CBSE-XII-2014 EXAMINATION

# CHEMISTRY

**SET-1**

**Series OSR**

Paper & Solution

**Code: 56/1**

Time: 3 Hrs.

Max. Marks: 70

**General Instructions:**

*(i) **All** questions are compulsory.*

*(ii) Questions number **1** to **8** are very short-answer questions and carry **1** mark each.*

*(iii) Questions number **9** to **18** are short-answer questions and carry **2** marks each.*

*(iv) Questions number **19** to **27** are also short-answer questions and carry **3** marks each.*

*(v) Questions number **28** to **30** are long-answer questions and carry **5** marks each.*

*(vi) Use Log Tables, if necessary. Use of calculators is **not** allowed.*

**1.** What is the effect of temperature on chemisorptions?

**Solution:**

It first increases then decreases or graphical representation.

**2.** What is the role of zinc metal in the extraction of silver ?

**Solution:**

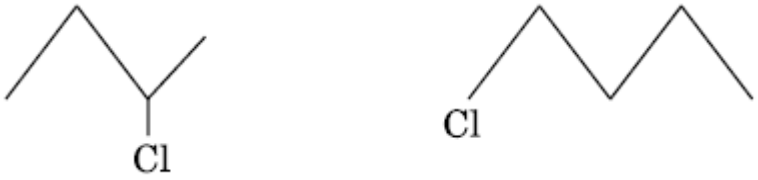
Zn acts as reducing agent.

**3.** What is the basicity of $H_3PO_3$ ?

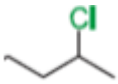
**Solution:**

2

**4.** Identify the chiral molecule in the following pair :




**Solution:**

2–Chlorobutane or 

or first molecule of the pair.

**5.** Which of the following is a natural polymer ?
Buna-S, Proteins, PVC

**Solution:**

Proteins

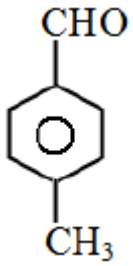
**6.** The conversion of primary aromatic amines into diazonium salts is known as _____ .
**Solution:**

Diazotization

**7.** What are the products of hydrolysis of sucrose ?
**Solution:**

Glucose & Fructose

**8.** Write the structure of p-methylbenzaldehyde.
**Solution:**




**9** An element with density $2.8\ g\ cm^{-3}$ forms a f.c.c. unit cell with edge length $4\times10^{-8}$ cm. Calculate the molar mass of the element.
$\left(Given:\ N_A = 6.022\times10^{23}\ mol^{-1}\right)$
**Solution:**

Given; d = 2.8g/cm$^3$ ; Z = 4 ; a = 4 × 10$^{-8}$ cm NA = 6.022 × 10$^{23}$ per mol

$$d = \frac{Z\times M}{a^3\times N_A} \quad \text{or} \quad M = \frac{d\times a^3\times N_A}{Z}$$

$$\Rightarrow M = \frac{2.8gcm^{-3}(4\times10^{-8}cm)^3\times6.022\times10^{23}}{4}$$

M = 2.8 × 16 x 10$^{-1}$ × 6.022 = 26.97 g/mol

**10.** (i) What type of non-stoichiometric point defect is responsible for the pink colour of LiCl ?
(ii) What type of stoichiometric defect is shown by NaCl ?

**OR**

How will you distinguish between the following pairs of terms :
(i) Tetrahedral and octahedral voids
(ii) Crystal lattice and unit cell
**Solution:**

(i) Metal excess defect / Metal excess defect due to anionic vacancies filled byfreeelectrons / Due to F – centers.
(ii) Schottky defect.

**Or**

(i) Tetrahedral void is surrounded by 4 constituent particles (atoms / molecules / ions).
Octahedral void is surrounded by 6 constituent particles (atoms / molecules / ions).

OR

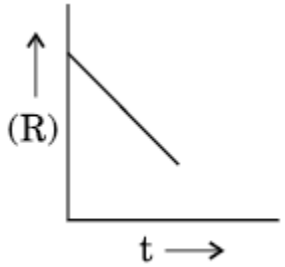
radius ratio ($r^+ / r^-$) for Tetrahedral void is 0.225 & radius ratio for octahedral voids is 0.414

(ii) A regular three dimensional arrangement of points in space is called a **crystal lattice**.
**Unit cell** is the smallest portion of a crystal lattice which, when repeated in three directions, generates an entire lattice. / unit cell is the miniature of crystal lattice / microscopic edition of the crystal lattice.

