CONTENTS

SOLVED SAMPLE PAPERS

DAV CENTENARY PUBLIC SCHOOL, PASCHIM ENCLAVE, NEW DELHI-87

CHEMISTRY

WEIGHTAGE

CLASS-XII (TERM-2)

S.No	UNIT	No. of Periods	MARKS
1	Electrochemistry	7	13
2	Chemical Kinetics	5	
3	Surface Chemistry	5	
4	*d*-and *f*-Block Elements	7	9
5	Coordination Compounds	8	
6	Aldehydes, Ketones and Carboxylic Acids	10	13
7	Amines	7	
TOTAL		**49**	**35**

DAV CENTENARY PUBLIC SCHOOL, PASCHIM ENCLAVE, NEW DELHI-87

PRACTICE PAPER–1

***Time Allowed:* 2 Hours** **Maximum Marks: 35**

General Instructions:

(*i*) *There are* 12 *questions in this question paper with internal choice.*

(*ii*) *Section A - Q. No.* 1 *to* 3 *are very short answer questions carrying* 2 *marks each.*

(*iii*) *Section B - Q. No.* 4 *to* 11 *are short answer questions carrying* 3 *marks each.*

(*iv*) *Section C- Q. No.* 12 *is case based question carrying* 5 *marks.*

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

(*vi*) *Use of log tables and calculators is not allowed*

SECTION-A

1. Out of the following pairs, predict with reason which pair will allow greater conduction of electricity (Any two) **2**

(*a*) Silver wire at 30°C or silver wire at 60°C

(*b*) 0.1 M CH_3COOH solution or 1M CH_3COOH solution

(*c*) KCl solution at 20°C or KCl solution at 50°C

Ans. (*a*) Silver wire at 30°C because conductance of metals increase with decrease in temperature due to decrease in resistance.

(*b*) 0.1 M CH_3COOH due to lower concentration, degree of ionisation increases.

(*c*) KCl at 50°C because mobility of ions increases with increase in temperature.

2. (*a*) Arrange the following in increasing order of pK_a. **2**

CH_3CH_2COOH, CH_3COOH, C_6H_5COOH, $C_6H_5CH_2COOH$

(*b*) Arrange the following in increasing order of reactivity towards $NaHSO_3$

Acetone, Acetaldehyde, Acetophenone, Formaldehyde

Ans. (*a*) $C_6H_5COOH < C_6H_5CH_2COOH < CH_3COOH < CH_3CH_2COOH$

(*b*) Acetophenone < Acetone < Acetaldehyde < Formaldehyde

3. (*a*) Write IUPAC name of $CH_3 — CH = CH —COOH$ **2**

(*b*) How will you distinguish between acetone and acetaldehyde?

Ans. (*a*) But-2-enoic acid

(*b*) Add Tollen's reagent. Acetaldehyde will form silver mirror whereas acetone will not react.

SECTION-B

4. Complete the following. **(1×3=3)**

(*a*) $CH_3COOH \xrightarrow[\Delta]{NH_3} A \xrightarrow{NaOBr} B$

(*b*) $C_6H_5NO_2 \xrightarrow{Fe/HCl} A \xrightarrow[0-5°C]{NaNO_2+HCl} B$

(*c*) $C_6H_5N_2^+Cl^- \xrightarrow[\Delta]{CuCN} A \xrightarrow{H_2O/H^+} B$

Ans. (*a*) 'A' is CH_3CONH_2,'B' is CH_3NH_2

(*b*) 'A' is $C_6H_5NH_2$,'B' is $C_6H_5N_2^+Cl^-$

(*c*) 'A' is $C_6H_5C \equiv N$'B' is C_6H_5COOH

OR

(*a*) How will you distinguish between the following pairs of compounds?

(*i*) Aniline and ethanamine (*ii*) Aniline and N-methyl aniline

(*b*) Arrange the following compounds in decreasing order of their boiling points.

Butanol, Butanamine, Butane

Ans. (*a*) (*i*) Add $NaNO_2$ + HCl. Cool it to 0 – 5°C. Add alkaline solution of phenol.
Aniline will form orange azo dye, ethanamine will not.
(*ii*) Add $CHCl_3$ and KOH (alc). Aniline will form offensive smelling compound, phenyl isocyanide, N-Methyl aniline will not react.
(*b*) Butanol > Butanamine > Butane

5. (*a*) Write electronic configuration of iron ion in the following complex ion and predict its magnetic behaviour in $[Fe(H_2O)_6]^{2+}$ (Fe = 26)
(*b*) Write IUPAC name of $[CoCl_2(en)_2]\ NO_3$
(*c*) Predict the geometry of $[Cu(NH_3)_4]^{2+}$ **(1+2)**

Ans. (*a*) t_{2g}^4, e_g^2, it has four unpaired electrons. [H_2O is weak field ligand]
(*b*) Dichloridobis (Ethane-1, 2-diamine) cobalt (III) nitrate.
(*c*) It has square planar geometry due to dsp^2 hybridisation.

