PT2

HALF YEARLY EXAMINATION 2022-23

CHEMISTRY

CLASS XII **Time : 3 hrs.**

Mark : 70

General Instructions

a) There are 35 questions in this question paper with internal choice.
b) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
c) SECTION B consists of 7 very short answer questions carrying 2 marks each.
d) SECTION C consists of 5 short answer questions carrying 3 marks each.
e) SECTION D consists of 2 case-based questions carrying 4 marks each.
f) SECTION E consists of 3 long answer questions carrying 5 marks each.
g) All questions are compulsory.
h) Use of log tables and calculators is not allowed.

SECTION - A **18 × 1 = 18**

1. Which among the following is an example of a solid solution in which the solute is a gas?

   a) Hydrated salts b) Humidity in air c) Pumice stone d) Aerated drinks

2. Given that $E^{o}_{Fe^{3+}|Fe}$ and $E^{o}_{Fe^{2+}|Fe}$ are – 0.036 V and –0.439 V, respectively. The value of $E^{o}_{Fe^{3+}, Fe^{2+}|Pt}$ would be:

   a) (- 0.036 + 0.439) V b) [3(+ 0.036) + 2(- 0.439)] V
   c) (-0.036 - 0.439) V d) [3 (- 0.036) + 2(+ 0.439)] V

3. The rate constant of a first order reaction is 3×10^{-6} per sec. If the initial concentration is 0.10 M, the initial rate of reaction is

   a) 3×10^{-8} Ms^{-1} b) 3×10^{-5} Ms^{-1} c) 3×10^{-7} Ms^{-1} d) 3×10^{-6} Ms^{-1}

4. Given that the abundance of isotopes ^{54}Fe, ^{56}Fe and ^{57}Fe is 5%, 90% and 5%, respectively. The atomic mass of Fe is

   a) 55.85 b) 55.75 c) 55.95 d) 55.05

5. Which of the following compound, on reaction with NaOH and Na_2O_2, gives yellow colour?

   a) $Cr(OH)_3$ b) $Zn(OH)_2$ c) $Al(OH)_3$ d) $CaCO_3$

6. The correct name of the compound $[Cu(NH_3)_4](NO_3)_2$ is:

   a) Cuprammonium nitrate b) Tetraammine copper (I) nitrate
   c) Tetraammine copper (II) nitrate d) Tetraammine copper (II) dinitrate

7. IUPAC name of neo-Pentylbromide is:

   a) 1-Bromo-3-methylbutane b) 1-Bromo-2,2-dimethylpropane.
   c) 1-Bromo-1,2-dimethylpropane d) 1-Bromo-2-methylbutane

8. Which is the correct increasing order of boiling points of the following compounds?
   1-Iodobutane, 1-Bromobutane, 1-Chlorobutane, Butane

   a) Butane < 1-Iodobutane < 1-Bromobutane <1-Chlorobutane
   b) Butane < 1-Chlorobutane < 1-Iodobutane <1-Bromobutane
   c) Butane < 1-Chlorobutane < 1-Bromobutane< 1-Iodobutane
   d) 1-Iodobutane < 1-Bromobutane < 1-Chlorobutane < Butane

9. Determination of the molar mass of acetic acid in benzene using freezing point depression is affected by

a) dissociation b) association

c) partial ionization d) complex formation

10. Choose the correct statement(s):

A. The stability of half filled d-subshell in Mn^{2+} can be related to its E^0 value.

B. The stability of completely filled d^{10} configuration in Zn^{2+} can be related to its E^0 value.

C. E^0 for Ni is related to the highest negative $\Delta_{hyd} H^o$. D. All of these

a) B b) A c) D d) C

11. Three separate test tubes contain aq. solution of dichloride of a metal:

i) test tube - 1 $\xrightarrow{KOH_{(excess)}}$ No change ii) test tube - 2 $\xrightarrow{dil.\ H_2SO_4}$ No change

iii) test tube - 3 $\xrightarrow{NH_4OH_{(excess)}}$ No change

Dichloride of metal is:

a) $FeCl_2$ b) $SnCl_2$ c) $ZnCl_2$ d) $CuCl_2$

12. Both Zn and Cd react with dil. HCl to produce H_2 gas but Hg is inert for dil. HCl. Compare reactivity of Zn, Cd and Hg by using given E^o.

