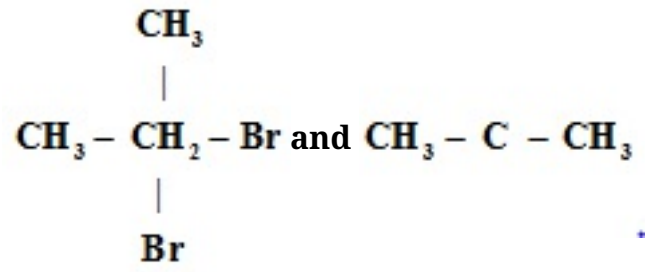
CBSE Class 12 Chemistry

Question Paper Chennai 2015 set 3

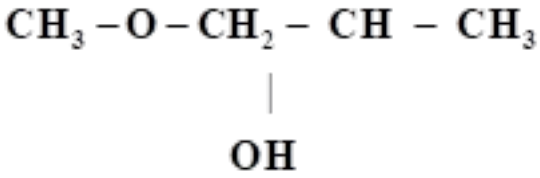
General Instructions :

- All the questions are compulsory.
- Question numbers 1 to 5 are very short answer questions carrying 1 mark each.
- Question numbers 6 to 10 are short answer question carrying 2 marks each.
- Question numbers 11 to 22 are also short answer questions carrying 3 marks each
- Question number 23 is a value based questions carrying 4 marks.
- Question numbers 24 to 26 are long answer questions carrying 5 m

1. **How much charge in Faradays is required for the reduction of 1 mol of Al^{3+} to Al ?**
   Ans. 3 Faraday/3F
2. **Which would undergo SN2 reaction faster in the following pair:**



   Ans. CH_3-CH_2-Br.
3. **Write the IUPAC name of the given compound:**



   Ans. 1-methoxypropan-2-ol.
4. **Write the dispersed phase and dispersion medium of paints.**
   Ans. Dispersed phase – Solid , Dispersion medium – Liquid.
5. **Copper atom has completely filled d-orbitals in its ground state but it is a transition element. Why?**
   Ans. Due to incompletely filled d-orbitals in +2 oxidation state (ie., in cu^{2+} state.)
6. **Arrange the following:**

(i)in increasing order of basic strength

$C_6H5 - NH_2$,$CH_3 - CH_2 - NH_2$, $C_6H_5 - NH - CH_3$

(ii)in increasing order of boiling point

$C_2H_5 - OH$,$CH_3 - CH_2 - NH_2$, $CH_3 - NH - CH_3$

Ans.

i. C_6H_5-NH_2 < C_6H_5-NH-CH_3 < CH_3-CH_2-NH_2.

ii. CH_3-NH-CH_3 < CH_3-CH_2-NH_2 < C_2H_5-OH

7. **Define rate constant (k). Write the unit of rate constant for the following**

   (i) First order reaction

   (ii) Second order reaction

   Ans. Rate constant is the proportionality constant that relates rate of reaction with concentration of reactants / Rate of the reaction when molar concentration of the reactant becomes unity.

   (i) Unit: time-1 or s-1.

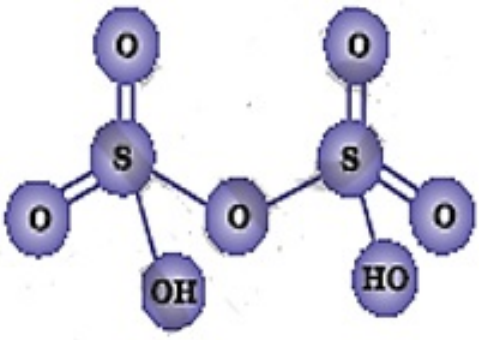
   (ii) Unit : L mol-1 time-1 or M^{-1} s^{-1}