**11.** State Kohlrausch law of independent migration of ions. Why does the conductivity of a solution decrease with dilution ?
**Solution:**

**Kohlrausch law of independent migration of ions**. The law states that limiting molar conductivity of an electrolyte can be stated as the sum of the individual contributions of the anion and cation of the electrolyte. On dilution,the conductivity (κ) of the electrolyte decreases as the number of ions per unit volume of solution decreases.

**12.** For a chemical reaction R → P, the variation in the concentration (R) vs. time (t) plot is given as




(i) Predict the order of the reaction.
(ii) What is the slope of the curve ?
**Solution:**

(i) Zero order reaction
(ii) slope = -k

**13.** Explain the principle of the method of electrolytic refining of metals. Give one example.
**Solution:**

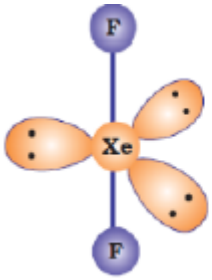
In this method, the impure metal is made to act as anode. A strip of the same metal in pure form is used as cathode. They are put in a suitable electrolytic bath containing soluble used as cathode. They are put in a suitable electrolytic bath containing soluble salt of the same metal. Pure metal is deposited at the cathode and impurities remain in the solution.
For example: electro refining of Cu, Ag, Au (any one)

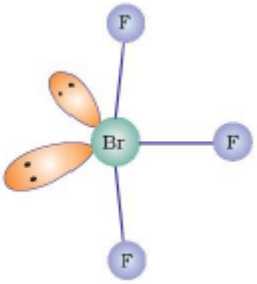
**14.** Complete the following equations :
(i) $P_4 + H_2O \rightarrow$
(ii) $XeF_4 + O_2F_2 \rightarrow$
**Solution:**

(i) $P_4 + H_2O \rightarrow$ no reaction or if attempted in any form, award one mark

(ii) $XeF_4 + O_2F_2 \rightarrow XeF_6 + O_2$.

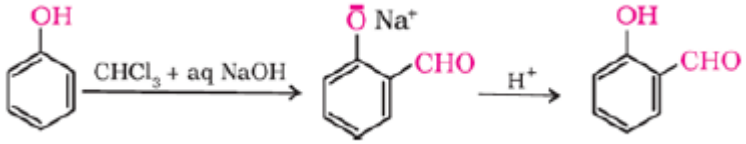
**15.** Draw the structures of the following :
(i) $XeF_2$
(ii) $BrF_3$
**Solution:**




**16.** Write the equations involved in the following reactions :
(i) Reimer – Tiemann reaction
(ii) Williamson synthesis
**Solution:**

**Reimer-Tiemann reaction**



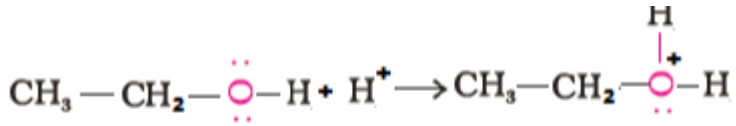

**Williamson synthesis**

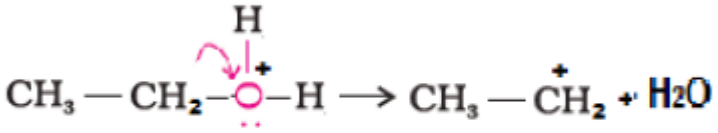

**17.** Write the mechanism of the following reaction :

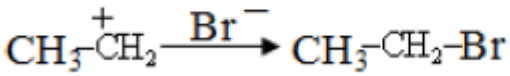
$$CH_3CH_2OH \xrightarrow{HBr} CH_3CH_2Br + H_2O$$