$Zn + Cd^{2+} \rightarrow Zn^{2+} + Cd \quad E^o = + 0.36\ V$

a) Zn > Cd > Hg b) Zn > Hg > Cd c) Cd > Zn > Hg d) Hg > Cd > Zn

13. Many protein-based biomaterlialist such as waste hair and feathers, can absorb heavy metal ions from wastewater. It has been observed that metal uptake by these materials increases in alkaline conditions. The enhanced uptake in alkaline conditions is due to:

a) availability of a high concentration of OH^- ions as ligands

b) generation of many ligand sites in the protein molecules due to removal of H^+

c) increase in solubility of the proteins

d) increased cross-linkages in the protein chains by formation of amide bonds

14. For an endothermic reaction, energy of activation is E_a and enthalpy of reaction is ΔH (both of these in kJ/mol). Minimum value of E_a will be

a) less than ΔH b) equal to ΔH c) more than ΔH d) equal to zero

15. Assertion (A) : NaOH cannot be stored in a vessel made of aluminium or zinc.

Reason (R) : A protective layer of oxide is formed on the surface of the metal.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

16. Assertion (A) : Chromium is used for coating iron.

Reason (R) : Chromium is non-corroding metal which forms a protective layer on iron.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

17. Assertion (A) : $K_3[Fe(CN)_6]$ is a low spin complex.

Reason (R) : Fe^{2+} ion in this complex undergoes sp^3d^2 hybridisation.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

18. Assertion (A) : $[Cr(H_2O)_6]Cl_2$ and $[Fe(H_2O)_6]Cl_2$ are reducing in nature.

Reason (R) : Unpaired electrons are present in their *d*-orbitals.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

SECTION - B

19. Define electrochemical cell. What happens if external potential applied becomes greater than E^o cell of electrochemical cell? **2**

20. There is a close similarity in physical and chemical properties of the 4d and 5d-series of the transition elements,much more than expected on the basis of usual family relationship. Why? **2**

OR

What is lanthanoid contraction? What is its effect on the chemistry of the elements which follow the lanthanoids?

21. A coordination compound has the formula $CoCl_3.4NH_3$. It does not liberate ammonia but forms a precipitating with $AgNO_3$. Write the structure and IUPAC name of the complex compound. **2**

22. Derive the relationship between relative lowering of vapour pressure and mole fraction of the volatile liquid. **2**

23. After 24 hrs, only 0.125 gm out of the initial quantity of 1 gm of a radioactive isotope remains behind. What is its half life period? **2**

24. i) Allyl chloride can be distinguished from Vinyl chloride by NaOH and silver nitrate test. Comment.

ii) Alkyl halide reacts with Lithium aluminium hydride to give alkane. Name the attacking reagent which will bring out this change. **2**

25. Explain as to why haloarenes are much less/reactive than haloalkanes towards nucleophilic substitution reactions. **2**

SECTION - C

26. If a current of 0.5 ampere flows through a metallic wire for 2 hours, then how many electrons would flow through the wire? **3**

27. Consider the reaction:

$2A + B \rightarrow C + D$ **3**

Following results were obtained in experiments designed to study the rate of reaction:

Exp. No.	Initial concentration (mol L^{-1}) [A]	[B]	Initial rate of formation [D] (m/min)
1.	0.10	0.10	1.5×10^{-3}
2.	0.20	0.20	3.0×10^{-3}
3.	0.20	0.40	6.0×10^{-3}

i) Write the rate law for the reaction.

ii) Calculate the value of rate constant for the reaction.

iii) Which of the following possible reaction mechanism is consistent with the rate law?

I. $A + B \rightarrow C + E$ (slow)

$A + E \rightarrow D$ (fast)

II. $B \rightarrow C + E$ (slow)

$A + E \rightarrow F$ (fast)

$A + F \rightarrow D$ (fast)

28. Describe with an example of each, the role of coordination compounds in

i) biological system

ii) analytical chemistry

iii) medicinal chemistry **3**

OR

a) Give names of two complexes which are used in medicines.

b) Using valence bond theory of complexes explain the geometry and magnetic nature of $[Ni(CN)_4]^{2-}$ (At No. of Ni = 28)

