
2014

Question: 1 – 30

ii- xiii

Question: 1

Give one example each of 'oil in water' and 'water in oil' emulsion.

[1]

Answer:

Oil in water : milk / vanishing cream (any one)

Water in oil : butter / cold cream (any one)

Question: 2

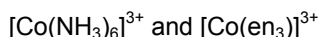
Which reducing agent is employed to get copper from the leached low grade copper ore? [1]

Answer:

Hydrogen / Iron

Question: 3

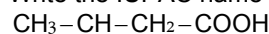
Which of the following is more stable complex and why? [1]

**Answer:**

$[\text{Co}(\text{en}_3)]^{3+}$: because (en) is a chelating ligand / bidentate ligand

Question: 4

Write the IUPAC name of the compound. [1]

**Answer:**

3-hydroxybutanoic acid / 3-hydroxybutan-1-oic acid

Question: 5

Which of the following isomers is more volatile : o-nitrophenol or p-nitrophenol? [1]

Answer:

o – nitrophenol

Question: 6

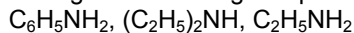
What are isotonic solutions? [1]

Answer:

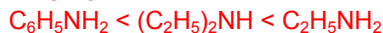
Solutions with same osmotic pressure

Question: 7

Arrange the following compounds in increasing order of solubility in water :



[1]

Answer:**Question: 8**

Which of the two components of starch is water soluble ? [2]

Answer:

Amylose

Question: 9

An element with density 11.2 g cm^{-3} forms a f.c.c. lattice with edge length of $4 \times 10^{-8} \text{ cm}$.



Calculate the atomic mass of the element. (Given: $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$)

[2]

Answer:

$$d = 11.2 \text{ g/cm}^3$$

$$z = 4$$

$$a = 4 \times 10^{-8} \text{ cm}$$

$$d = \frac{Z \times M}{N_A \times a^3}$$

$$11.2 = \left(\frac{4 \times M}{6.022 \times 10^{23}} \right) \times (4 \times 10^{-8})^3$$

$$M = \frac{11.2 \times 6.022 \times 10^{23} \times 4 \times 10^{-8} \times 4 \times 10^{-8}}{4}$$

$$M = 11.2 \times 6.022 \times 16 \times 10^{-1}$$

$$M = 107.9 \text{ g mol}^{-1} \text{ or } 107.9 \text{ u}$$

Question: 10

[2]

Examine the given defective crystal

A^+	B^-	A^+	B^-	A^+
B^-	0	B^-	A^+	B^-
A^+	B^-	A^+	0	A^+
B^-	A^+	B^-	A^+	B^-

Answer the following questions:

i. What type of stoichiometric defect is shown by the crystal?

Answer:

Schottky defect

ii. How is the density of the crystal affected by this defect?

Answer:

Decreases

iii. What type of ionic substances show such defect?

Answer:

Alkali metal halides/ Ionic substances having almost similar size of cations and anions (NaCl/KCl)

Question: 11

Calculate the mass of compound (molar mass = 256 g mol^{-1}) to be dissolved in 75 g of benzene to lower its freezing point by 0.48 K ($K_f = 5.12 \text{ K kg mol}^{-1}$). [2]

Answer:

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

$$0.48 \text{ K} = 5.12 \text{ K kg mol}^{-1} \times \left(\frac{w_2}{75 \times 256} \right) \times 1000, \text{ or}$$

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

$$w_2 = 1.8 \text{ g}$$

Question: 12

Define an ideal solution and write one of its characteristics.

[2]



Answer:

Solutions which obey Raoult's law over the entire range of concentration

A-A or B-B ~A-B interactions

$$\Delta H_{\text{mix}} = 0$$

$$\Delta V_{\text{mix}} = 0$$

(any one)

Question: 13

Write two differences between 'order of reaction', and 'molecularity of reaction'.