**Solution:**

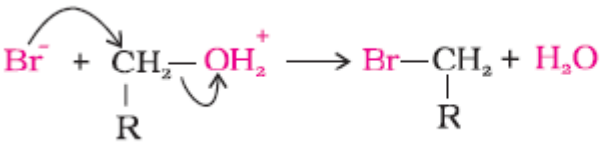
**HBr → $H^+$ + Br**







Or



( where R = -$CH_3$)

**18.** Write the name of monomers used for getting the following polymers :
(i) Bakelite
(ii) Neoprene
**Solution:**

(i) Phenol & Formaldehyde
(ii) 2–Chloro–1,3–butadiene (or Chloroprene)

**19** (a) Calculate $\Delta_r G^o$ for the reaction
Mg (s) + $Cu^{2+}$ (aq) → $Mg^{2+}$ (aq) + Cu (s)
Given : $E^o$ cell = + 2.71 V, 1 F = 96500 C $mol^{-1}$
(b) Name the type of cell which was used in Apollo space programme for providing electrical power.
**Solution:**

(a) Given $E^oCell$ = +2.71V & F = 96500C $mol^{-1}$ n = 2 (from the given reaction)
$\Delta rG^O$ = – n x F x EoCell
$\Delta rG^O$ = – 2 x 96500 C mol-1 x 2.71V
= - 523030 J / mol or - 523.030 kJ / mol
(b) Hydrogen – oxygen fuel Cell / Fuel cell.

**20.** The following data were obtained during the first order thermal decomposition of $SO_2Cl_2$ at a constant volume :

$$SO_2Cl_2(g) \longrightarrow SO_2(g) + Cl_2(g)$$

| Experiment | Time/$s^{-1}$ | Total pressure/atm |
|---|---|---|
| 1 | 0 | 0.4 |
| 2 | 100 | 0.7 |

Calculate the rate constant.
(Given : log 4 = 0.6021, log 2 = 0.3010)

**Solution:**

| | $SO_2Cl_2$ | $\rightarrow SO_2 +$ | $Cl_2$ |
|---|---|---|---|
| At $t = 0s$ | 0.4 atm | 0 atm | 0 atm |
| At $t = 100s$ | $(0.4 - x)$ atm | $x$ atm | $x$ atm |

Pt = 0.4 – x + x + x

Pt = 0.4 + x

0.7 = 0.4 + x

x = 0.3

$$k = \frac{2,303}{t} \log \frac{pi}{2pi^{-} pt}$$

$$k = \frac{2,303}{t} \log \frac{0,4}{0,8 - 0,7}$$

$$k = \frac{2,303}{100_s} \log \frac{0,4}{0,1}$$

$$k = \frac{2,303}{100_s} x0.6021 = 1.39x10^{-2} s^{-1}$$

**21.** What are emulsions ? What are their different types ? Give one example of each type.
**Solution:**

These are liquid-liquid colloidal systems or the dispersion of one liquid in another liquid.
**Types:** (i) Oil dispersed in water (O/W type) Example; milk and vanishing cream
(ii) Water dispersed in oil (W/O type) Example; butter and cream.
**(Any one example of each type)**

**22.** Give reasons for the following :
(i) $(CH_3)_3$ P = O exists but $(CH_3)_3$ N = O does not.
(ii) Oxygen has less electron gain enthalpy with negative sign than sulphur.
(iii) $H_3PO_2$ is a stronger reducing agent than $H_3PO_3$.
**Solution:**

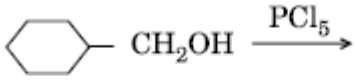
(i) As N can't form 5 covalent bonds / its maximum covalency is four.
(ii) This is due to very small size of Oxygen atom / repulsion between electrons is large in relatively small 2p sub-shell.
(iii) In $H_3PO_2$ there are 2 P–H bonds, whereas in $H_3PO_3$ there is 1 P–H bond

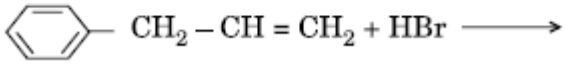
**23.** (i) Write the IUPAC name of the complex $[Cr(NH_3)_4 Cl_2]Cl$.
(ii) What type of isomerism is exhibited by the complex $[Co(en)3]^{3+}$ ? (en = ethane-1,2-diamine)
(iii) Why is $[NiCl_4]_{2-}$ paramagnetic but $[Ni(CO)_4]$ is diamagnetic ?
(At. nos. : Cr = 24, Co = 27, Ni = 28)
**Solution:**

(i) Tetraamminedichloridochromium (III) chloride.
(ii) Optical isomerism
(iii) In $[NiCl_4]_{2-}$ ; Cl– acts as weak ligand therefore does not cause forced pairing, will thuselectron remain unpaired hence paramagnetic.