OR

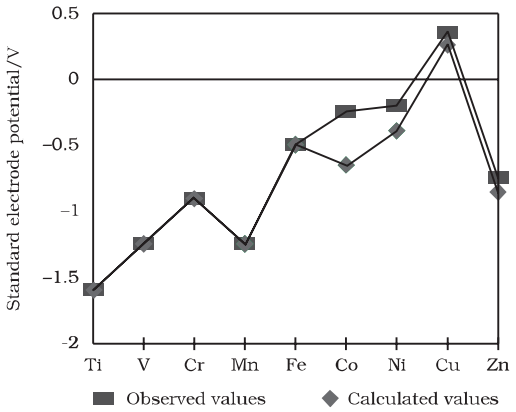
(*a*) Give the formula of potassium tetrahydroxidozincate II.
(*b*) Why $[Ni(CN)_4]^{2-}$ is diamagnetic whereas $[NiCl_4]^{2-}$ paramagnetic?
(*c*) $[Ti(H_2O)_6]^{3+}$ is violet whereas $(Ti(H_2O)_6)^{4+}$ is colourless. Why?

Ans. (*a*) $K_2[Zn(OH)_4]$
(*b*) $[Ni(CN)_4]^{2-}$ does not have unpaired electrons whereas $(NiCl_4)^{2-}$ has unpaired elections.
(*c*) $[Ti(H_2O)_6]^{3+}$ has one unpaired electron. It can undergo d-d transition by absorbing energy from visible region and radiates purple colour whereas $[Ti(H_2O)_6]^{4+}$ does not have unpaired electrons.

6. Give reasons for the following. **(1×3=3)**
(*a*) Transition metals act as catalyst.
(*b*) It is difficult to obtain oxidation state greater than two for copper.
(*c*) CrO is basic but Cr_2O_3 is amphoteric.

Ans. (*a*) It is due to large surface area and ability to show variable oxidation state.
(*b*) It is due to high third ionisation energy.
(*c*) Oxidation state of Cr in Cr_2O_3 is +3 and CrO is +2. Higher the oxidation state, lesser will be ionic character. That is why CrO is basic but, Cr_2O_3 is amphoteric.

7. Observed and calculated values for standard electrode potentials of elements from Ti to Zn in the first series are depicted in the diagram. **(3)**



Explain the following observations.
(*a*) The general trend towards less negative E° values across the series.
(*b*) The unique behaviour of copper.
(*c*) More negative E° values of Mn and Zn.

Ans. (*a*) It is due to increase in sum of first and second ionisation enthalpies.
(*b*) The high energy needed to convert Cu(s) to Cu^{2+}(aq) is not balanced by hydration energy.
(*c*) Mn^{2+} ($3d^5$) is more stable due to half filled d orbitals and Zn^{2+}($3d^{10}$) is more stable due to completely filled d-orbitals.

OR

Give reason of the following.
(*a*) Transition metals form alloys.
(*b*) Zinc has lowest enthalpy of atomisation.
(*c*) Manganese shows higher oxidation state of +4 with fluorine but shows +7 with oxygen.

Ans. (*a*) It is due to similar atomic size, they can replace each other in metallic bond.

(*b*) It is due to weak metallic bonds due to larger size and absence of unpaired electrons.

(*c*) It is because 'F' cannot form double bond whereas oxygen can form double bonds.

8. (*a*) Why do true solution not show Tyndall effect?

(*b*) Lyophilic sols are more stable than lyophobic sols. Why?

(*c*) When KI is added to excess of $AgNO_3$, positively charged AgI sol is formed. Why?

Ans. (*a*) The particles of true solutions are very small (<1 nm), do not scatter light, and hence, do not show Tyndall effect.

(*b*) In lyophilic sols, there is strong attraction between dispersed phase and dispersion medium as compared to lyophobic sols.

(*c*) It is due to adsorption of Ag^+ due to excess of $AgNO_3$ forming AgI/Ag^+.

9. Arrange the following in increasing order of property specified. **(1×3=3)**

(*a*) Aniline, ethanamine, N-ethyl ethanamine (solubility in water)

(*b*) Ethanoic acid, ethanamine, ethanol (boiling point)

(*c*) Methenamine, N, N-dimethyl methanamine, N-methyl methanamine (basic strength in aquous phase)

Ans. (*a*) Aniline < N-ethyl ethanamine < ethanamine

(*b*) Ethanamine < ethanol < ethanoic acid

(*c*) N, N-dimethyl methanamine < methanamine < N-methyl methanamine

OR

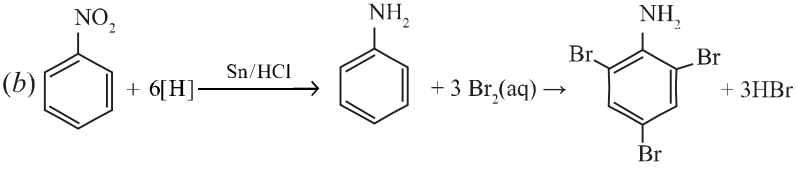
(*a*) Give a chemical test to distinguish between N-methyl ethanamine and N, N-dimethyl ethanamine.

(*b*) Write the reaction for the catalytic reduction of nitrobenzene followed by reaction of product formed with Bromine water.

(*c*) Out of butan-l-ol and butan-1-amine, which will be more soluble in water and why?