[2]

Answer:

- Order of reaction is meant for elementary as well as for complex reactions but molecularity is for elementary reactions.
- Order can be zero or fraction but molecularity cannot be zero or fraction. (or any other difference)

Question: 14

Outline the principles behind the refining of metals by the following methods :

[2]

i. Zone refining method.

Answer:

Impurities are more soluble in melt than in solid state of the metal.

ii. Chromatographic method

Answer:

Different components of a mixture are differently adsorbed on an adsorbent.

Question: 15

Complete the following chemical equations

[2]

i. $\text{Ca}_3\text{P}_2 + \text{H}_2\text{O} \rightarrow$

Answer:

ii. $\text{Cu} + \text{H}_2\text{SO}_4 (\text{conc.}) \rightarrow$

Answer:

OR

Arrange the following in the order of property indicated against each set :

i. HF, HCl, HBr, HI - increasing bond dissociation enthalpy.

Answer:

ii. H_2O , H_2S , H_2Se , H_2Te - increasing acidic character.

Answer:**Question: 16**

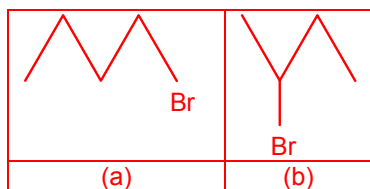
Write the IUPAC name of the complex $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]^+$. What type of isomerism does it exhibit?

[2]



Answer:

Tetraamminedichloridochromium (III) ion
Geometrical isomerism / cis – trans

**Question: 17**

[2]

i. Which alkyl halide from the following pair is chiral and undergoes faster S_N2 reaction

Answer:

- is chiral
- undergoes faster S_N2

ii. Out of S_N1 and S_N2 which reaction occurs with

- Inversion of configuration
- Racemisation

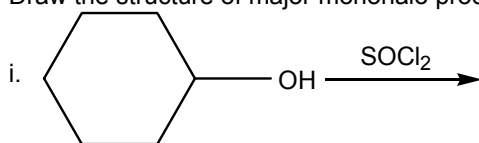
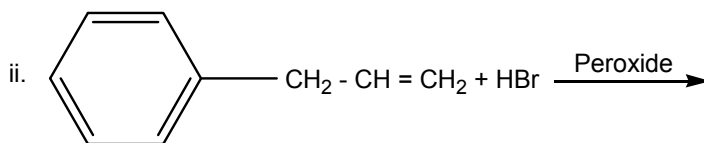
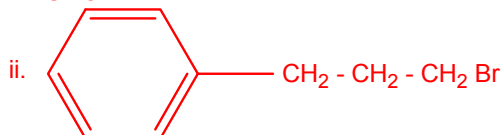
Answer:

- S_N2
- S_N1

Question: 18

[2]

Draw the structure of major monohalo product in each of the following reactions :

**Answer:****Answer:****Question: 19**

[3]

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



Answer:

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

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

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: Soap
Micelles

Multimolecular colloid: S₈ (or any other)
Gold sol.

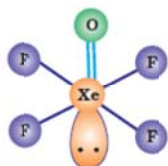
Question: 20

[3]

a. Draw the structures of the following molecules.

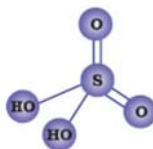
i. XeOF₄

Answer:



ii. H₂SO₄

Answer:



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

Answer:

White phosphorus: It exists as discrete tetrahedral P₄ unit.

Red phosphorus: It exists in the form of polymeric chain, or, correct structures.

Question: 21

[3]

Account for the following :

i. PC/ is more covalent than PC/r.



Answer:

Because +5 oxidation state is more covalent than +3 high charge to size ratio high polarizing power.

- ii. Iron on reaction with HCl forms FeCl₂ and not FeCl₃.

Answer:

Because HCl is a mild oxidising agent/ formation of hydrogen gas prevents the formation of FeCl₃.

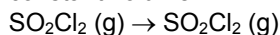
- iii. The two O-O bond lengths in the ozone molecule are equal.

Answer:

Because of resonance in O₃ molecule.

