CHEMISTRY

Maximum : 60 Scores

Time: 2 Hours
Cool off time: 15 Minutes

Instructions

- There is a 'cool off time' of 15 minutes in addition to the writing time of 2 hrs.
- You are not allowed to write your answers nor to discuss anything with others during the 'cool off time'.
- Use the 'cool off time' to get familiar with questions and to plan your answers.
- Read questions carefully before answering.
- All questions are compulsory and only internal choice is allowed.
- When you select a question, all the sub-questions must be answered from the same question itself.
- Calculations, figures and graphs should be shown in the answer sheet itself.
- Give equations wherever necessary.
- Electronic devices except non-programmable calculators are not allowed in the Examination Hall.

1. a. Every substance has some magnetic properties associated with it. How will you account for the following magnetic properties?
   i. Paramagnetic property **1**
   ii. Ferromagnetic property **1**
   b. A compound is formed by two elements P and Q. Atoms of Q (as anions) make hcp lattice and those of the element P (as cations) occupy all the tetrahedral voids. What is the formula of the compound? **2**
2. Osmotic pressure is a colligative property and it is proportional to the molarity of solution.
   a. What is osmotic pressure? **1**
   b. Molecular mass of NaC*l* determined by osmotic pressure measurement is found to be half of the actual value. Account for it. **1**
   c. Calculate the osmotic pressure exerted by a solution prepared by dissolving 1.5g of a polymer of molar mass 185000 in 500 m*l* of water at 37°C [R = 0.0821 L atm K^{-1} mol^{-1}]. **2**
3. a. The cell reaction in Daniel cell is $Zn_{(s)} + Cu^{2+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$ and Nernst equation for single electrode potential for general electrode reaction $M^{n+}_{(aq)} + ne^- \rightarrow M_{(s)}$ is

   $$E_{M^{n+}/M} = E^\circ_{M^{n+}/M} - \frac{2.303RT}{nF}\log\frac{[M]}{[M^{n+}]}$$

   Derive Nernst equation for Daniel Cell. **3**
   b. Daniel cell is a primary cell while lead storage cell is a secondary cell. Write any one difference between primary cells and secondary cells. **1**
4. a. Consider a general reaction,

$aA + bB \rightarrow cC + dD$

The rate expression for the reaction is Rate = $k[A]^x[B]^y$

i. Establish the significance of '(a + b)' and '(x + y)' in terms of order and molecularity. 1

ii. Write any two differences between order and molecularity. 2

iii. Write any two differences between order and molecularity. 2

b. "Reactions with zero order is possible, but zero molecularity is not". Justify the statement. 1

5. Sols are colloidal systems in which dispersion medium is liquid and dispersed phase is solid.

a. Write any four differences between lyophilic sols and lyophobic sols. 2

b. Peptisation is a method of preparation of sols. Write a general procedure for peptisation. 1

6. a. Calcination and roasting are pre treatments in metallurgy before metal extraction. Differentiate between calcination and roasting. 1

b. Match the items of **column I** with items of **column II**

Column I	Column II
i. Distillation	a. Ge
ii. Liquation	b. Ni
iii. Zone refining	c. Cu
iv. Vapour phase refining	d. Zn
	e. Sn

2

7. Compounds of nitrogen, phosphorus and sulphur such as ammonia, phosphoric acid and sulphuric acid are used in fertilizer industry.

a. Describe Haber process for the manufacture of ammonia. 2

b. Write the chemical equation for the preparation of phosphoric acid (H_3PO_4) from orthophosphorus acid (H_3PO_3) 1

c. Describe Contact process for the manufacture of sulphuric acid. 2

8. Potassium dichromate is an orange coloured crystal and is an important compound used as an oxidant in many reactions.

a. How do you prepare $K_2Cr_2O_7$ from chromite ore? 3

b. How will you account for the colour of potassium dichromate crystals? 1

9. $[Co(NH_3)_5SO_4]Cl$ is an octahedral coordination compound.

a. Write the IUPAC name of the above coordination compound. 1

b. Write the formula of the ionisation isomer of the above compound. 1

c. How do 'd' orbitals split in an octahedral crystal field? 1

d. Draw the diagram which indicate the splitting of 'd' orbitals in tetrahedral field. 1

10. a. Most important chemical reactions of halo alkanes are their substitution reactions.

i. What is S_N1 reaction? 1

ii. Arrange the four isomeric bromo butanes in the increasing order of their reactivity towards S_N1 reaction. 2

b. How will you prepare chlorobenzene from benzene diazonium chloride? 1

11. a. How will you prepare the following compounds using Grignard reagent?

i. Primary alcohol

ii. Secondary alcohol 2

b. How will you distinguish primary and secondary alcohols using Luca's test? 1

c. Write the correct pair of reactants for the preparation of t-butyl ethyl ether by Williamson synthesis. 1

12. a. Aldol condensation reaction is a special reaction of aldehydes.
   i. What is aldol condensation reaction? 1
   ii. Write the structural formula of aldol formed from ethanal. 1

   b. Write simple chemical tests and observations used to distinguish between the following compounds.
   i. Propanal and propanone 1
   ii. Phenol and benzoic acid 1

   c. Write the names of the reagents used to bring about the following transformations.
   i. $C_6H_5COCl \rightarrow C_6H_5CHO$
   ii. $CH_3COOH \rightarrow \underset{\underset{Cl}{|}}{CH_2}-COOH$ 1

13. a. Write the method of preparation of primary amines. 1

   b. Describe a chemical reaction given only by primary amines. 1

   c. What is diazotisation? 1

14. Biomolecules are formed by certain specific linkages between simple monomeric units. Write the names of linkages and monomeric units in the following class of biomolecules.
   i. Starch 1
   ii. Protein 1
   iii. Nucleic acid 1

15. a. Write any two differences between step growth polymerisation and chain growth polymerisation. 2

   b. What are the monomers of the following?
   i. Neoprene
   ii. Nylon - 6 1

16. a. Antibiotics are classified in to broad spectrum antibiotics and narrow spectrum antibiotics. Write one example each for these antibiotics. 1

   b. Write one similarity and one difference between antiseptics and disinfectants. 2

ANSWERS - Chemistry

1. a. i. **Paramagnetic property:** The substances which are weakly attracted by magnetic field and do not retain magnetism after removing the magnetic field are called paramagnetic substances. Paramagnetism arises due to the presence of unpaired electrons.

   e.g. TiO, O_2, Cu^{2+}, Fe^{3+}, Cr^{3+}

   ii. **Ferromagnetic property:** The substances which are strongly attracted by magnetic field and retain magnetism after removing the magnetic field are called ferromagnetic substances. In ferromagnetic substances, the magnetic moments permanently align in one direction to give a net magnetic moment.

   e.g. iron, cobalt, nickel, gadolinium and CrO_2

Magnetic moments in ferromagnetic substances