Ans. (*a*) Add Hinsberg reagent. N-methyl ethanamine will form compound insoluble in KOH while N, N - dimethyl ethanamine will not react.

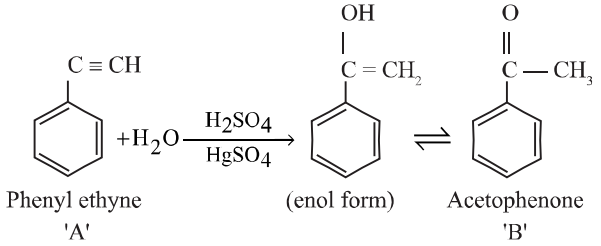
$$C_6H_5SO_2Cl + CH_3NHC_2H_5 \rightarrow C_6H_5SO_2N(CH_3)-C_2H_5 + HCl$$

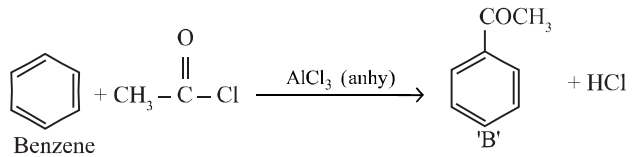
(*b*) 

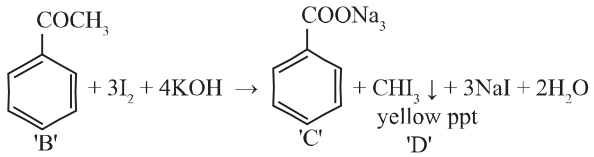
(*c*) Butan-1-ol will be more soluble in water because alcohols form stronger H – bonds than amines as oxygen is more electronegative than nitrogen.

10. An organic compound 'A' C_8H_6 on treatment with dil H_2SO_4 containing $HgSO_4$ gives a compound 'B'. 'B' can be obtained by reaction of benzene with acetyl chloride in presence of $AlCl_3$(only). 'B' on treatment with I_2 / KOH gives 'C' and a yellow ppt on 'D'. Identify A, B, C and D. Give the chemical reaction involved. **(3)**

Ans.







11. Calculate the emf of cell for the following cell reaction at 298 K and also represent the cell

$E^\circ_{cell} = 2.204V$, $Mg(s) + Sn^{2+}(0.1M) \rightarrow Mg^{2+}(0.01M) + Sn(s)$ [log 10 = 1] [$\log 10^{-1} = -1$] **(1×3=3)**

Ans. Mg (s) / Mg^{2+} (0.01 M) || Sn^{2+} (0.1M) / Sn(s)

$$E_{cell} = E^\circ_{cell} - \frac{0.0591}{n}\log\frac{[Mg^{2+}]}{[Sn^{2+}]} = 2.204V - \frac{0.0591}{2}\log\frac{[0.01]}{[0.1]}$$

$$= 2.204V - \frac{0.0591}{2}\log 10^{-1} = 2.204V + 0.0295$$

$$= 2.2335\ V$$

SECTION-C

12. Read the passage given below and answer the questions that follow. **(5)**

Most literature data for the change in food quality based either on some chemical reaction, microbial growth, death or sensory value follow a zero order or first order kinetics. The integrated equations (1) and (2) for the reaction are

$$\text{Zero order, loss } [A] = [A]_0 - k_0 t$$

$$\text{Gain } [B] = [B]_0 + k_0 t$$

$$\text{First order, loss } \ln\frac{[A]}{[A]_0} = -k_1 t$$

$$[A] = [A_0]\, e^{-k_1 t}$$

$$\text{Gain } \ln\frac{[B]}{[B]_0} = +k_1 t$$

$$[B] = [B]_0\, e^{k_1 t}$$

(*Source: T.P. Labzua, Department of Food Science and Nutrition, University of Minnesota St. Paul MN 55/08 page. 358*)

(*a*) What is order of photo chemical reaction? (1)

(*b*) If half life of reaction is independent of initial concentration, what is order of reaction? (1)

(*c*) If we plot a graph between ln[A] vs time, what will be nature of graph and slope? Draw the graph. (1)

(*d*) A first order reaction has rate constant $2 \times 10^{-3}\ s^{-1}$. How long will it take 5g of A change to 2g of B? (2)

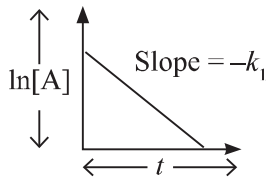
[log5 = 0.6990 log 3 = 0.4771 log2 = 0.3010]

OR

The time required to decompose 'A' to half of its initial amount is 60 minutes. If decomposition is zero order, calculate, the rate constant if initial concentration of 'A' is 0.02 M.

Ans. (*a*) Zero order (*b*) First order

(*c*)



It will be straight line as shown in diagram.