Question: 22

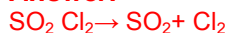
The following data were obtained during the first order thermal decomposition of SO₂Cl₂ at a constant volume. [3]



Experiment	Time/s-1	Total pressure / atm
1	2	0.4
2	100	

Calculate the rate constant.

(Given : log 4 = 0.6021, log 2 = 0.3010)

Answer:

At t = 0s 0.4 atm 0 atm 0 atm

At t = 100s (0.4 - x) atm x atm x atm

P_t = 0.4 - x + x + x

P_t = 0.4 + x

0.7 = 0.4 + x

x = 0.3

$$k = \frac{2.303}{t} \log \left(\frac{p_i}{2p_i - p_t} \right)$$

$$k = \frac{2.303}{t} \log \left(\frac{0.4}{0.8 - 0.7} \right)$$

$$k = \frac{2.303}{100} \log \frac{0.4}{0.1}$$

$$k = \frac{2.303}{100} \times 0.6021 = 1.39 \times 10^{-2} \text{ s}^{-1}$$

Question: 23

How would you account for the following: [3]

- 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:

Because it is unstable at cooking temperature.

Question: 24

[3]

i. Deficiency of which vitamin causes night-blindness?

Answer:

Vitamin A

ii. Name the base that is found in nucleotide of RNA only.

Answer:

Uracil

iii. Glucose on reaction with HI gives n-hexane. What does it suggest about the structure of glucose?

Answer:

It suggests that six carbon atoms are in straight chain / $\text{CHO} - (\text{CHOH})_4 - \text{CH}_2\text{OH}$

Question: 25

After the ban on plastic bags, students of one school decided to make the people aware of the harmful effects of plastic bags on environment and Yamuna River. To make the awareness more impactful, they organized rally by joining hands with other schools and distributed paper bags to vegetable vendors, shopkeepers and departmental stores. All students pledged not to use polythene bags in future to save Yamuna River. After reading the above passage, answer the following questions:

[3]

i. What values are shown by the students?

Answer:

Concern towards environment caring, socially awareness, team work, etc.

ii. What are biodegradable polymers? Give one example.

Answer:

Polymers which can be degraded by the action of microorganisms, e.g., PHBV, Nylon-2- nylon- 6/ or any natural polymer.

iii. Is polythene a condensation or an addition polymer ?

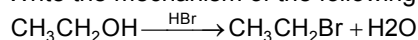
Answer:

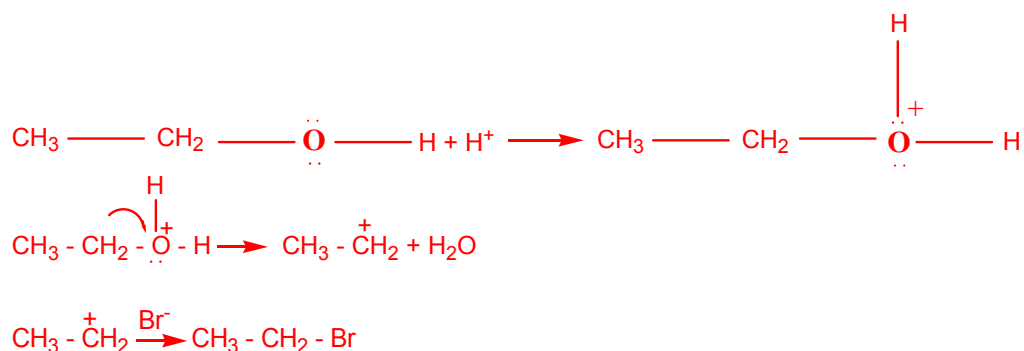
Addition polymer

Question: 26

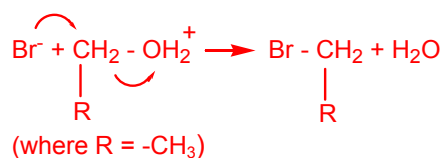
[3]

i. Write the mechanism of the following reaction.

