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**2013**

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Question: 1 – 30

i-vii

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**Question: 1**

What type of hybridization is associated with N in NH<sub>3</sub>? What is the expected bond angle in H<sub>3</sub>? [1]

**Answer:**

The N atom in NH<sub>3</sub> is sp<sup>3</sup> 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]

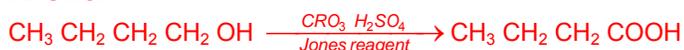
**Answer:**

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]



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**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  $Mn^{2+}$  has configuration  $[Ar] 3d^5$  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  $4.0 \text{ g cm}^{-3}$ . Calculate the length of the edge of the unit cell of caesium chloride crystal. [Molar mass of CsCl =  $168.5 \text{ g mol}^{-1}$ ,  $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$ ] [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  $1.5 \times 10^7 \text{ s}^{-1}$  at  $50^\circ\text{C}$  and  $4.5 \times 10^7 \text{ s}^{-1}$  at  $100^\circ\text{C}$ . Calculate the value of activation energy,  $E_a$  for the reaction. [ $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ ] [2]

**Question: 14**

What are photochemical reactions? Explain the mechanism of the photochemical reaction occurring between hydrogen and chlorine gas. [2]

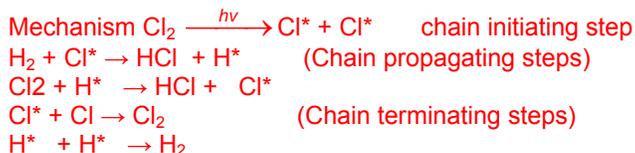


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**Answer:**

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  $\text{H}_2$  and  $\text{Cl}_2$  to form HCl takes place on exposure light.

**Question: 15**

How are the following sols produced: [2]

a. Sulphur sol

**Answer:**

Sulphur solution is obtained by bubbling  $\text{H}_2\text{S}$  through an oxidizing agent like bromine water.

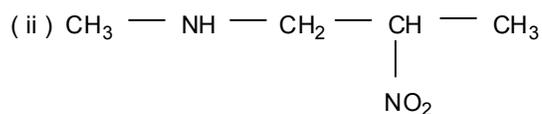
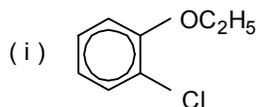
b. Collodion

**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:**

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

**Question: 17 (\*\*)**

[2]

Write one reaction each to exemplify the following:

- Aldol condensation
- 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<sup>3+</sup> has d<sup>0</sup> 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 [Cr(CO)<sub>6</sub>].  
[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.



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**Question: 23 (\*\*)**

Give one important use of each of the following

- i. Bithional
- ii. Chloramphenicol
- iii. Streptomycin
- iv. Paracetamol

**Answer:**

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

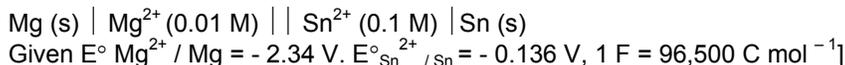
**Question: 24 (\*\*)**

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  $103.0 \text{ g mol}^{-1}$ , calculate the molal elevation constant for benzene. [3]

**Question: 25 (\*\*)**

[3]

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



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

**Question: 26 (\*\*)**

Write reactions and conditions for the following conversions:

- i. Chloroform into diethylcarbonate
- ii. Phenol into salicylic acid
- iii. 2-propanone into 2-methyl-2-propanol

**Question: 27 (\*\*)**

Write chemical tests to distinguish between:

[3]

- i. Phenol and Benzoic acid
- ii. Propanol and Propanone
- iii. Formic acid and acetic acid

**Question: 28 (\*\*)**

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

OR

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



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- b. Write the balanced equation (a) when potassium dichromate heated (b) when it reacts with conc.  $\text{H}_2\text{SO}_4$  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.  $\text{ClF}_3$  exists but  $\text{FCl}_3$  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:  $\text{LiAlH}_4$ ,  $\text{I}_2 / \text{NaOH}$ ,  $\text{NaHSO}_4$  and Schiff's reagent.
- ii. Write which two reagents can be used to distinguish between the compounds in each of the following pairs
- a.  $\text{CH}_3\text{CHO}$  and  $\text{CH}_3\text{COCH}_3$
- b.  $\text{CH}_3\text{CHO}$  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