Slope = $-k_1$

(*d*) Amount [A] left after time 't' = 5 – 2 = 3g

$$t = \frac{2.303}{k}\log\frac{[A]_0}{[A]} = \frac{2.303}{2\times10^{-3}}\log\frac{5}{3}$$

$$t = \frac{2.303}{2\times10^{-3}}(\log 5 - \log 3)$$

$$= \frac{2.303\times10^{3}}{2}(0.6990 - 0.4771)$$

$$= \frac{2303}{2}\times 0.2219 = 255.51 \text{ seconds}$$

OR

$$k = \frac{[A]_0 - [A]}{t}$$

$$k = \frac{[A]_0 - [A]_0/2}{t_{1/2}} = \frac{[A]_0}{2t_{1/2}}$$

$$k = \frac{0.02}{2\times60} = \frac{1}{12}\times10^{-3}$$

$$= 0.0833 \times 10^{-3}$$

$$k = 8.33 \times 10^{-5} \text{ min}^{-1}$$

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PRACTICE PAPER – 2

***Time Allowed:* 2 Hours** **Maximum Marks: 35**

General Instructions: Same as Practice Paper-1

SECTION-A

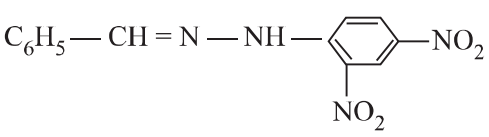
1. (*a*) Why are carboxylic acids stronger than phenol? Justify. (Any two) **(2)**

(*b*) Write the structure of 2, 4 - DNP of benzaldehyde.

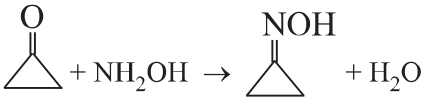
(*c*) Write reaction of cyclopropanone with hydroxyl amine

Ans. (*a*) It is because carboxylate ion is more stable than phenoxide ions due to dispersal of charge on two oxygen.

(*b*)



(*c*)



2. Give reasons. **(2)**

(*a*) It is not possible to determine Λ°_m for weak electrolyte graphically.

(*b*) Λ° of HCl is greater than that of NaCl.

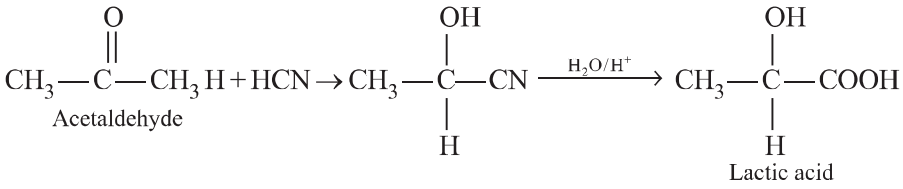
Ans. (*a*) It is because a curve cannot be extrapolated.

(*b*) Λ°_{HCl} is more than Λ°_{NaCl} because ionic mobility of H^+ is more than that of Na^+ since it is lighter than Na^+.

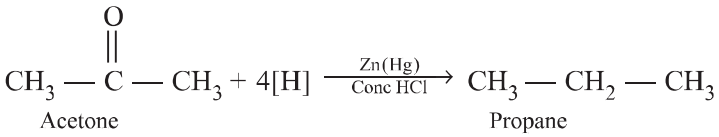
3. How will you carry out following conversions. **(2)**

(*a*) Acetaldehyde to lactic acid (*b*) Acetone to propane

Ans. (*a*)



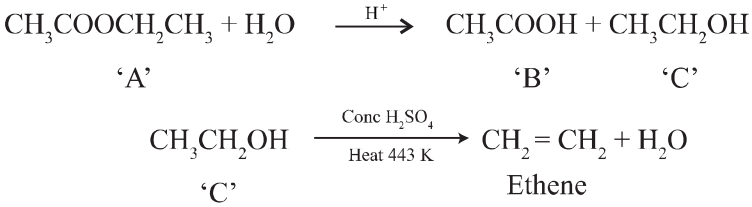
(*b*)



SECTION-B

4. An organic compound 'A' with molecular formula $C_4H_8O_2$ was hydrolysed with dil. H_2SO_4 to give a carboxylic acid 'B' and an alcohol 'C'. 'C' on dehydration gives ethene and 'C' also on oxidation gives back 'B'. Identify 'A', 'B' and 'C' and write the chemical equations for the reactions involved. **(3)**

Ans. 'A' is $CH_3COOCH_2CH_3$ (Ethyl ethanoate), 'B' is ethanoic acid and 'C' is ethanol.



$$\underset{\text{'C'}\\\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[\text{Oxidation}]{2[O]} \underset{\text{'B'}\\\text{Ethanoic acid}}{CH_3COOH}$$

5. The resistance of a conductivity cell filled with 0.1 mol L^{-1} KCl solution is 100 Ω. If the resistance of the same cell when filled with 0.02 mol L^{-1} KCl solution is 520 Ω, calculate the conductivity and molar conductivity of 0.02 mol L^{-1} KCl solution. The conductivity of 0.1 mol L^{-1} KCl solution is 1.29×10^{-2} S cm^{-1}. **(3)**

Ans.

$$K = \frac{1}{R}\times\frac{l}{a}$$

$$1.29 \times 10^{-2}\ Scm^{-1} = \frac{1}{100}\times\frac{l}{a}$$

$$\frac{l}{a} = 1.29\ cm^{-1}$$

$$K = \frac{1}{R}\times\frac{l}{a} = \frac{1}{520\ \Omega}\times 1.29\ cm^{-1} = 2.48 \times 10^{-3}\ Scm^{-1}$$

$$\Lambda_m = \frac{1000\ K}{M} = \frac{1000\times 2.48\times10^{-3} Scm^{-1}}{0.02\ mol\ L^{-1}} = 124\ Scm^2\ mol^{-1}$$