**Answer:**

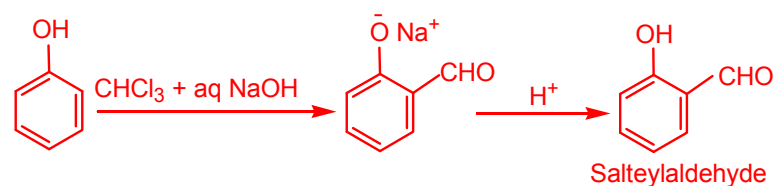


OR



ii. Write the equation involved in Reimer-Tiemann reaction.

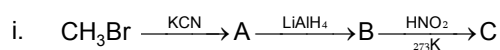
Answer:



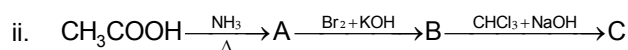
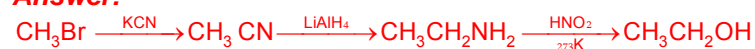
Question: 27

Give the structures of A, B and C in the following reactions :

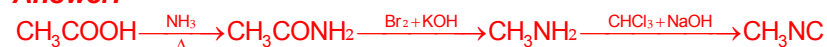
[3]



Answer:



Answer:



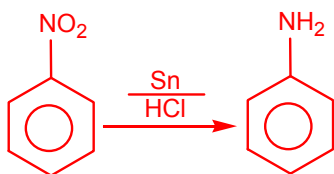
OR

How will you convert the following :

i. Nitrobenzene into aniline

Answer:





ii. Ethanoic acid into methanamine

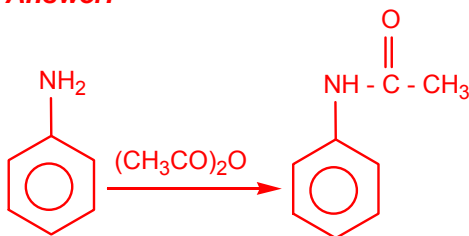
Answer:



iii. Aniline into N-phenylethanamide

(Write the chemical equations involved.)

Answer:



Question: 28

- a. Define the following terms:
i. Limiting molar conductivity

[2]

Answer:

Limiting molar conductivity when concentration approaches 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} KCl solution is 100Ω . If the resistance of the same cell when filled with 0.02 mol L^{-1} KCl solution is 520Ω , calculate the conductivity and molar conductivity of 0.02 mol L^{-1} KCl solution. The conductivity of 0.1 mol L^{-1} KCl solution is $1.29 \times 10^{-2} \text{ S cm}^{-1}$.

Answer:

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

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

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

$$\text{Concentration} = 0.02 \text{ mol L}^{-1} = 1000 \times 0.02 \text{ mol m}^{-3} = 20 \text{ mol m}^{-3}$$

$$\text{Molar conductivity } (\Delta_m): \left(\frac{\kappa}{c} \right) = \frac{0.248 \times 10^{-2} \text{ S m}^{-1}}{20 \text{ mol m}^{-3}} = 124 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1} = 124 \text{ S cm}^2 \text{ mol}^{-1}$$



OR

- a. Explain the State Faraday's first law of electrolysis. How much charge in terms of Faraday is required 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 $\text{Mg(s)} \mid \text{Mg}^{2+} (0.1\text{M}) \parallel \text{Cu}^{2+} (0.01) \mid \text{Cu(s)}$

[Given $E^\circ_{\text{cell}} = +2.71\text{V}$, $1 F = 96500 \text{ C mol}^{-1}$]

Answer:

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

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

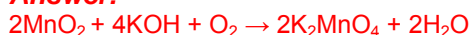
$$E_{\text{cell}} = 2.71 - \frac{0.059}{2} \log 10 = 2.71 - 0.0295 = 2.68 \text{ V}$$

Question: 29

- a. How do you prepare:
i. K_2MnO_4 from MnO_2 ?

[2]

Answer:



- ii. NaCrO_7 from Na_2CrO_4 ?