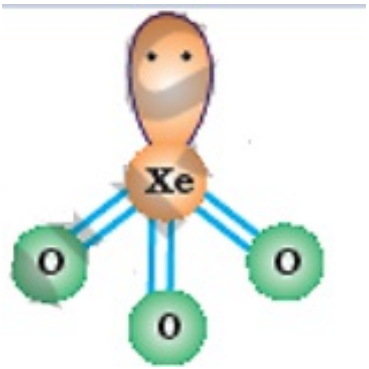
8. **Write the structures of the following:**

   (i) $H_2S_2O_7$

   (ii) XeO_3

   Ans.

i) 

(ii) 

9. **Derive the relationship between relative lowering of vapour pressure and molar mass of the solute.**

   Ans. As per Raoult's law pA = x_A p_A^o

$P_A = p_A^o(1 - x_B) = p_A^o - p_A^o x_B$

$(p_A^o - p_A) / p_A^o = x_B$

$\Delta p / p_A^o = X_B = w_B M_A / M_B w_A$

$$MB = \frac{w_B M_A}{(\Delta p / p_A^o) w_A}$$

10. **Write down the IUPAC name of the complex $[Co(NH_3)5(CO_3)]$ Cl. What type of isomerism is shown by this complex?**

OR

Using IUPAC norms write the formulae for the following coordination compounds:

i. **Tetrachloridocuprate(II)**
ii. **Potassium tetrahydroxozincate(II)**

Ans. Pentaamminecarbonatocobalt(III) chloride. Ionization isomerism

OR

i. $[CuCl_4]^{2-}$
ii. $K_2[Zn(OH)^4]$

11. **Give reasons for the following:**
    i. Dinitrogen is a gas but phosphorus is a solid.
    ii. Bond angle decreases from H_2O to H_2Te.

    Halogens have the maximum negative electron gain enthalpy.

Ans.

i. Because of pπ-pπ multiple bonding in nitrogen (diatomic) which is absent in phosphorus (polymeric / polyatomic).
ii. Because of decrease in tendency of sp^3 hybridisation from H_2O to H_2Te .

iii. Due to their smallest atomic sizes in respective periods, or due to the fact that they have only one electron less than the next noble gas configuration.

12. **How do you convert the following :**
    i. **Aniline to benzene**
    ii. **Ethanamide to methanamine**
    iii. **Nitrobenzene to aniline**

OR

Write the chemical equations involved when $C_2H_5NH_2$ is treated with the following reagents:

i. **CH_3COCl/pyridine**
ii. **$C_6H_5SO_2Cl$**
iii. **$CHCl_3$ + KOH**

Ans.

i. $C_6H_5NH_2 \xrightarrow{NaNO_2+HCl\ /\ 278K} C_6H_5N_2Cl \xrightarrow{H_3PO_2+H_2O} C_6H_6$
ii. $CH_3\text{-}CONH_2 \xrightarrow{KOH\ +\ Br_2} CH_3NH_2$
iii. $C_6H_5NO_2 \xrightarrow{Sn+HCl\ or\ Fe+HCl} C_6H_5NH_2$

OR

i. $C_2H_5NH_2 + CH_3COCl \xrightarrow{pyridine} C_2H_5\text{-}NHCOCH_3 + HCl$
ii. $C_2H_5NH_2 + C_6H_5SO_2Cl \longrightarrow C_2H_5NH\text{-}O_2SC_6H_5 + HCl$
iii. $C_2H_5NH_2 + CHCl_3 + KOH \rightarrow C_2H_5NC + KCl + H_2O$

13. **Define the following terms:**
    (i) F-centre
    (ii) p-type semiconductor
    (iii) Ferrimagnetism

Ans

i. In a catalysis process when the reactants and catalyst occur in same phase , the process is called homogeneous catalysis.
ii. The process of settling of colloidal particles forming precipitate is called coagulation.
iii. Polymeric substances or macromolecules when added to suitable solvents form solutions in which the size of the macromolecules may be in colloidal range. Such colloids are known as macromolecular colloids.

