
2013

Question: 1 – 30

i-vii

Question: 1

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° .

Question: 2

Mention one property which is caused due to the presence of F – center in a solid. [1]

Answer:

F-center is responsible for the color and the paramagnetic behavior of the solid.

Question: 3

Write Nernst equation for single electrode potential. [1]

Answer:

See topics on 'Nernst equation'

Question: 4

How does chemical adsorption of a gas on a solid vary with temperature? [1]

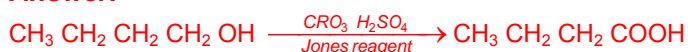
Answer:

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

Question: 5

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

Answer:



Question: 6

What is an 'ambident group'? Give an example. [1]

Answer:

It is the group which can combine at either ends. For example, -CN group.

Question: 7

Mention two main functions of carbohydrates in plants. [1]

Answer:

Carbohydrates form higher polymers viz. cellulose etc. (in plants) and also form part of plant fruits.

Question: 8

The rate constant of a reaction is $3 \times 10^{-4} \text{ L mol}^{-1} \text{ min}^{-1}$. What is the order of the reaction? [1]



Answer:
Second order

Question: 9 ()**

[2]

How are the following conversions accomplished? (Write reaction only)

- Aniline to chlorobenzene
- Nitrobenzene to phenol
- Aniline to benzoic acid.

Question: 10

Why is the third ionization energy of manganese (At. No. = 25) unexpectedly high?

[2]

Answer:

The bivalent ion M_n^{2+} has configuration [Ar] 3d⁵ which is a stable configuration. So the third ionization energy of manganese is unexpectedly high.

Question: 11

Cesium chloride crystallizes as a body centered cubic lattice and has a density of 4.0 g cm⁻³. Calculate the length of the edge of the unit cell of caesium chloride crystal. [Molar mass of CsCl = 168.5 g mol⁻¹, $N_A = 6.02 \times 10^{23}$ mol⁻¹]

[2]

Answer:

$$a^3 = \frac{Z \times M}{\text{Density} \times N_A} = \frac{2 \times 168.5}{4.0 \times 6.02 \times 10^{23}} = 139.95 \times 10^{-24}$$
$$A = 519.2 \times 10^{-8} \cong 5.2 \text{ pm.}$$

Question: 12

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.

- 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 Raoult's law.
- 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: 13 ()**

The rate constant of a reaction is 1.5×10^7 s⁻¹ at 50°C and 4.5×10^7 s⁻¹ at 100°C. Calculate the value of activation energy, E_a for the reaction. [R = 8.314 JK⁻¹ mol⁻¹]

[2]

Question: 14

What are photochemical reactions? Explain the mechanism of the photochemical reaction occurring between hydrogen and chlorine gas.

[2]



Answer:

The chemical reactions in which the necessary activation energy to the reactants is provided by visible or u.v. light are called photochemical reactions.

The reaction between H_2 and Cl_2 to form HCl takes place on exposure light.



Mechanism $\text{Cl}_2 \xrightarrow{h\nu} \text{Cl}^* + \text{Cl}^*$ chain initiating step

$\text{H}_2 + \text{Cl}^* \rightarrow \text{HCl} + \text{H}^*$ (Chain propagating steps)

$\text{Cl}_2 + \text{H}^* \rightarrow \text{HCl} + \text{Cl}^*$

$\text{Cl}^* + \text{Cl} \rightarrow \text{Cl}_2$ (Chain terminating steps)

$\text{H}^* + \text{H}^* \rightarrow \text{H}_2$

Question: 15

How are the following sols produced:

[2]

- a. Sulphur sol

Answer:

Sulphur solution is obtained by bubbling H_2S through an oxidizing agent like bromine water.

- b. Collodion

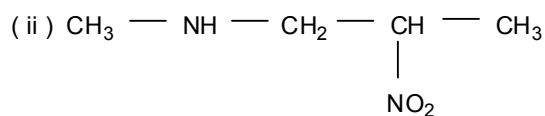
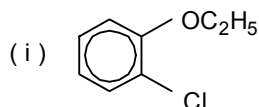
Answer:

Cellulose nitrate colloid can be prepared by dispersing it in a mixture of ethyl alcohol and ether. This is commercially known as collodion.

Question: 16

Write IUPAC names of the following:

[2]

**Answer:**

- i. 2-chloro-1-ethoxy benzene
ii. (N-Methyl) 2-nitro propanamine.

Question: 17 ()**

[2]

Write one reaction each to exemplify the following:

- i. Aldol condensation
ii. Friedel-Crafts

Question: 18

How do you account for the following?

[2]



- i. All scandium salts are white. (AT. No. of Sc = 21)

Answer:

Sc^{3+} has d^0 configuration. So no d-d-transitions are possible. All scandium salts are white.

- ii. The first ionization energies of the 5d transition elements are higher than those of the 3d and 4d transition elements in respective groups.

Answer:

The first ionization energy of 5d row elements is higher due to their higher effective nuclear charge. This is due to poor shielding effect of 4f –electrons.