In $[Ni(CO)_4]$ ; CO acts as strong ligand therefore causes forced pairing, thus electrons Will become paired hence diamagnetic.

**24.** (a) Draw the structures of major monohalo products in each of the following reactions :

(i) 

(ii) 

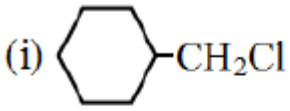
(b) Which halogen compound in each of the following pairs will react faster in $S_N2$ reaction :

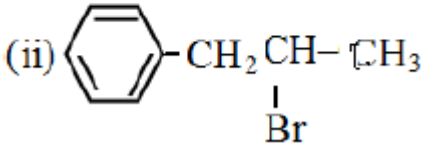
(i) $CH_3Br$ *or* $CH_3I$

(ii) $(CH_3)_3C-Cl$ or $CH_3-Cl$

**Solution:**

(a)

(i) 

(ii) 

(b) (i) $CH_3$–I

(ii) $CH_3$–Cl

**25.** Account for the following :

(i) Primary amines (R-$NH_2$) have higher boiling point than tertiary amines ($R_3N$).

(ii) Aniline does not undergo Friedel – Crafts reaction.

(iii) $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution.

**OR**

Give the structures of A, B and C in the following reactions :

(i) $C_6H_5NO_2 \xrightarrow{Sn+HCl} A \xrightarrow[273K]{NaNO_2+HCl} B \xrightarrow{H_2O} C$

(ii) $CH_3CN \xrightarrow{H_2O/H^+} A \xrightarrow[\Delta]{NH_3} B \xrightarrow{Br_2+KOH} C$

**Solution:**

(i) As primary amines form inter molecular H – bonds, but tertiary amines don't form H – bonds.

(ii) Aniline forms salt with Lewis acid AlCl3.

(iii) This is because of the combined effect of hydration and inductive effect (+I effect).

**Or**

(i) $C_6H_5NO_2 \xrightarrow{Sn+HCl} \underset{A}{C_6H_5NH_2} \xrightarrow{NaNO_2+HCl;173K} \underset{B}{C_6H_5N_2^+Cl^-} \xrightarrow{H^2O} \underset{C}{C_6H_5OH}$

(ii) $CH_3CN \xrightarrow{H_2O/H^+} \underset{A}{CH_3COOH} \xrightarrow[\Delta]{NH_3} \underset{B}{CH_3CONH_2} \xrightarrow{Br_2+KOH} \underset{C}{CH_3NH_2}$

**26.** Define the following terms as related to proteins :
(i) Peptide linkage
(ii) Primary structure
(iii) Denaturation
**Solution:**

(i) Peptide linkage is an amide formed between –COOH group and $–NH_2$ group ( -CO-NH- )
(ii) Specific sequence of amino acids in a polypeptide chain is said to be the **primary structure** of the protein.
(iii) When a protein in its native form, is subjected to change in temperature or change in pH, protein loses its biological activity. This is called **denaturation of protein**

**27.** On the occasion of World Health Day, Dr. Satpal organized a 'health camp' for the poor farmers living in a nearby village. After check-up, he was shocked to see that most of the farmers suffered from cancer due to regular exposure to pesticides and many were diabetic. They distributed free medicines to them. Dr. Satpal immediately reported the matter to the National Human Rights Commission (NHRC). On the suggestions of NHRC, the government decided to provide medical care, financial assistance, setting up of super-speciality hospitals for treatment and prevention of the deadly disease in the affected villages all over India.
(i) Write the values shown by
(a) Dr. Satpal
(b) NHRC.
(ii) What type of analgesics are chiefly used for the relief of pains of terminal cancer ?
(iii) Give an example of artificial sweetener that could have been recommended to diabetic patients.
**Solution:**