14. **The rate constant of a first order reaction increases from 2×10^{-2} to 8×10^{-2} when the temperature changes from 300 K to 320 K. Calculate the energy of activation (E_a). (log 2 = 0.301, log 3 = 0.4771, log 4 = 0.6021)**

Ans. $\log (k_2 / k_1) = (E_a / 2.303R) (T_2-T_1) /T_1T_2$

$\log [(8x10^{-2})/(2x10^{-2})] = 20 E_a / 2.303x8.314x300x320$

$E_a = [\log(4)x2.303x8.314x300x320] / 20$

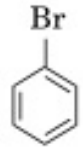
$E_a = 55336.8 \text{ J mol}^{-1} = 55.34 \text{ kJ mol}^{-1}$.

15. **Define the following terms:**
(i) Homogeneous catalysis
(ii) Coagulation
(iii) Macromolecular colloids

Ans

i. In a catalysis process when the reactants and catalyst occur in same phase , the process is called homogeneous catalysis.
ii. The process of settling of colloidal particles forming precipitate is called coagulation.
iii. Polymeric substances or macromolecules when added to suitable solvents form solutions in which the size of the macromolecules may be in colloidal range. Such colloids are known as macromolecular colloids.

16. **Write the structure of the major product in each of the following reactions :**
1. $CH_3\text{-}CH{=}CH_2 + H_2O \xrightarrow{H^+}$
2. $CH_3 - CH_2 - \underset{\displaystyle Br}{\underset{|}{CH}} - CH_3 + KOH \xrightarrow{\text{ethanol/heat}}$

3.  $+CH_3COCl \xrightarrow{anhyd.\ AlCl_3}$

Ans.

i. CH_3- CH(OH)-CH_3

ii. CH_3-CH=CH-CH_3

iii. p-Br-C_6H_4-CO-CH_3

17. i. **Mention the principle behind the zone refining of metals.**
    ii. **What is the role of dilute NaCN in the extraction of gold?**
    iii. **Which form of iron is the purest form of commercial iron?**

Ans.

i. The impurities are more soluble in the melt of metal than in solid state of the metal.

ii. As leaching agent, thereby oxidizing the metal into soluble cyanocomplex / $[Au(CN)_2]$-.

iii. Wrought iron

18. **When 1.5 g of a non-volatile solute was dissolved in 90 g of benzene, the boiling point of benzene raised from 353.23 K to 353.93 K. Calculate the molar mass of the solute. (Kb for benzene = 2.52 K kg mol–1)**

Ans. $\Delta T_b = K_b\ m$

$\Delta T_b = K_b\ (WB \times 1000 / M_B \times W_A)$

$353.93-353.23 = 2.52 \times 1.5 \times 1000 / M_B \times 90$

$M_B = (2.52 \times 1.5 \times 1000) / (0.7 \times 90)$

$= 60.0$ g mol-1.

19. i. **Write the product obtained when D-glucose reacts with Br_2 water.**
    ii. **What type of linkage is present in proteins?**
    iii. **Write one difference between DNA and RNA.**

Ans.

i. Gluconic acid or $COOH-(CHOH)_4-CH_2OH$

ii. Peptide linkage or -NH-CO- links

iii.

s.no	DNA	RNA
1	Sugar is 2-deoxy ribose	Sugar is ribose
2	Double helical structure	Single stranded structure

20. a. **Write the hybridization and shape of**

i. **$[Co(NH_3)_6]^{3+}$**

ii. **$[NiCl_4]^{2-}$**

(Atomic number : Co = 27, Ni = 28)

b. **Out of NH_3 and 'en', which ligand forms more stable complex with metal and why?**

Ans.

a. i. d^2sp^3 ; Octahedral

ii. sp^3 ; Tetrahedral

b. 'en' , forms chelate .

21. **Write the names and structures of the monomers of the following polymers:**

i. **Buna-N**

ii. **Bakelite**

iii. **Teflon**

Ans.

i. But-1,3-diene, Acrylonitrile; $CH_2=CH-CH=CH_2$, $CH_2=CH-CN$

ii. Phenol, Formaldehyde; C_6H_5OH, HCHO

iii. Tetrafluoroethylene; $CF_2=CF_2$

22. **Give reasons for the following:**

(i) Dinitrogen is a gas but phosphorus is a solid.

