobic sols. [2]

Answer:

Higher stability of lyophilic sols: Lyophilic colloids have affinity for the dispersion medium. So their sol can be prepared by merely dispersing them in the dispersion medium. They are reversible.

Examples: Agar-agar, gelatin, starch, egg albumin etc.

On the other hand lyophobic colloids are dispersion medium hating colloids. So their colloidal solution cannot be prepared by merely dispersing them in the dispersion medium.

OR

a. How does vulcanization change the character of natural rubber? [1]

Answer:

Heating rubber with sulphur causes cross linking of polymer chains through disulphide bonds. This makes rubber hard and stiff. It prevents the intermolecular movement of rubber springs resulting in change of physical character of rubber.

b. Why are the numbers 66 and 6 put in the names of nylon-66 and nylon-6? [1]

Answer:

Nylon-6 is obtained from the monomer caprolactam which contains 6 carbon atoms.

Nylon-66 is a condensation polymer of hexamethylene-diamine and adipic acid, the two monomers has 6 carbon atoms each.

Question: 15 [2]

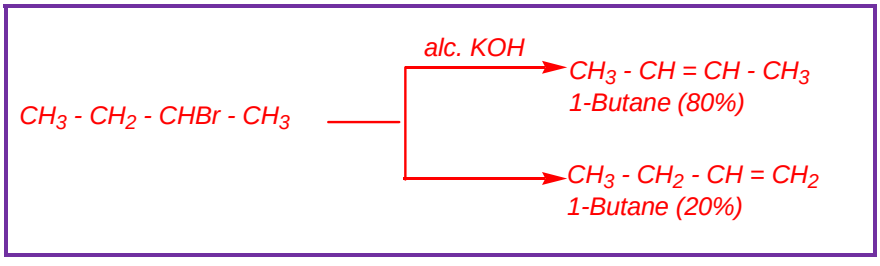
What is Saytzeff rule? Illustrate with suitable example.

Answer:

Sometimes a haloalkane can undergo elimination in two different ways forming a mixture of two products. The products in the reaction are that the alkene having the lesser number of hydrogen's on the double bonded carbon atom.

This generalization is known as Saytzeff's rule.

For example,



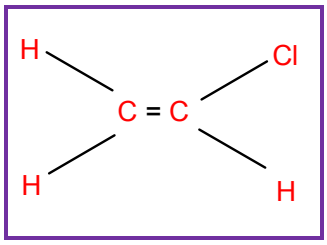
Question: 16 [2]

Draw the structure of the monomer of each of the following polymers:

i. Polyvinylchloride (PVC)

Answer:

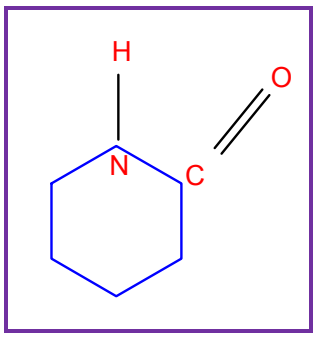
Monomer of PVC is vinyl chloride



ii. Nylon – 6

Answer:

Monomer of Nylon-6 is amino caproic acid



Question: 17

i. Give an example of linkage isomerism. [1]

Answer:

$[Co(NH_3)_5ONO]Cl_2$ and $[Co(NH_3)5NO_2]Cl_2$ are linkage isomers. In $[Co(NH_3)_5ONO]Cl_2$, the bonding is through oxygen (-ONO) whereas in $[Co(NH_3)5NO_2]Cl_2$, the bonding is through nitrogen ($-NO_2$).

ii. A solution of KOH hydrolyses CH_3 $CHCl_2CH_2CH_3$ and $CH_2CH_2CH_2CH_2Cl$. Which one of these is more easily hydrolyzed? [1]

Answer:

$CH_3CH_2CH_2CH_2Cl_2$ undergoes hydrolysis more easily than CH_3CHCl_2 CH_3. $CH_3CH_2CH_2CH_2Cl$ being a primary alkyl halide has less steric hindrance than $CH_3CHCl_2CH_3$ which is secondary alkyl halide.