(i) (a) dedicated towards work/ kind/ compassionate (any two).
(b) Dutiful / caring / humane in the large interest of public health in rural area. (any other suitable value)
(ii) Narcotic analgesics
(iii) Aspartame / Saccharin / Alitame / Sucrolose.(any one)

**28.** (a) Define the following terms :
(i) Molarity
(ii) Molal elevation constant ($K_b$)
(b) A solution containing 15 g urea (molar mass = 60 g $mol^{-1}$) per litre of solution in water has the same osmotic pressure (isotonic) as a solution of glucose (molar mass = 180 g $mol^{-1}$) in water. Calculate the mass of glucose present in one litre of its solution.

**OR**

(a) What type of deviation is shown by a mixture of ethanol and acetone ? Give reason.
(b) A solution of glucose (molar mass = 180 g $mol^{-1}$) in water is labelled as 10% (by mass). What would be the molality and molarity of the solution ?
(Density of solution = 1.2 g $mL^{-1}$)
**Solution:**

(a)
(i) Molarity is defined as number of moles of solute dissolved in one litre of solution.
(ii) It is equal to elevation in boiling point of 1 molal solution.
(b) For isotonic solutions: $\boldsymbol{\pi}$ urea = $\boldsymbol{\pi}$ glucose

$$\frac{W_{urea}}{M_{urea}xV_s} = \frac{W_{Glucose}}{M_{Glucose}xV_s} \text{ (As volume of solution is same)}$$

$$\frac{W_{urea}}{M_{urea}} = \frac{W_{Glucose}}{M_{Glucose}} \text{ or } \frac{15g}{60g\ mol^{-1}} = \frac{W_{Glucose}}{180g\ mol^{-1}}$$

$$W_{Glucose} = \frac{15g \times 180g\ mol^{-1}}{60g\ mol^{-1}} = 45g$$

OR

(a) It shows positive deviation.
It is due to weaker interaction between acetone and ethanol than ethanol-ethanol interactions.
(b) Given: WB = 10g WS = 100g, WA = 90g MB = 180g/mol & d = 1.2g/m L

$$M = \frac{Wt\% \times \text{dencity} \times 10}{Mol.wt.}$$

$$M = \frac{10 \times 1.2 \times 10}{180} = 0.66M \text{ or } 0.66 \text{ mol/L}$$

$$m = \frac{W_B \times 1000}{M_B \times W_A(\text{in g})}$$

$$m = \frac{10 \times 1000}{180 \times 90}$$

= 0.61m or 0.61mol/kg **(or any other suitable method)**

**29.** (a) Complete the following equations :
(i) $Cr_2O_7^{2-} + 2OH^- \longrightarrow$
(ii) $MnO_4^- + 4H^+ + 3e^- \longrightarrow$
(b) Account for the following :
(i) Zn is not considered as a transition element.
(ii) Transition metals form a large number of complexes.
(iii) The $E^\circ$ value for the $Mn^{3+}/Mn^{2+}$ couple is much more positive than that for $Cr^{3+}/Cr^{2+}$ couple.

**OR**

(i) With reference to structural variability and chemical reactivity, write the differences between lanthanoids and actinoids.
(ii) Name a member of the lanthanoid series which is well known to exhibit +4 oxidation state.
(iii) Complete the following equation :
$Mn_4^- + 8H^+ + 5e^- \rightarrow$
(iv) Out of $Mn^{3+}$ and $Cr^{3+}$, which is more paramagnetic and why ?
(Atomic nos. : Mn = 25, Cr = 24)
**Solution:**

(a) (i) $Cr_2O_7^{2-} + 2OH^- \rightarrow 2CrO_4^{2-} + H_2O$
(ii) $MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$
(b) (i) Zn / Zn2+ has fully filled d orbitals.
(ii) This is due to smaller ionic sizes / higher ionic charge and availability of d orbitals.
(iii) because Mn $^{+2}$ is more stable($3d^5$) than $Mn^{3+}$ ($3d^4$). $Cr^{+3}$ is more stable due to $t2g^3$ / $d^3$ configuration.