6. Complete the following. **(3)**

(*a*) $C_6H_5CH_2Cl \xrightarrow{AgNO_2} A \xrightarrow{Sn/HCl} B \xrightarrow[Alc.KOH]{CHCl_3} C$

(*b*) $CH_3NH_2 \xrightarrow{HNO_2} A \xrightarrow{PCl_5} B \xrightarrow{KCN} C$

Ans. (*a*) $\underset{\text{'A'}}{C_6H_5CH_2NO_2}$ $\underset{\text{'B'}}{C_6H_5CH_2NH_2}$ $\underset{\text{'C'}}{C_6H_5CH_2N\equiv C}$

(*b*) $CH_3NH_2 \xrightarrow{HNO_2} \underset{\text{'A'}}{CH_3OH} \xrightarrow{PCl_5} \underset{\text{'B'}}{CH_3Cl} \xrightarrow{KCN} \underset{\text{'C'}}{CH_3C\equiv N}$

OR

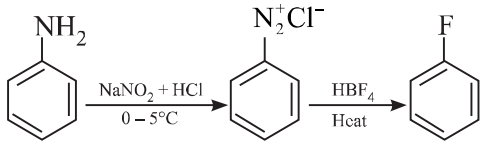
How will you convert.

(*a*) Aniline to Fluorobenzene

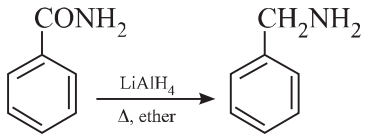
(*b*) Benzamide to Benzyl amine

(*c*) Ethanamine to N,N-Diethyl ethanamine

Ans. (*a*)



(*b*)



(*c*) $CH_3CH_2NH_2 \xrightarrow{C_2H_5Cl} C_2H_5-\underset{\displaystyle H}{\underset{|}{N}}-C_2H_5 \xrightarrow{C_2H_5Cl} C_2H_5-\underset{\displaystyle C_2H_5}{\underset{|}{N}}-C_2H_5$

7. Answer the following questions. **(3)**

(*a*) Which of the following is most effective electrolyte for coagulation of AgI/Ag^+ sol?
$MgCl_2$, K_2SO_4, $K_4[Fe(CN)_6]$

(*b*) What happens when a freshly precipitated $Fe(OH)_3$ is shaken with small amount of $FeCl_3$.

(*c*) Out of sulphur sol and proteins, which one forms macromolecular colloid?

Ans. (*a*) $K_4[Fe(CN)_6]$ is most effective because $[Fe(CN)_6]^{4-}$ has highest charge.

(*b*) $Fe(OH)_3$ precipitate is converted into colloidal state by preferential adsorption of Fe^{3+} ions.

(*c*) Proteins will form macromolecular colloid.

8. An organic compound 'A' with molecular formula C_7H_7NO reacts with Br_2/aqKOH to give a compound 'B', which upon reaction with $NaNO_2$ and HCl at 0°C gives 'C'. Compound 'B' on further reaction with Br_2 water gives white precipitate of 'D'. Identify 'A', 'B', 'C' and 'D', and write the reactions involved. **(3)**

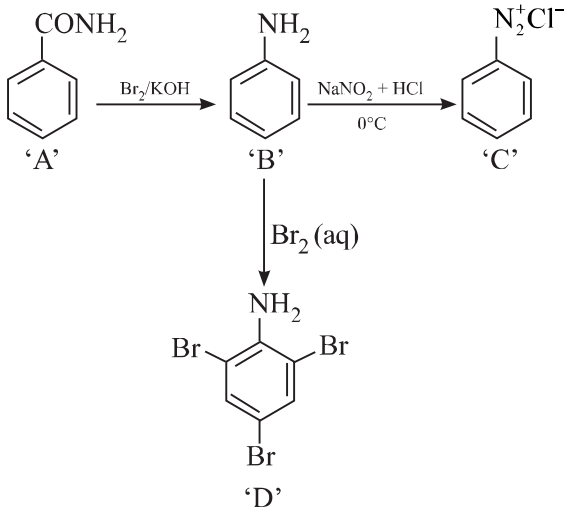
OR

Complete the following:

(*a*) $CH_3Cl + AgCN \longrightarrow X \xrightarrow{Na/C_2H_5OH} Y$ (*b*) $C_2H_5NO_2 \xrightarrow{Sn/HCl} X \xrightarrow{CH_3COCl} Y$

(*c*) $CH_3CH_2CONH_2 \xrightarrow{LiAlH_4} X \xrightarrow{HNO_2} Y$

Ans. A is C_6H_5–$CONH_2$, benzamide, 'B' is aniline, 'C' is benzene diazonium chloride,'D' is 2,4,6 - tribromoaniline.



OR

(*a*) $CH_3N \rightleftharpoons C$, CH_3NHCH_3 (*b*) $C_2H_5NH_2$, $C_2H_5NHCOCH_3$

(*c*) $CH_3CH_2CH_2NH_2$, $CH_4CH_2CH_2OH$

9. (*a*) Write the formula of the coordination compound Tetraamine aqua chlorido cobalt (III) chloride. **(3)**

(*b*) Give two examples of ambidentate ligands.

