SAMPLE TEST PAPER	KPS
CHEMISTRY	**College Of Competitions**

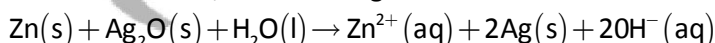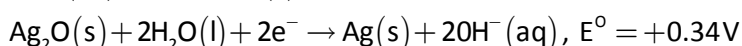| Max. Marks: 70	By : SANDEEP SHARMA (+91–9871 945 585)	Time: 180 Minutes

General instructions:

a) **All the questions are compulsory.**

b) **Q01-08 are of very short answer type and carry 1 mark each. (Answers in one word/ sentence)**
   Q09-18 are of short answer type and carry 2 marks each. (Answers in about 30 words)
   Q19-27 are of short answer type and carry 3 marks each. (Answers in about 40 words)
   Q28-30 are of long answer type and carry 5 marks each. (Answers in about 70 words)

c) **There is no overall choice. However internal choice has been provided in some of the cases.**

Q01. Why is vapour pressure of a solution of glucose in water lower than that of water?

Q02. How is t-butyl alcohol obtained from acetone?

Q03. Does the hydrolysis of XeF_6 leads to a redox reaction?

Q04. Explain why hydrophobic sols are less stable than hydrophillic sols.

Q05. Iron (II) oxide has a cubic structure and edge of the unit cell is $5\overset{0}{A}$. If density of oxide is $4 \, g \, cm^{-3}$, calculate the number of Fe^{2+} and 0^{2-} ions present in each unit cell. $\left(FeO=72 \, g \, mol^{-1}, \, N_A=6.022×10^{23} mol^{-1} \right)$

Q06. Cyclohexyl chloride has high dipole moment than chlorobenzene, why?

Q07. What prompted Bartlet to the discovery of noble gas compounds?

Q08. Carboxylic acids cannot give the properties of carbonyl group. Explain, why?

Q09. a) Explain the observed K_b order:
   $Et_2 \, NH > Et_3 \, N > Et \, NH_2$ in aqueous solution.
   b) Diazonium salts of aromatic amines are more stable than that of aliphatic amines?

Q10. Write a short notes on: a) H.V.Z. reaction
                                        b) Cannizaro's reaction

Q11. Write three distinct differences between physical adsorption and chemical adsorption.

Q12. A first order reaction is 15% complete in 20 minutes. How long will it take to be 60% complete?

OR

In the button cell used in watches, the following reaction occurs
$$Zn(s) + Ag_2O(s) + H_2O(l) \rightarrow Zn^{2+}(aq) + 2Ag(s) + 20H^-(aq)$$
Determine E^o for the cell and $\triangle_r G^o$ for the reaction.

Given: $Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$, $E^o = -0.76V$
            $Ag_2O(s) + 2H_2O(l) + 2e^- \rightarrow Ag(s) + 20H^-(aq)$, $E^o = +0.34V$
            $F = 96500 \, C \, mol^{-1}$.

Q13. How is the variability in oxidation states of the transition elements different from that of the non-transition elements? Illustrate with examples.
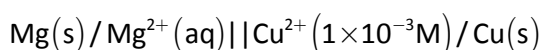
OR

How will you account for the following observations:
(i)   The enthalpies of atomisation of the transition metals are high?
(ii)   Of the lanthanides, only cerium ($Z = 58$) is known to exhibit quite stable +4 state in solutions?

Q14. An antifreeze solution is prepared from 222.6g of ethylene glycol $\left[C_2H_5(OH)_2\right]$ and 200g of water. Calculate the molality of the solution. If the density of this solution be $1.072\,gml^{-1}$, what will be the molarity of the solution?

Q15. Prove that the packing fraction in *fcc* is 74%.

Q16. Nitric oxide reacts with hydrogen to give nitrogen and water as shown below
$$2NO + 2H_2 \rightarrow N_2 + 2H_2O$$
The kinetics of this reaction is explained by the following steps:
   (i) $2NO + H_2 \rightarrow N_2 + H_2O_2\,(Slow)$
   (ii) $H_2O_2 + H_2 \rightarrow 2H_2O\,(Fast)$
What is the predicated rate law?