Question: 18

Calculate the mass of compound (molar mass = 256 $gmol^{-1}$) to be dissolved in 75 gof benzene to lower its freezing point by 0.48 K (K_f = 5.tZ K kg mol^{-1}). [2]

Answer:

$$\Delta T_f = \frac{K_f \times w_2 \times 1000}{w_1 \times M_2}$$

$$0.48K = 5.12Kkgmol^{-1} \times \left(\frac{W_2}{75 \times 256}\right) \times 1000, or$$

$$w_2 = \frac{0.48 \times 75 \times 256}{5.12 \times 1000}, or$$

w_2 = 1.8g

Question: 19

a. In reference to Freundlich adsorption isotherm write the expression for adsorption of gases on solids in the form of an equation.

Answer:

$$\frac{x}{m} = Kp\left(\frac{1}{n}\right) or$$

$$\log\left(\frac{x}{m}\right) = \log K + \frac{1}{n}\log p.$$

b. Write an important characteristic of lyophilic sols.

Answer:

Reversible in nature/ stable sol/ solvent loving (or any other).

c. Based on type of particles of dispersed phase, give one example each of associated colloid and multimolecular colloid.

Answer:

Associated colloid: $\frac{\text{Soap}}{\text{Micelles}}$

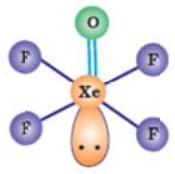
Multimolecular colloid: $\frac{\text{S8}}{\text{Gold sol.}}$ (or any other)

OR

a. Draw the structures of the following molecules.

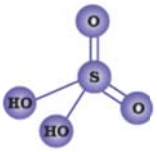
i. $XeOF_4$

Answer:



ii. H_2SO_4

Answer:



b. Write the structural difference between white phosphorus, and red phosphorus.

Answer:
White phosphorus: It exists as discrete tetrahedral P_4 unit.
Red phosphorus: It exists in the form of polymeric chain, or, correct structures.

Question: 20 [3]
How would you account for the following:

i. Give two examples of macromolecules that are chosen as drug targets

Answer:
Carbohydrates, lipids, proteins, enzymes, nucleic acids (any two).

ii. What are antiseptics give an example.

Answer:
Antiseptics are the chemical substances which are used to kill or prevent the growth of microbes. For example, Dettol, Iodoform, boric acid, phenol, etc.

iii. Why is the use of aspartame limited to foods and soft drinks.

Answer:
Becasuse it is unstable at cooking temperature.

Question: 21
i. State Henry's law correlating the pressure of a gas and its solubility in a solvent and mention two applications for the law. [2]

Answer:
It states that at constant temperature, the solubility of a gas in a liquid is directly proportional to the pressure of the gas.

Applications:
a. in the production of carbonated beverages
b. in the deep sea diving
c. in the function of lungs

ii. In which one of the two structures, NO^{+}_{2} and NO^{1}, the bond angle has a higher value? [1]

Answer:
The bond angle of NO^{+}_{2} is higher than NO^{-}_{2}.

Question: 22
Give reasons for the following observations:
What is a semiconductor? Describe the two main types of semiconductors and explain mechanisms for their conduction. [3]

Answer:
The solids which have intermediate conductivities generally between 10-6 to 104 Ω-1 m-1 are called semiconductors. For example - germanium and silicon. The two main types of semiconductors are as follows:

n-type semiconductor:
When a silicon crystal is doped with atoms of group-15 elements, such as P, As, Sb or Bi; then only four of the five valence electrons of each impurity atom participate in forming covalent bonds and fifth electrons is almost free to conduct electricity. Silicon that has been doped with a group-15 element is called n-type semiconductor.

p-type semiconductor:
When a silicon crystal is doped with atoms of group-13 elements such as B, Al, Ga or In; each impurity atom forms only three covalent bonds with the host atoms.

The place where the fourth electron is missing is called a hole which moves through the crystal like a positive charge and hence increases its conductivity. Silicon that has been doped with group-13 element is called p-type semiconductor.

Question: 23

Name the reagents which are used in the following conversions: [3]

i. A primary alcohol to an aldehyde

Answer:
Pyridinium chlorochromate (PCC) a complex of chromium trioxide with pyridine and HCl.