(*c*) Predict the geometry of $[Ni(CN)_4]^{2-}$

Ans. (*a*) $[Co(NH_3)_4(H_2O)Cl]Cl_2$

(*b*) CN^-, NO_2^-, SCN^- are examples of ambidentate ligands. (Any two)

(*c*) It has dsp^2 hybridisation and square planar geometry.

OR

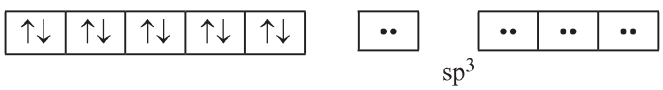
(*a*) Write IUPAC name of (*i*) $[Co(NH_3)_6]^{3+}$ (*ii*) $[NiCl_4]^{2-}$

(*b*) What is hybridisation and shape of $[Ni(CO)_4]$. [Atomic number of Ni = 28]. Is it diamagnetic or paramagnetic.

Ans. (*a*) (*i*) Hexaammine cobalt (III) (*ii*) Tetrachloridonickelate (II)

(*b*) Ni(28) [Ar] $4s^2$ $3d^8$

Ni(0) [Ar] $4s^0$ $3d^{10}$

$[Ni(Co)_4]$ 

sp^3

It has sp^3 hybridisation, tetrahedral shape and diamagnetic.

10. Following ions are given. **(3)**

Cr^{2+}, Cu^{2+}, Cu^{+}, Fe^{2+}, Fe^{3+}, Mn^{3+}

Identify the ion which is

(*a*) strong reducing agent (*b*) unstable in aqueous solution.

(*c*) a strong oxidising agent.

Ans. (*a*) Cr^{2+} is strong reducing agent because it can lose one electron to form Cr^{3+} (t_{2g}^3) which is half filled and more stable.

(*b*) Cu^{+} is unstable in aqueous solution and disproportionate to Cu^{2+} and Cu because hydration enthalpy of Cu^{2+} ions overcome second ionisation enthalpy.

(*c*) Mn^{3+} can gain electron to form Mn^{2+} ($3d^5$) which is more stable, that is why Mn^{3+} is strong oxidising agent.

11. Give suitable reason in each. **(3)**

(*a*) Why are Zn, Cd, Hg non-transition elements?

(*b*) Which transition metal of 3d series does not show variable oxidation state?

(*c*) Why are melting points of transition metals high?

Ans. (*a*) It is because neither they nor their ions have incompletely filled d-orbitals.

(*b*) Sc and Zn (Any one)

(*c*) It is due to strong metallic bonds as they have unpaired electrons, therefore strong interatomic attraction.

OR

(*a*) Why is Cu^{2+} ion blue coloured while Zn^{2+} ion colourless in aqueous solution?

(*b*) Why is separation of mixture of lanthanoid elements difficult?

(*c*) Why are Zn, Cd, Hg soft metals and have low melting points?

Ans. (*a*) Cu^{2+} has one unpaired electrons, undergoes d-d-transition by absorbing light from visible region and radiates blue colour where as Zn^{2+} does not have unpaired electron.

(*b*) It is due to similar ionic size due to lanthanide contraction. Their resemble in properties making separation difficult.

(*c*) It is due to weak metallic bonds due to large size and absence of unpaired electrons.

SECTION-C

12. Read the passage given below and answer the questions that follow. **(5)**

The rate of reaction which may also be called the velocity or speed can be defined with the relation to the concentration of any of the reacting substances or to that of any product of reaction. If the species chosen is a reactant which has a concentration 'c' at time 't', the rate will be $-\frac{dc}{dt}$, while the rate with reference to the product having a concentration '*x*' at time 't' is $\frac{dx}{dt}$. Any concentration units may be used for expressing the rate, thus if mol L^{-1} is used for concentration and seconds for the time, the units for rate are mol L^{-1} s^{-1}. For reactions, pressure units are sometimes used in place of concentration, so that legitimate units for rate would be (mmHg) s^{-1} and atm s^{-1}. The order of a reaction concerns the dependence of the rate upon the concentrations of reacting substances; thus, if the rate is found experimentally to be proportional to the α^{th} power of the concentration of one of the reactant 'A', to the β^{th} power of the concentration of a second reactant 'B', so rate = k $[A]^{\alpha}$ $[B]^{\beta}$, the order of reaction is 'α' w.r.t. 'A' and 'β' w.r.t 'B' and overall order is α + B.

(*Source: Laidler KJ & Glasstone S (1948), Rate, order and molecularity in chemical kinetics, Journal of chemical education, 25(7). 383*)

(*a*) Give an example of reaction with fractional order. (1)

(*b*) What is half life of zero order reaction? (1)

(*c*) What is unit of '*k*' for first order reaction if time is measured in seconds? (1)

(*d*) The decomposition of NH_3 on platinum surface is zero order reaction. What are rates of production of N_2 and H_2 if $k = 2.5 \times 10^{-4}$ mol L^{-1} s^{-1}? (2)

OR

For the reaction $2A + B \longrightarrow A_2B$, the rate = k [A] $[B]^2$ with k = 2.0×10^{-6} mol^{-2} L^2 s^{-1}. Calculate the rate of reaction when [A] = 0.1M and [B] = 0.2 mol L^{-1}.