29. Compare the chemistry of actinoids with that of lanthanoids with reference to:

i) Electronic configuration

ii) Oxidation states

iii) Chemical reactivity **3**

30. How do you convert :

i) Chlorobenzene to toluene

ii) But - 1 - ene to But - 2 - ene

iii) Ethanol to Ethyl iodide **3**

SECTION - D

31. **Read the text and answer the questions.** **4**

Many chemical and biological processes depend on osmosis, the selective passage of solvent molecules through the porous membrane from a dilute solution to a more concentrated one. The osmotic pressure (π) depends on molar concentration of the solution (π = CRT). If two solutions are of equal solute concentration and, hence, have the same osmotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic. Osmosis is the major mechanism, for transporting water upward in the plants. Transpiration is the leaves supports the transport mechanism of water. The osmotic pressure of seawater is about 30 atm; this is the pressure that must be applied to the seawater (separated from pure water using a semi-permeable membrane) to get drinking water.

Answer the following questions: (Answer any four)

i) What will happen if a plant cell kept in a hypertonic solution?

ii) Glucose solution to be injected into the blood stream must have same ..... as that of the bloodstream.

iii) What are the factors on which osmotic rise of a solution depends?

iv) What type of solution has the same molarity?

v) Which mechanisms helps in the transportation of water in a plant?

32. **Read the given passage and answer any four questions that follow:** **4**

The order of the reaction is the sum of the powers of the concentration of the reactants in the rate law. It can either be a whole number or a fraction the order of the reaction is determined by the experimental methods based on this value, reactions may be classified as first-order, second-order, third-order, etc. A reaction whose order is different from the actual due to large excess concentration of one of the reactants is called pseudo order reaction. Another property of a reaction called molecularity helps in understanding its mechanism. The number of reacting species (atoms, ions, or molecules) taking part in an elementary reaction, which must collides simultaneously in order to bring about a chemical reaction is called the molecularity of a reaction. The reaction can be unimolecular when one reacting species is involved, bimolecular reactions involve a simultaneous collision between two species & trimolecular or termolecular reactions involve a simultaneous collision between three reacting species.

a) For the reaction, A + B $\rightarrow$ Products, the rate is given as, rate = $k[A][B]^2$. How will the rate change if the volume of the reaction mixture is reduced to 1/3 of its original volume?

b) The hydrolysis of ethyl acetate in the presence of acid is a reaction of first order whereas, in the presence of alkali, it is a reaction of second order. Give reason.

c) The graph between time (t) and the substance consumed at any time is found to be a straight line passing through the origin. Predict the order of the reaction.

d) For which type of reactions, order, and molecularity have the same value?

e) Why is the probability of reaction with molecularity higher than three very rare?

SECTION - E

33. a) A 0.2 percent aqueous solution of a non-volatile solute exerts a vapour pressure of 1.004 bar at 100^0 C. What is the molar mass of the solute? (Given: Vapour pressure of pure water at 100^0 C is 1.013 bar and molar mass of water is 18 g mol^{-1}).

b) Calculate the freezing point of a solution containing 18 g glucose, $C_6H_{12}O_6$ and 68.4 g sucrose, $C_{12}H_{22}O_{11}$ in 200 g of water. The freezing point of pure water is 273 K and K_f for water is 1.86 km^{-1}. **5**

OR

a) What are primary batteries. Give an example.

b) Conductivity of 0.00241 M acetic acid solution is 7.896×10^{-5} S cm^{-1}. Calculate its molar conductivity in this solution. If Λ_m^0 for acetic acid be 390.5 S cm^2 mol^{-1}, what would be its dissociation constant?

34. i) Complete the following chemical equations:

a) $Cr_2O_7^{2-}(aq) + H_2S(g) + H^+(aq) \rightarrow$

b) $Cu^{2+}(aq) + I^-(aq) \rightarrow$

ii) How would you account for the following?

a) The oxidising power of oxoanions are in the order.

$VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$

b) The third ionisation enthalpy of manganese (Z = 25) is exceptionally high.

c) Cr^{2+} is a stronger reducing agent than Fe^{2+}. **5**

35. For the complex $[Fe(en)_2Cl_2]Cl$, identify the following:

i) Hybrid orbitals and shape of the complex

ii) Magnetic behaviour of the complex

iii) Number of its geometrical isomers

iv) Whether there may be optical isomer also

v) Name of the complex and oxidation number of iron **5**