$CH_3 - CH = CH - CH_2OH \xrightarrow{PCC} CH3 - CH = CH - CHO$

ii. Phenol to 2,4,6-tribromophenol

Answer:
Ni / H_2 or LiAl H_4 or $NaBH_4$

iii. 1-Bromobutane, 1-Bromo-2-2-diemethylpropane, 1-Bromo-2-methylbutane

Answer:
1-Bromobutane > 1-Bromo-2-methylbutane > 1-Bromo-2-2-diemethylpropane

Question: 24

i. What may be the possible oxidation states of the transition metals with the following d electronic configurations in the ground state of their atoms:
$3d^3rs^2$, $3d^54s^2$ and $3d^64s^2$. Indicate relative stability of oxidation states in each case. [3]

Answer:
The most stable oxidation state for $3d^3rs^2$= +5
The most stable oxidation state for $3d^54s^2$ = +7 , +2
The most stable oxidation state for $3d^64s^2$= +2

ii. Define 'order of a reaction'. [2]

Answer:
The sum of powers of the concentration terms of the reactants in the rate law expression is called the order of that chemical reaction.

OR

a. State reasons for the following: [3]

i. pKb value for aniline is more than that for methylamine.

Answer:
Due to resonance in aniline, N acquires positive charge, which increases its pK_b whereas due to electron donating methyl group electron density increases on N which decreases its pK_b.

ii. Ethylamine is soluble in water whereas aniline is not soluble in water.

Answer:
Due to formation of hydrogen bond with water ethyl amine is soluble in water whereas due to bulky phenyl group aniline does not form H-bond and thus is insoluble.

iii. Primary amines have higher boiling points than tertiary amines.

Answer:
Due to hydrogen bonding in primary amines, they have higher boiling points whereas there is no hydrogen bonding in tertiary amines.

b. How many moles of mercury will be produced by electrolyzing 1.0 M $Hg(NO_3)_2$ solution with a current of 2.00 A for 3 hours? [$Hg(NO_3)_2$ = 200.6 g mol^{-1}] [2]

Answer:
$m = ZIt$

$$m = \frac{M \times I \times t}{nF}$$

$$m = \frac{M}{2 \times 96500\ Cmol\text{-}1} \times 2A \times 3 \times 60 \times 60s$$

$m = 0.112\ mol \times M$

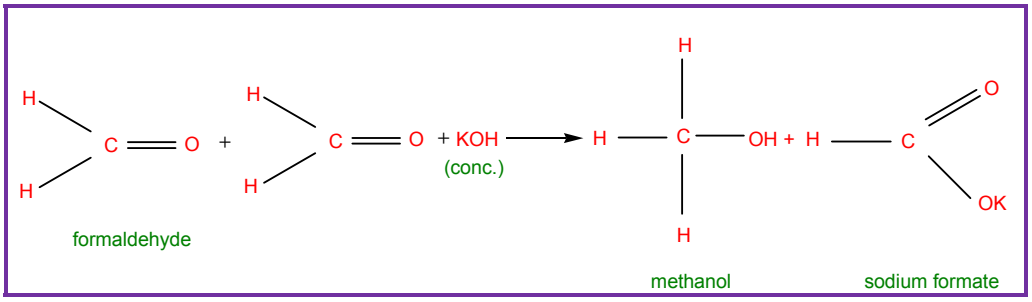
$$\text{No. of moles of mercury} = \frac{0.112mol \times M}{M}$$

Question: 25

a. Illustrate the following name reactions by giving example: [2]

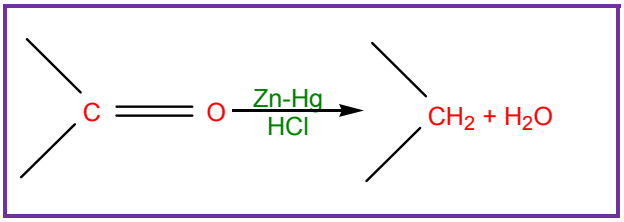
i. Cannizzaro's reaction

Answer:
Aldehydes which do not have an α-hydrogen atom, undergo self oxidation and reduction reaction on treatment with concentrated alkali.



ii. Clemmensen reduction

Answer:
The carbonyl group of aldehydes and ketones is reduced to CH_2 group on treatment with zinc and amalgam and concentrated HCl.