Or

(i)

| **Lanthanoids** | **Actinoids** |
|---|---|

| | |
|---|---|
| Atomic / ionic radii does not show much variation / +3 is the most common oxidation state, in few cases +2 & +4 | Atomic / ionic radii show much variation Besides +3 oxidation state they exibit +4,+5,+6,+7 also. |
| They are quite reactive | Highly reactive in finely divided state |

**(Any two Points)**

(ii) Cerium (Ce4+)

(iii) $MnO^{4-} + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

(iv) $Mn^{3+}$ is more paramgnetic

Because $Mn^{3+}$ has 4 unpaired electrons ($3d^4$) therefore more paramagnetic whereas $Cr^{3+}$ has 3 unpaired electrons ($3d^3$).

**30.** (a) Write the products formed when $CH_3CHO$ reacts with the following reagents :

(i) HCN

(ii) $H_2N - OH$

(iii) $CH_3CHO$ in the presence of dilute NaOH

(b) Give simple chemical tests to distinguish between the following pairs of compounds :

(i) Benzoic acid and Phenol

(ii) Propanal and Propanone

**OR**

(a) Account for the following :

(i) $Cl - CH_2COOH$ is a stronger acid than $CH_3COOH$.

(ii) Carboxylic acids do not give reactions of carbonyl group.

(b) Write the chemical equations to illustrate the following name reactions :

(i) Rosenmund reduction

(ii) Cannizzaro's reaction

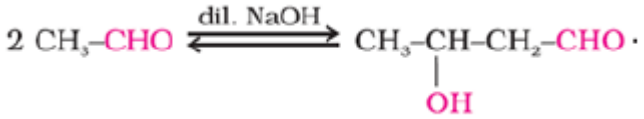
(c) Out of $CH_3CH_2 - CO - CH_2 - CH_3$ and $CH_3CH_2 - CH_2 - CO - CH_3$, which gives iodoform test ?

**Solution:**

(a) (i)


(ii) $CH_3CH{=}N{-}OH$

(iii)



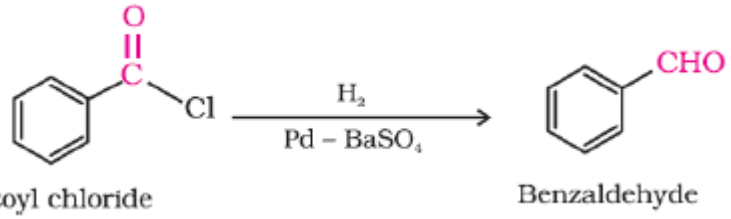

(b) (i) Add neutral FeCl3 in both the solutions, phenol forms violet colour but benzoic acid does not.

(ii) **Tollen's reagent test**: Add ammoniacal solution of silver nitrate (Tollen's reagent) in both the solutions propanal gives silver mirror whereas propanone does not. (or any other correct test)

(a) (i) As Cl acts as electron withdrawing group ( – I effect) ,$CH_3$ shows +I effect.

(ii) The carbonyl carbon atom in carboxylic acid is resonance stabilised.

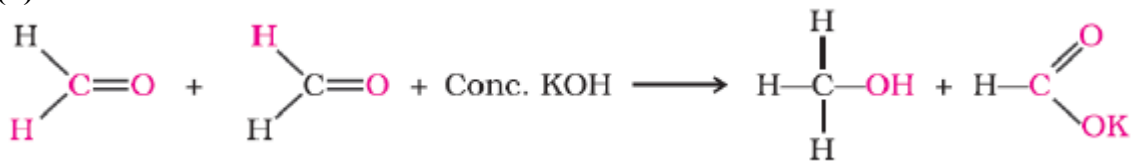
(b) (i) **Rosenmund reduction:**




Benzoyl chloride Benzaldehyde

Or $RCOCl \xrightarrow{H_2/Pd-BaSO_4} RCHO + HCl$.

**(ii) Cannizzaro's Reaction:**




Or With bezaldehyde

(c) $CH_3–CH_2–CH_2–CO–CH_3$.