(ii) Bond angle decreases from H2O to H2Te.

(iii) Halogens have the maximum negative electron gain enthalpy.

Ans.

i. Because of pπ-pπ multiple bonding in nitrogen (diatomic) which is absent in phosphorus (polymeric / polyatomic).

ii. Because of decrease in tendency of sp^3 hybridisation from H_2O to H_2Te .

iii. Due to their smallest atomic sizes in respective periods, or due to the fact that they have only one electron less than the next noble gas configuration.

23. Seeing the growing cases of diabetes and depression among young children, Mr. Chopra, the principal of one reputed school organized a seminar in which he invited parents and principals. They all resolved this issue by strictly banning junk food in schools and introducing healthy snacks and drinks like soup, lassi, milk, etc. in school canteens. They also decided to make compulsory half an hour of daily physical activities for the students in the morning assembly. After six months, Mr. Chopra conducted the health survey in most of the schools and discovered a tremendous improvement in the health of the students.

After reading the above passage, answer the following questions:

i. What are the values (at least two) displayed by Mr. Chopra?

ii. As a student, how can you spread awareness about this issue?

iii. Why should antidepressant drugs not be taken without consulting a doctor?

iv. Give two examples of artificial sweeteners.

Ans.

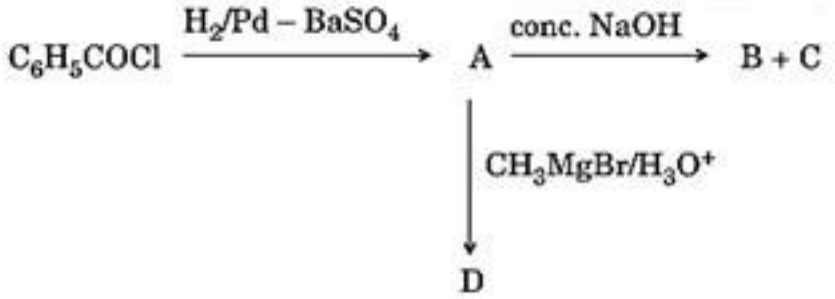
i. Social awareness ,Health conscious, Caring , empathy, concern .(or any other two values)

ii. Cartoon display / street play/poster making (or any other correct answer)

iii. Wrong choice and over dose may be harmful.

iv. Saccharin , Aspartame

24. i. **Write the structures of A, B, C and D**



ii. **Distinguish between the following:**

i. **C_6H_5 -$COCH_3$ and C_6H_5 - CO CH_2CH_3**

ii. **Benzoic acid and Phenol**

iii. **Write the structure of 2-hydroxybenzaldehyde.**

OR

a. **Write the structures of the main products when ethanal (CH_3 - CHO) reacts with the following reagents:**

i. **HCN**

ii. **H_2N - NH_2/H+**

iii. **$LiAlH_4$**

b. **Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction:**
$C_6H_5COCH_3$, CH_3 - CHO, CH_3 - CO - CH_3

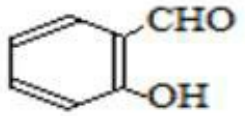
c. **Give a simple chemical test to distinguish between the following pair of compounds:**
CH_3CH_2CHO andCH_3CHO

Ans.

a. A is C_6H_5CHO; B & C/ C & B are $C_6H_5CH_2OH$ & C_6H_5COONa D is $C_6H_5CH(OH)CH_3$

b. i. C_6H_5-CO-CH_3 forms yellow coloured CHI_3 on heating with I_2+KOH / NaOH but C_6H_5-CO-CH_2-CH_3 does not / equation form.

ii. With neutral $FeCl_3$, phenol gives violet coloration but benzoic acid does not. (any other suitable test).

c. 