b. How would you obtain the following: [3]

i. But-2-enal from ethanol

Answer:

$$2CH_3\text{-}CHO \xrightarrow{\text{dil NaOH}} CH_3\text{-}CH(OH)\text{-}CH_2\text{-}CHO \xrightarrow[-H_2O]{V} CH_3\text{-}CH\text{-}CHO$$

ii. Butanoic acid from butanol

Answer:

$$CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_2OH \xrightarrow{CrO_3, H_2SO_4} CH_3\text{-}CH_2\text{-}CH_2\text{-}COOH$$

iii. Benzoic acid from ethyl benzene

Answer:

$$C_6H_5\text{-}CH_2\text{-}CH_3 \xrightarrow[(ii)\ H^+]{(i)\ KMnO4,\ KOH} C_6H_5\text{-}COOH$$

OR

a. Give chemical tests to distinguish between the following: [2]

i. Benzoic acid from ethyl benzene

Answer:

Sodium bicarbonate test. Warm each compound with $NaHCO_3$, Benzoic acid gives brisk effervescence of CO_2 gas whereas ethyl benzoate does not respond to this test.

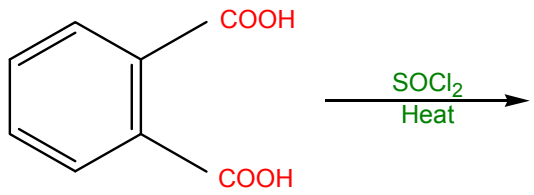
ii. Benzaldehyde from acetophenone.

Answer:

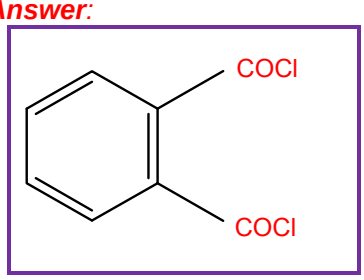
Iodoform test: Warm each organic compound with I_2 and NaOH solution with Acetophenone ($C_6H_5COCH_3$) yellow precipitates of iodoform is formed white Benzaldehyde does not respond to this test.

b. Complete each synthesis by giving the missing material, reagent or products: [3]

i.



Answer:



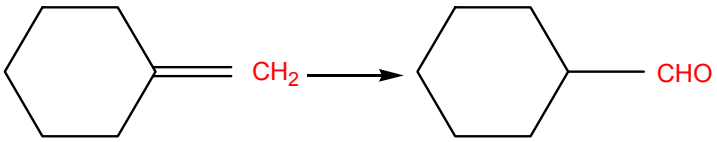
ii.

$C_6H_5CHO \xrightarrow{H_2NCONHNH_2}$,

Answer:

$C_6H_5CH = NNHCONH_2$

iii.



Answer:

B_2H_6. H_2O_2/OH^-

Question: 26

i. 18g of glucose, $C_6H_{12}O_6$ (Molar Mass= 180g mol^{-1}) is dissolved in 1Kg of water in a sauce pan. At what temperature will this solution boil? [2]

Answer:

w_1 = weight of solvent (H_2O) = 1 kg and w_2 = weight of solute ($C_6H_{12}O_6$) = 18 gm

M_2 = Molar mass of solute (C6H12O6) = 180 g mol^{-1}

K_b = 0.52 K Kg mol^{-1}

$T_b^\circ = 373.15K$

$$\Delta DT_b = \frac{K_b \times 1000}{M_2 \times w_1} = \frac{0.52 \times 1000 \times 18}{180 \times 1000} = 0.052K$$

$\Delta T_b = T_b - T_b^\circ \Rightarrow 0.052 = T_b - 373.15 \Rightarrow T_b = 373.202K$

ii. Arrange the following in increasing order of their basic strength in aqueous solution: [1]
$CH_3.NH_2$,$(CH_3)_3N$, $(CH_3)_2NH$

Answer:

$(CH_3)_3N$,CH_3NH_2, $(CH_3)_2NH$

OR

i. What are three types of RNA molecules which perform different functions? [2]

Answer:

There are three different types of RNA molecules: Messenger RNA (mRNA), Transfer RNA (tRNA) and Ribosomal RNA (rRNA)

ii. Write the IUPAC name of [1]

$CH_3 - CH - CH_2 - CH = CH_2$
|

Cl

Answer:

5 4 3 2 1

$CH_3 - CH - CH_2 - CH = CH_2$

Cl

IUPAC Name: 4-Chloropent-1-ene

Question: 27 [3]

Determine the osmotic pressure of a solution prepared by dissolving 2.5 x 10^{-2} g of K_2SO_4 in 2L of water at 25° C, assuming that it is completely dissociated. (R=0.0821 L atm $K^{-1}mol^{-1}$, Molar mass of K_2SO_4=174g mol^{-1}).

Answer:

W_2 = 2.5 x 10-2 (Mass of K2SO4) and M2 = 174 g mol-1(Molar mass K2SO4)

V = 2L, R = 0.0821 L atm K-1 mol-1 and T = 250C = 298 K

Osmotic pressure, $\pi = \frac{w_2RT}{M_2V}$

$$\pi = \frac{2.5 \times 10^{-2} \times 0.0821 \times 298}{174 \times 2} = \frac{61.1645 \times 10^{-2}}{348} = 1.76 \times 10^{-3} \text{ atm.}$$

OR

Calculate the emf of the following cell at 298 K: [3]

Fe(s) | Fe^{2+} (0.001M) || H^+ (g) | H_2 (g)(1bar), Pt(s)

(Given E^0_{cell} = +0.44V)

Answer:

At anode: $Fe \rightarrow Fe^{2+} + 2e^-$

At cathode: $2H^+ + 2e^- \rightarrow H_2$

So, total number of electrons (n) transferred = 2

Given: E^o_{cell} = +0.44 Volt

Temperature (T) = 298 K

$$E_{cell} = E^0_{cell} - \left(\frac{2.303RT}{nF}\right)\log\frac{a_{oxi}}{a_{Red}}$$

$$E_{cell} = E^0_{cell} - \left(\frac{0.05916V}{n}\right)\log\frac{a_{oxidation}}{a_{Reduction}} \Rightarrow E_{cell} = 0.44 - \frac{0.0.591V}{2}\log\frac{0.001}{1}$$

Therefore, E_{cell} = 0.44(–0.02955 × – 3) = 0.44 + 0.08865 = 0.53 Volt.

Question: 28

a. Define the following terms: [2]

i. Limiting molar conductivity

Answer:

Limiting molar conductivity when concentration approches zero the conductivity is known as limiting molar conductivity.

ii. Fuel cell

Answer:

Fuel cells are the cells which convert the energy of combustion of fuels to electrical energy.

b. Resistance of a conductivity cell filled with 0.1 mol L^{-1} KC/ solution is 100Ω. If the resistance of the same cell when filled with 0.02 mol^{-1} KCl, solution is 520 Ω, calculate the conductivity and molar conductivity of 0.02 mol L^{-1} KCl solution. The conductivity of 0.1 mol L^{-1} KC/ solution is 1.29 x 10^{-2} x 10-2 Ω^{-1} cm^{-1}.

Answer:

Cell constant (G* is Conductivity X Resistance): $1.29 \frac{S}{m} \times 100\ \Omega = 129\ m^{-1} = 129\ cm^{-1}$

Conductivity of 0.02 mol L^{-1} KCL solution = $\frac{\text{cell constant}}{\text{resistance}}$

$x = \left(\frac{G^*}{R}\right) = \left(\frac{129\ m^{-1}}{520\Omega}\right) = 0.248\ S\ m^{-1} = 0.248 \times 10^{-2}\ Scm^{-1}$

Concentration = 0.02 mol L^{-1} = 1000 x 0.02 mol m^{-3}= 20 mol m^{-3}

Molar conductivity $(\Delta_m): \left(\frac{K}{c}\right) = \frac{248 \times 10^{-3} Sm^{-1}}{20\,mol\,m^{-3}}$ =124 x 10^{-4} S m^2 mol^{-1}= 124 S cm^2 mol^{-1}

OR

a. Explain the State Faraday's frst law of electrolysis. How much charge in terms of Faraday isrequired for the reduction of 1 mol of Cu^{2+} to Cu.