Ans. (*a*) $H_2 + Br_2 \longrightarrow 2HBr$, rate = k $[H_2]^1$ $[Br_2]^{1/2}$

(or)

$CH_3CHO \xrightarrow{\Delta} CH_4 + CO$, rate = k $[CH_3CHO]^{3/2}$

(*b*) $t_{1/2} = \dfrac{[R]_0}{2k}$

(*c*) s^{-1}

(*d*) rate = $k = [NH_3]^0$, $2NH_3(g) \longrightarrow N_2(g) + 3H_2(g)$

$$\frac{-d[NH_3]}{dt} = \frac{d[N_2]}{dt} = +\frac{1}{3}\frac{d[H_2]}{dt} = k = 2.5 \times 10^{-4} \text{ mol } L^{-1} \text{ } s^{-1}$$

rate of production of N_2 = 2.5×10^{-4} mol L^{-1} s^{-1}

rate of production of H_2 = $2.5 \times 3 \times 10^{-4}$ mol L^{-1} s^{-1}

= 7.5×10^{-4} mol L^{-1} s^{-1}

OR

Rate = k [A] $[B]^2$

= 2.0×10^{-6} [0.1] $[0.2]^2$

= 8×10^{-9} mol L^{-1} s^{-1}

DAV CENTENARY PUBLIC SCHOOL, PASCHIM ENCLAVE, NEW DELHI-87

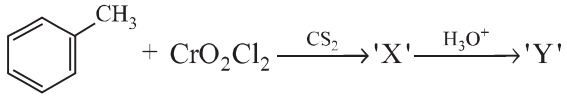
PRACTICE PAPER–3

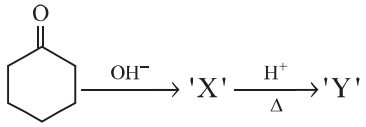
Time Allowed:* 2 *Hours ***Maximum Marks:* 35**

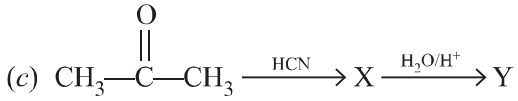
General Instructions: Same as Practice Paper-1

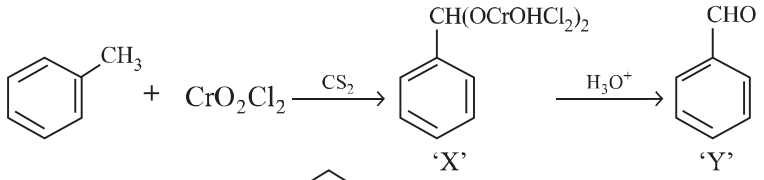
SECTION-A

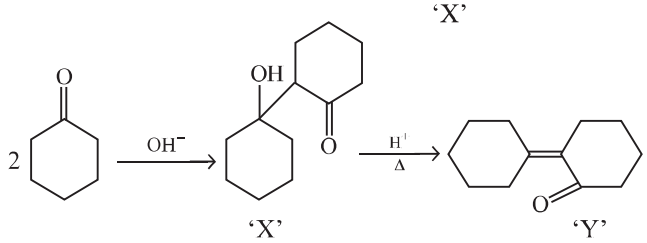
1. Complete the following, [Identify 'X' and 'Y'] [Attempt any 2] **(2)**

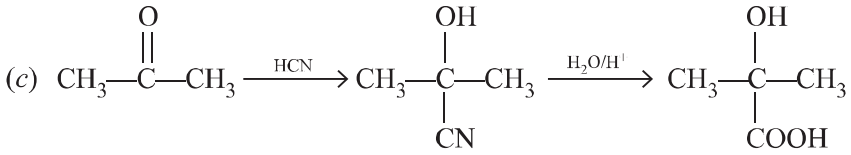
(*a*) 

(*b*) 

(*c*) 

Ans. (*a*) 

(*b*) 

(*c*) 

2. The following results have been obtained during the kinetic studies of the reaction P + 2Q → R + 2S **(2)**

Expt.	Initial conc. of P	Initial conc. of Q	Initial rate of formation of R
1	0.10 mol / L	0.10 mol / L	3.0×10^{-4} mol L^{-1} min^{-1}
2	0.30 mol / L	0.30 mol / L	9.0×10^{-4} mol L^{-1} min^{-1}
3	0.10 mol / L	0.30 mol / L	3.0×10^{-4} mol L^{-1} min^{-1}
4	0.20 mol / L	0.40 mol / L	6.0×10^{-4} mol L^{-1} min^{-1}

Determine the rate law expression for the reaction.

