Worksheet-1: XII Chemistry

Topics: Coordination chemistry, d and f block elements, electrochemistry, chemical kinetic, organic chemistry

1. (a) Write the formula of the following coordination compound: iron(III)hexacyanoferrate(II).

(b) What type of isomerism is exhibited by the complex $[Co(NH_3)_5Cl]SO_4$?

(c) Write the hybridization and number of unpaired electrons in $[CoF_6]^{3-}$ (Atomic number Co= 27).

(d) Write the formula and hybridization of tris(ethane-1,2–diamine) cobalt(III) sulphate

2. (a) Nickel chloride gives a green coloured complex [A] in aqueous solution. When it is treated with ethane –1, 2 – diamine (en) gives pale - yellow solution [B] which on subsequent addition of ethane –1, 2 – diamine turns to blue/purple [C] and finally to violet [D]. Write the structures of complexes [A], [B], [C] and [D].

(b) Draw the complex $[Co(NH_3)_4Cl_2]^+$ and mention which types of isomerism is possible. Explain with structures.

3. Give reason:
(i) Iron has higher enthalpy of atomization than that of copper
(ii) Sc^{+3} is colorless whereas Ti^{+3} is colored in aqueous solution.
(iii) Transition elements and their compounds are generally found to be good catalysts in chemical reactions.

4. Choose the correct answers

(a) Which of the following system has maximum number of unpaired electrons with weak field ligand in octahedral geometry? (a) d^5 (b) d^9 (c) d^7 (d) d^6

(b) The energy difference between t_{2g} and e_g level in an octahedral crystal field is (a) 4 Dq, (b) 6 Dq, (c) 8 Dq, (d) 10 Dq

(c) The destruction of degeneracy and splitting of d-orbitals due to repulsive forces caused by approaching ligands is known as (a) crystal field splitting, (b) Crystal field stabilization, (d) spin pairing, (d) kinetic stability

(d) Crystal field theory assumes that interaction between metal ion and ligand is (a) purely covalent, (b) purely coordinate covalent, (c) polar covalent, (d) electrostatic

(e) Which of the complex has as optical isomer? (a) $[Co(NH_3)_3Cl]^+$ (b) $[Co\ (en)(NH_3)_2]^+$ (c) $[Co\ (en)(H_2O)_4]^+$ (d) $[Co\ (en)_2(NH_3)_2]^{3+}$

5. Two half cell reactions of an electrochemical cell are given below :
$MnO^-_4(aq) + 8H^+ (aq) + 5e^- \rightarrow Mn^{2+} (aq) + 4H_2O (I)$, $E° = + 1.51$ V
$Sn^{2+} (aq) \rightarrow 4\ Sn^{4+} (aq) + 2e^-$, $E° = + 0.15$ V
Construct the redox equation from the two half cell reactions and predict if this reaction favors formation of reactants or product shown in the equation.

6. Determine the values of equilibrium constant (K_c) and $\Delta G°$ for the following reaction :
$Ni(s) + 2Ag^+ (aq) \rightarrow Ni^{2+} (aq) + 2Ag(s)$,
$E° = 1.05$ V, ($1F = 96500$ C mol^{-1}, $R = 8.314$ J/Mol/K, $T = 298$ K)

7. The molar conductivity of a 1.5 M solution of an electrolyte is found to be 138.9 S cm^2 mol^{-1}. Calculate the conductivity of this solution.

8. Express the rate of the following reaction in terms of the formation of ammonia:
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

9. A reaction is of first order in reactant A and of second order in reactant B. How is the rate of this reaction affected when (i) the concentration of B alone is increased to three times (ii) the concentrations of A as well as B are doubled?

10. The thermal decomposition of HCOOH is a first order reaction with a rate constant of 2.4×10^{-3} s^{-1} at a certain temperature. Calculate how long will it take for three-fourths of initial quantity of HCO_2 H to decompose. (log 0.25 = -0.6021)

11. Draw the structure for each compound (a) isopropyldimethylamine, (b) dipropylamine, (c) benzamide, (d) N-methylacetamide

12. How will you convert (i) Benzene into aniline and (ii) aniline to N, N −dimethylaniline, (iii) 4-nitrotoluene to 2-bromobenzoic acid

13. Arrange the following in increasing order of their basic strength:
$C_2H_5NH_2$, $C_6H_5NH_2$, NH_3, $C_6H_5CH_2NH_2$ and $(C_2H_5)_2NH$

14. Give one chemical test to distinguish (i) phenol and butanol, (ii) aniline and butyl amine, (iii) acetophenone and ethanol, (iv) acetaldehyde and Propanal, (v) butyl amine and dibutyl amine, (vi) benzaldehyde and ethanol

15. Explain:
(i) Cyclohexene undergoes electrophilic addition with Br_2/CCl_4 but benzene does not.
(ii) Nitrobenzene does not undergo Friedel craft's reaction
(iii) Aniline reacts with bromine water at room temperature readily but toluene reacts with bromine in presence of Lewis acid catalyst followed by heating.
(iv) Tertiary alcohol gives positive Lucas test but butanol does not.

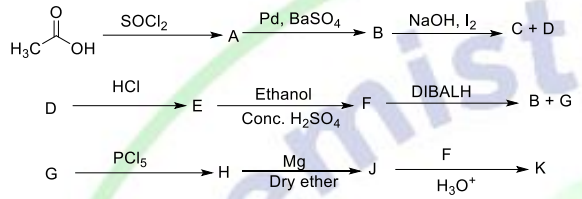
16. An organic compound A on treatment with ethyl alcohol gives carboxylic acid B and compound C. Hydrolysis of C under acidic conditions gives B and D. Oxidation of D with $KMnO_4$ also gives

B. B on heating with $Ca(OH)_2$ gives E with molecular formula C_3H_6O. E does not give Tollens' test or reduce Fehling solution but forms 2,4-dinitrophenylhydrazone. Identify A, B, C, D, E.

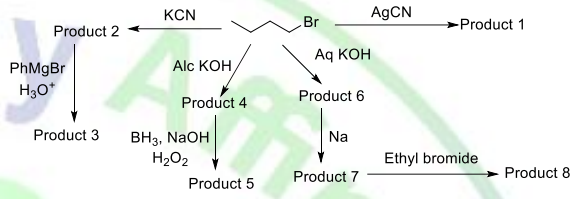
17. Which type of organic compounds undergo Cannizaro and Aldol Condensation reaction. Justify your answers with appropriate examples.

18. Write the products of the following reactions:

(a)



(b)



19. Which electrophile is produced in the reaction of benzene with benzoyl chloride in the presence of anhydrous $AlCl_3$. Justify. Name of the reaction also.

20. Benzyl chloride undergoes SN^1 reaction but ethyl chloride undergoes SN^2. Why?

21. Cu^{+1} undergoes disproportionation reaction in aqueous solution but Cu^{+2} is soluble in water. Explain.

22. Justify: Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4) Mn^{3+} is an oxidizing agent.

23. Write two similarities between lanthanoid and actinoid.

24. Lanthanoid elements rarely form coordination compounds but actinoid elements can form many coordination compounds. Explain.

25. Chromium has higher melting point than manganese. Explain.

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All The Best