Question: 19

[3]

Using the valence bond approach, deduce the shape and magnetic character of $[\text{Cr}(\text{CO})_6]$.
[At. No. of Cr = 24] (**)

Question: 20

Discuss the synthesis of bakelite and give its use.

[3]

Answer:

Synthesis

Bakelite is prepared with the help of phenol and formaldehyde. Phenol and formaldehyde reacts in presence of alkaline to form o-hydroxyphenol and p-hydroxyphenol then these two hydroxyphenol gives Bakelite.

Uses:

Soft Bakelite is used as bonding give for wooden planks and in the preparation of varnishes.

Question: 21

Name the chemical components which constitute nucleotides. Write any two functions of nucleotides in a cell.

[3]

Answer:

A nucleotide is made up of nitrogen containing heterocyclic base, a pentose sugar and phosphoric acid residue.

Important functions of nucleotides in a cell are:

- Nucleotides are building blocks of nucleic acids which are poly-nucleotides.
- Some nucleotides act as energy carriers.

Question: 22 ()**

What are hormones? State the function of the following hormones:

[3]

- Testosterone
- Oxytocin

Answer:

Hormones are complex organic compounds which are produced in endocrine glands and are directly secreted into blood stream. These control the various metabolic processes.

- Testosterone controls normal function of male sex organs.
- Oxytocin produces milk in the mammary glands of animals.



Question: 23 ()**

Give one important use of each of the following

- Bithional
- Chloramphenicol
- Streptomycin
- Paracetamol

Answer:

- Bithional is added to soap to impart antiseptic properties.
- Chloramphenicol is a broad spectrum antibiotic used to cure typhoid, dysentery, pneumonia.
- Streptomycin is used for the treatment of tuberculosis.
- Paracetamol is used to bring down high fever.

Question: 24 ()**

Explain as to why there is a rise in boiling point when a non – volatile solid is dissolved in a liquid. 0.90 g of a non electrolyte was dissolved in 87.90 g of benzene. This raised the boiling point of benzene by 0.25°C . If the molecular mass of the non – electrolyte is 103.0 g mol^{-1} , calculate the molal elevation constant for benzene. [3]

Question: 25 ()**

[3]

Calculate the cell emf at 25°C for the following cell:

$\text{Mg (s)} \mid \text{Mg}^{2+} (0.01\text{ M}) \parallel \text{Sn}^{2+} (0.1\text{ M}) \mid \text{Sn (s)}$
Given $E^{\circ} \text{Mg}^{2+} / \text{Mg} = -2.34\text{ V}$. $E^{\circ} \text{Sn}^{2+} / \text{Sn} = -0.136\text{ V}$, $1\text{ F} = 96,500\text{ C mol}^{-1}$

Calculate the maximum work that can be accomplished by the operation of this cell.

Question: 26 ()**

Write reactions and conditions for the following conversions:

- Chloroform into diethylcarbonate
- Phenol into salicylic acid
- 2-propanone into 2-methyl-2-propanol

Question: 27 ()**

Write chemical tests to distinguish between:

[3]

- Phenol and Benzoic acid
- Propanol and Propanone
- Formic acid and acetic acid

Question: 28 ()**

- Starting from a sample of chromite ore, how is potassium dichromate prepared? Describe all these steps involved with chemical equations.
- Write the balanced chemical equation for the reaction between an acidified solution of potassium dichromate and potassium iodide.

OR

- Describe how Potassium dichromate is made from chromite ore and the equation for the chemical equation for the chemical reactions involved



-
- b. Write the balanced equation (a) when potassium dichromate heated (b) when it reacts with conc. H_2SO_4 in cold.
- c. Draw the structures of chromate and dichromate ion.

Question: 29 ()**

[5]

- A. How is aniline obtained from benzene?
- B. Why are the secondary amines more basic than primary amines? Explain.
- C. Write the complete chemical reactions for the conversion of aniline to sulphanilic acid.
- D. Mention two important uses of sulphanilic acid.
- E. Write a chemical reaction of aniline which may distinguish it from ethyl amine.

Question: 30 ()**

Explain the following observations:

[5]

- a. Most of the known noble gas compounds are those of xenon.
- b. ClF_3 exists but FCl_3 does not.
- c. Among the hydrides of elements of group 16, water shows unusual physical properties.
- d. Unlike phosphorus, nitrogen shows little tendency for catenation.
- e. Sulphur in vapor state exhibits paramagnetic behaviour.

OR

- i. You are provided with four reagents: LiAlH_4 , I_2 / NaOH , NaHSO_4 and Schiff's reagent.
- ii. Write which two reagents can be used to distinguish between the compounds in each of the following pairs
- a. CH_3CHO and CH_3COCH_3
- b. CH_3CHO and $\text{C}_6\text{H}_5\text{CHO}$
- c. $\text{C}_6\text{H}_5\text{COCH}_3$ and $\text{C}_6\text{H}_5\text{COC}_6\text{H}_5$

(**) Currently out of syllabus. Answer can be provided up on request