OR

a. $CH_3CH(OH)CN$

   i. $CH_3CH=N-NH_2$

   ii. CH_3CH_2OH

b. $C_6H_5-CO-CH_3 < CH_3-CO-CH_3 < CH_3-CHO$

c. CH_3CHO gives yellow precipitate of CHI_3 with I_2 + KOH but CH_3CH_2CHO does not/ equation form

25. **Calculate e.m.f. and ΔG for the following cell:**

Ni (s) | $Ni2^+$ (0.01 M) || Ag^+ (0.001 M) | Ag (s)

Given : $E^0_{(Ni2+/Ni)}$ = - 0.25 V, $E^0_{(Ag+/Ag)}$ = + 0.80 V

OR

a. **The conductivity of 0.1 mol L^{-1} solution of NaCl is 1.06 $\times 10^{-2}$ S cm^{-1}. Calculate its molar conductivity and degree of dissociation (α). Given $\lambda^0(Na^+)$ = 50.1 S cm^2 mol^{-1} and $\lambda^0(Cl^-)$ = 76.5 S cm^2 mol^{-1}.**

b. **What is the difference between primary battery and secondary battery ? Give one example of each type.**

Ans. $E_{Cell} = (E^o_{Ag} - E^o_{Ni}) - (0.0591/n) \log[Ni^{2+}/(Ag^+)^2]$

$= (0.80 + 0.25) - 0.02955\log(10^{-2}/10^{-6})$

$= 1.05 - 0.0178 = 1.0322$ V

$\Delta G = - n F E_{cell}$

$= - 2 \times 96500 \times 1.0322$

$= - 199214$ J mol^{-1} = - 199.2 kJ mol^{-1}

OR

a. Molar Conductivity (Λ_m) = 1000 K / C

= (1000 x 1.06 x10^{-2}) / 0.1

= 106 S cm^{-2} mol^{-1}.

Deg. of dissociation (α) = Λ_m / Λ^0_m

= 106 / (50.1+76.5)

= 0.8373

b. Primary battery- non rechargeable whereas secondary battery is chargeable.
Eg: primary battery-dry cell, mercury cell(any one) , secondary battery- lead storage battery, Ni-Cd battery(any one)

26. a. **Account for the following :**

i. **Ce^{4+} is a strong oxidizing agent in aqueous solution.**

ii. **Transition metals have high enthalpy of atomization.**

iii. **Mn shows maximum number of oxidation states in 3d series.**

b. **Complete the following equations :**

i. **2 Mn O_4^- + 6 H^+ + 5 N O_2^- →**

ii. **Cr_2 O_7^{2-} + 14 H^+ + 6 Fe^{2+} →**

OR

a. **Account for the following :**

i. **Transition metals form coloured compounds.**

ii. **Cr^{2+} is a strong reducing agent.**

iii. **Actinoids show irregularities in their electronic configurations.**

b. **Define lanthanoid contraction. Write the common oxidation state of lanthanoids.**

Ans.

a. i. Ce^{4+} gets reverted to 3+ oxidation state in aqueous medium hence is a good oxidizing agent/ Ce is more stable in +3 oxidation state.

ii. Due to very strong metal-metal bonding (involving large no. Of electrons of the d-orbitals)

iii. Mn has maximum no. of unpaired electrons in 3d-orbitals.

b. i. $2MnO_4^- + 6H^+ + 5NO_2^- \rightarrow 2Mn^{2+} + 5\ NO_3^- + 3\ H_2O$

ii. $Cr_2O7^{2-} + 14H^+ + 6\ Fe^{2+} \rightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$

OR

a. i. Due to d-d transitions (involving absorption of energy in visible range) / unpaired electrons in d- orbitals.

ii. Because Cr is more stable in +3 oxidation state.

iii. Due to stability of $5f^0$, $5f^7$, $5f^{14}$ / very small energy difference comparable energy among 5f, 6d, and 7s orbitals.

b. The overall decrease in atomic and ionic radii from La to Lu (due to poor shielding effect of 4f electrons) is called Lanthanoid contraction. Common oxidation state of Lanthanoids is +3.