OR

Calculate the emf of the cell
$$Mg(s)/Mg^{2+}(aq)||Cu^{2+}(1\times10^{-3}M)/Cu(s)$$
Given: $E^O_{Cu^{2+}/Cu} = +0.34V$, $E^O_{Mg^{2+}/Mg} = -2.37V$.

Q17. How would you account for the following:
   (i)   Frenkel defects are not found in alkali metal halides.
   (ii)   Schottky defects lower the density of related solids?

Q18. State Raoult's law for solutions of volatile liquid component. Taking a suitable example, explain the meaning of positive deviation from Raoult's law?

OR

Define the term 'osmotic pressure'. Describe, how the molecular mass of a substrate can be determined on the basis of osmotic pressure measurement?
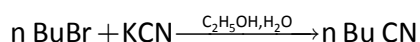
Q19. What happens when D-Glucose is treated with the following reagents?
   (i) HI   (ii) Bromine water   (iii) HNO_3

Q20. An organic compound A contains 69.77% carbon, 11.63% hydrogen and the rest is oxygen. The molecular mass of the compound is 86. It does not reduce Tollen's reagent but forms an addition product with sodium hydrogen sulphite and gives positive Iodoform test. On vigorous oxidation it gives ethanoic and propanoic acids. Write the possible structure of the compound A.

Q21. a) Derive the general expression for Half-life of a first order reaction.
b) The decomposition of NH_3 on platinum surface is a zero order reaction. What would be the rates of production of N_2 and H_2 if $K = 2.5\times10^{-4}\,mol\,L^{-1}\,s^{-1}$?

OR

Three electrolytic cells A, B and C containing solutions of zinc sulphate, silver nitrate and copper sulphate respectively are connected in series. A steady current of 1.5 ampere is passed through them until 1.45g of silver is deposited at the cathode of cell B. How long did the current flow? What mass of copper and what mass of zinc were deposited on the concerned electrodes?
(Atomic masses: $Ag = 108$, $Zn:65.4$ $Cu = 63.5$, all in amu)

Q22. a) Suggest a mechanism for the reaction:
$$n\,BuBr + KCN \xrightarrow{C_2H_5OH,H_2O} n\,Bu\,CN$$
b) Describe carbylamine reaction.

OR

Explain the following situations:
   (i)   In the structure of HNO_3 molecule, the $N-O$ bond (121pm) is shorter than $N-OH$ bond 140pm).
   (ii) SF_4 is easily hydrolysed whereas SF_6 is not easily hydrolysed.
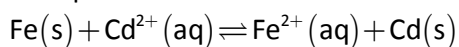
(iii) XeF_2 has a straight linear structure and not a bent angular structure.

Q23. Explain the following types of substances with one suitable example, for each case:
(i)   Cationic detergents
(ii)   Food preservatives
(iii)   Analgesics

OR

a)   Express the relationship amongst cell constant, resistance of the solution in the cell, and conductivity of the solution. How is molar conductivity of a solute related to conductivity of its solution?
b)   Calculate the equilibrium constant for the reaction
$$Fe(s)+Cd^{2+}(aq)\rightleftharpoons Fe^{2+}(aq)+Cd(s)$$
Given: $E^O_{Cd^{2+}/Cd}=0.40V$, $E^O_{Fe^{2+}/Fe}=-0.44V$.

Q24. Describe the underlying principle of each of the following metal refining methods:
(i)   Electrolytic refining of metals
(ii)   Vapour phase refining of metals
(iii)   Zone refining.

OR

Carry out the following conversions
(i)   Propanone to propene
(ii)   Benzoic acid to Benzaldehyde
(iii)   Bromobenzene to 1-Phenylethanol.

Q25. Explain the formation of: a)   BUNA-S
                                            b)   Nylon-6
                                            c)   Bakellite
Also, give one use of each polymer.

OR

Suggest a possible reason for the following observations:
(i)   The order of reactivity of haloalkanes is RI > RCl > RBr.
(ii)   Neopently chloride does not allow SN_2 mechanism.
(iii)   Ethers have low boiling points.