Answer:

The amount of substance deposited at any electrode during electrolysis is directly proportional to the quantity of electricity passed through the electrolyte. (aq. Solution or melt) Charge = Q = 2F.

b. Calculate emf of the following cell at 298K $Mg(s)\left|Mg^{2+}(0.1M)\right\|Cu^{2+}(0.01)\left|Cu(s)\right.$

[Given E^{o}_{cell} = +2.71V, I F = 96500 C mol^{-1}]

Answer:

$E\ cell = E^0\ cell - \frac{0.059}{n} \log \frac{[Mg^{2+}]}{[Cu^{2+}]}$

$E\ cell = 2.71 - \frac{0.059}{2} \log \frac{0.10}{0.01}$

$E\ cell = 2.71 - \frac{0.059}{2} \log 10 = 2.71 - 0.0295 = 2.68\ V$

Question: 29

a. How do you prepare: [2]

i. K_2MnO_4 from MnO_2?

Answer:

$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$

ii. $NaCrO_7$ from Na2CrO_4?

Answer:

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

b. Account for the following: [3]

i. Mn^{2+} is more stable than Fe^{2+} towards oxidation to +3 state.

Answer:
Because of $3d^5$(half filled) stable configuration of Mn^{2+}

ii. The enthalpy of atomization is lowest for Zn in 3d series of the transition elements.

Answer:
Because in zinc there is no unpaired electron / there is no contribution from the inner d electrons.

iii. Actinoid elements show wide range of oxidation states.

Answer:
Because of comparable energies of 7s, 6d and 5f orbitals

OR

i. Name the element of 3d transition series which shows maximum number of oxidation states. Why does it show so ?

Answer:
Mn, because of presence of 5 unpaired electrons in 3d subshell.

ii. which transition metal of 3d series has positive $E^o(M^{2+/M})$ value and why?

Answer:
Cu , because enthalpy of atomization and ionisation enthalpy is not compensated by enthalpy of hydration.

iii. Out of Cr^{3+} and Mn^{3+}, which is a stronger oxidizing agent and why?

Answer:
Mn^{3+}, because Mn^{2+} is more stable due to its half filled ($3d^5$)configuration

iv. Name a member of the lanthanoid series which is well known to exhibit +2 oxidation state.

Answer:
Eu^{+2}(Eu)

v. Complete the following equarion:
$MnO_4^- + 8H^+ + 5e^- \rightarrow$

Answer:
$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H2O$

Question: 30

a. Write chemical equations for the reactions involved in the manufacture of potassium permanganate from pyroulu site ore. [2]

Answer:
Preparation of potassium permanganate: Potassium permanganate is prepared by the fusion of MnO_2 (pyrolusite) with potassium hydroxide and an oxidizing agent like KNO_3 to form potassium manganate which disproportionate in a neutral or acidic solution to form permanganate.

$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$

$3K_2MnO_4 + 4HCl \rightarrow 2\ KMn\ O_4 + MnO_2 + 2H_2O + 4\ KCl$

b. CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN. [1]

Answer:
Because the positve charge on carbonyl carbon of CH_3 CHO decreases to a lesser extent due to one electron releasing(+I effect) CH_3 group as compared to CH_3 $COCH_3$(two electron releasing CH_3 group) and hence more reactive.

OR

a. How does vulcanization change the character of natural rubber? [1]

Answer:
Heating rubber with sulphur causes cross linking of polymer chains through disulphide bonds. This makes rubber hard and stiff. It prevents the intermolecular movement of rubber springs resulting in change of physical character of rubber.

b. Why are the numbers 66 and 6 put in the names of nylon-66 and nylon-6? [1]

Answer:
Nylon-6 is obtained from the monomer caprolactam which contains 6 carbon atoms.

Nylon-66 is a condensation polymer of hexamethylene-diamine and adipic acid, the two monomers has 6 carbon atoms each.

Answer:

c. CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN. [1]

Answer:
Because the positve charge on carbonyl carbon of CH_3 CHO decreases to a lesser extent due to one electron releasing(+I effect) CH_3 group as compared to CH_3 $COCH_3$(two electron releasing CH_3 group) and hence more reactive.