Answer:



- b. Account for the following:
i. Mn^{2+} is more stable than Fe^{2+} towards oxidation to +3 state.

[3]

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 $E^\circ(M^{2+/M})$ 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:

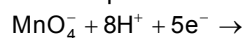
Mn^{3+} , because Mn^{2+} is more stable due to its half filled ($3d^5$) configuration

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 equation:



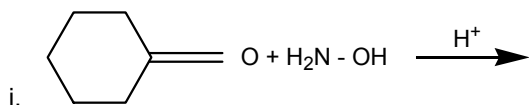
Answer:



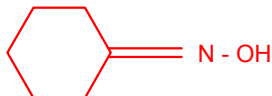
Question: 30

[2]

a. Write the products of the following reactions:

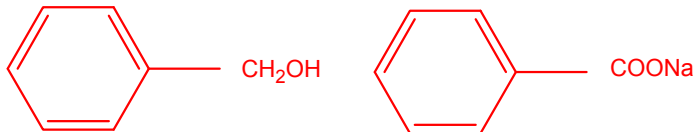


Answer:



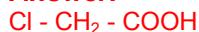
ii. $2 C_6H_5CHO + \text{conc. NaOH}$

Answer:



iii. $CH_3COOH \xrightarrow{Cl_2/P}$

Answer:



b. Give simple chemical tests to distinguish between the following pairs of compounds: [3]

i. Benzaldehyde and Benzoic acid

Answer:



Add NaHCO_3 , benzoic acid will give brisk effervescence whereas benzaldehyde will not give this test. (or any other test).

ii. Propanal and propanone

Answer:

Add Tollen's reagent, propanal will give silver mirror whereas propanone will not give this test. (or any other test)

OR

a. Account for the following: Propanol and propanone

[2]

Answer:

i. CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN .

Answer:

Because the positive charge on carbonyl carbon of CH_3CHO decreases to a lesser extent due to one electron releasing (+I effect) CH_3 group as compared to CH_3COCH_3 (two electron releasing CH_3 group) and hence more reactive.

ii. Carboxylic acid is a stronger acid than phenol.

[3]

Answer:

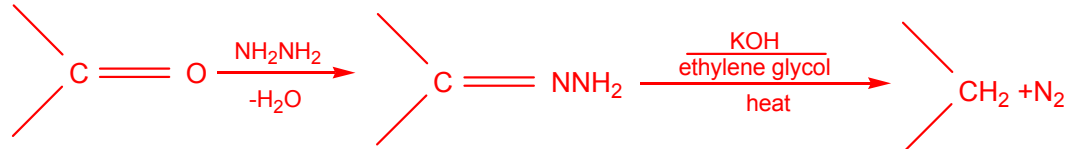
Because carboxylate ion (conjugate base) is more resonance stabilized than phenoxide ion.

b. Write the chemical equations to illustrate the following name reactions :

Answer:

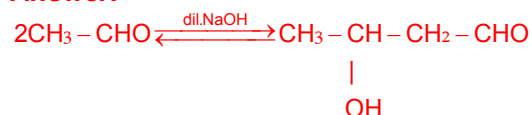
i. Wolff-Kishner reduction

Answer:



ii. Aldol condensation

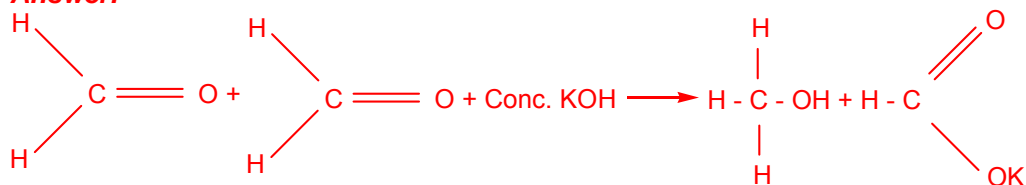
Answer:



(or any other example)

iii. Cannizzaro reaction

Answer:



(or any other example)