Q26. a)   What is the structural difference between a nucleoside and a nucleotide.
b)   The two strands in DNA are not identical but are complementary, explain.
c)   The amino acids start to migrate toward cathode in acidic medium. Why?

OR

a)   What are biodegradable polymers? Give an example of such a polymer and mention its uses.
b)   Square planer complexes (of MX_2L_2 type) with coordination number of 4 exhibit geometrical isomerism whereas tetrahedral complexes with similar composition, do not. Why?

Q27. a)   Resistance of a conductivity cell filled with 0.1M KCl solution is 100 ohm. If the resistance of the same cell when filled with 0.02 M KCl solution is 520 ohms, calculate the conductivity and molar conductivity of 0.02M KCl solution. Conductivity of 0.1M KCl solution is 1.2 Sm^{-1}?
b)   Give reasons for the following:
(i)   Rusting of iron is quicker in saline water than in ordinary water.
(ii)   Aluminium metal cannot be produced by the electrolysis of aqueous solution of aluminium salt.

OR

a)   State two advantages of H_2-O_2 fuel cell over ordinary cell.
b)   Silver is electrodeposited on a metallic vessel of total surface areas 900cm^2 by passing a current of 0.5 ampere for two hours. Calculate the thickness of silver deposited.
Given: Density of silver = 10.5 g cm^{-3},   Atomic mass of Ag= 108 amu,   F=96500 C mol^{-1}.

Q28. a) Write balanced chemical equations for the following reactions:
   (i) Chlorine is passed through hot and concentrated NaOH solution.
   (ii) XeF_4 is hydrolysed.
   (iii) Excess of SO_2 reacts with sodium hydroxide solution.

   b) Arrange the following in order of the property mentioned:
   (i) PH_3, NH_3, SbH_3, AsH_3 (Increasing basic strength)
   (ii) F_2, Cl_2, Br_2, I_2 (Bond dissociation enthalpy)

OR

   a) Give reasons for the following observations:
   (i) Cu^+ ion is not stable in aqueous solution.
   (ii) Mn(II) ion shows maximum paramagnetic character amongst the bivalent ions of first transition series.
   (iii) Scandium (Atomic number 21) salts are white.

   b) Describe the reactions involved in the preparation of $K_2Cr_2O_7$ from chromite ore.

Q29. a) Explain the mechanism of a nucleophillic attack on the carbonyl group of an aldehyde or a ketone.

   b) An organic compound (A) Molecular formula ($C_8H_{16}O_2$) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid also produced (B). On dehydration (C) gives but-1-ene. Write the equations for the reactions involved?

OR

   a) Complete the following chemical equations:
   (i) $Cr_2O_7^{2-}(aq) + H_2S(g) + H^+(aq) \longrightarrow$
   (ii) $Cu^{2+}(aq) + I^-(aq) \longrightarrow$

   b) How would you account for the following:
   (i) The oxidizing power of oxoanions are in the order
   $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$
   (ii) Third ionization enthalpy of manganese (Z=25) is exceptionally high.
   (iii) Cr^{2+} is a strong reducing agent than Fe^{2+}?

Q30. a) Compare the chemistry of the actinoids with that of lanthanoids with reference to
   (i) Electronic Configuration
   (ii) Oxidation states
   (iii) Chemical reactivity

   b) Describe the formation of $KMnO_4$ from pyrolusite ore and write the ionic equations for the reaction that takes place between acidified $KMnO_4$ solution and iron(II) ions?

OR

   a) What are micelles?
   'Action of soap is due to emulsification and Micelle formation'. Comment.

   b) Account for the followings:
   (i) NF_3 is highly exothermic compound.
   (ii) NO_2^+ has large bond angle than NO_2^-

   c) The decomposition of a compound is found to follow a first order rate law. If it takes 15 minutes for 20% of original material to react. Calculate the followings:
   (i) Rate constant
   (ii) The time at which 10% of the original material remains unreacted.

Good Luck To All..!

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