Ans.

$$\text{rate} = k\,[A]^x\,[B]^y$$

$$3.0 \times 10^{-4} = k\,[0.1]^x\,[0.10]^y \quad ...(i)$$

$$3.0 \times 10^{-4} = k\,[0.1]^x\,[0.30]^y \quad ...(ii)$$

Dividing (*i*) by (*ii*), we get

$$1 = \left(\frac{1}{3}\right)^y$$

$$\left(\frac{1}{3}\right)^0 = \left(\frac{1}{3}\right)^y$$

$$\Rightarrow \quad y = 0$$

$$9.0 \times 10^{-4} = k\,[0.30]^x\,[0.30]^y \quad ...(iii)$$

$$3.0 \times 10^{-4} = k\,[0.1]^x\,[0.30]^y \quad \ldots(iv)$$

Dividing (*iii*) by (*iv*), we get

$$(3)^1 = (3)^x$$

$$\Rightarrow \quad x = 1$$

$$\text{rate} = k\,[A]^1\,[B]^0$$

3. Define molar conductivity. On dilution, why does the molar conductivity of HCOOH increase drastically, while that of HCOONa increase gradually? **(2)**

Ans. Molar conductivity is defined as conducting power of all the ions produced by one molar solution of an electrolyte. HCOOH is weak electrolyte, on dilution, number of ions as well as mobility of ions increases, hence Λ_m increases drastically HCOONa is strong electrolyte, on dilution number of ions do not increase appreciably only mobility of ions increases hence Λ_m increases gradually.

SECTION-B

4. Write the hybridisation and magnetic behaviour of the following complexes. **(3)**

(*a*) $[CoF_6]^{3-}$ (*b*) $[Ni(CN)_4]^{2-}$ (*c*) $[Co(NH_3)_6]^{3+}$

[Atomic number of Co = 27, Ni = 28]

Ans. (*a*) sp^3d^2, paramagnetic (*b*) dsp^2, diamagnetic (*c*) d^2sp^3, diamagnetic

OR

(*a*) Write IUPAC name of $[Mn(H_2O)_6]\,SO_4$.

(*b*) Why is $[Fe(CN)_6]^{4-}$ diamagnetic while $[FeF_6]^{3-}$ is paramagnetic?

(*c*) Why is $[Co(en)_3]^{3+}$ is more stable than $[Co(NH_3)_6]^{3+}$?

Ans. (*a*) Hexaaqua manganese (II) sulphate

(*b*) $[Fe(CN)_6]^{4-}$ does not have unpaired electrons as CN^- is strong ligand whereas $[FeF_6]^{3-}$ has unpaired electron. F^- is weak ligand, hence paramagnetic.

(*c*) It is because 'en' is didentate ligand forming chelate NH_3 is unidentate ligand. Chelates are more stable.

5. How is the rate of reaction affected when **(3)**

(*a*) surface area of the reactant is increased (*b*) temperature of reaction is decreased, and

(*c*) catalyst is added to reversible reaction?

Ans. (*a*) Greater the surface area, more will be rate of reaction.

(*b*) The rate of reaction will decrease.

(*c*) Catalyst increases the rate of forward as well as backward reaction equally but equilibrium is reached faster in presence of catalyst.

6. (*a*) Calculate the spin only moment of Co^{2+} (Z = 27) by writing the electronic configuration of Co and Co^{2+}. **(3)**

(*b*) Give reason and select one atom / ion which will exhibit asked property.

(*i*) Sc^{3+} or Cr^{3+} (Exhibit diamagnetic behaviour)

(*ii*) Cr or Cu (High melting and boiling points)

Ans. (*a*) Co(27) $[Ar]4s^23d^7$

$Co^{2+}(27)\ [Ar]4s^03d^7$

$$\mu_B = \sqrt{n(n+2)} = \sqrt{3(3+2)} = \sqrt{15} = 3.87\text{BM}$$

(*b*) (*i*) Sc^{3+} is diamagnetic due to absence of unpaired electron.

(*ii*) Cr has high melting point. Due to presence of unpaired electrons it forms strong metallic bonds.

7. The electrical resistance of a column of 0.05M KOH solution of length 50 cm and area of cross-section 0.625 cm^2 is 5×10^3 ohm. Calculate its resistivity, conductivity and molar conductivity. **(3)**

Ans. $l = 50$ cm $\quad A = 0.625\ cm^2 \quad \dfrac{l}{A} = \dfrac{50\ cm}{0.625}$

$$\rho = R \times \frac{A}{l} = 5\times10^3 \times \frac{0.625}{50} = 62.5 \text{ ohm cm}$$

$$k = \frac{l}{\rho} = \frac{1}{62.5} = 1.6 \times 10^{-2} \text{ S cm}^{-1}$$

$$\Lambda_m = \frac{1000K}{M} = \frac{1000\times1.6\times10^{-2}}{0.05} = 320 \text{ S cm}^2 \text{ mol}^{-1}$$

8. Give reasons for the following observations. **(3)**

(*a*) Physisorption decrease with increase in temperature

(*b*) Addition of alum purifies water.

(*c*) Brownian movement provides stability to the colloidal solution.

Ans. (*a*) It is because physisorption involves weak van der waal's forces of attraction.

(*b*) Alum coagulates mud particles settling them down faster.

(*c*) It causes stirring effect because colloidal particles do not settle down and hence leads to stability.

9. Illustrate giving chemical equations for the following. **(3)**

(*a*) Carbylamine reaction (*b*) Hoffmann bromide reaction

(*c*) Gabriel phthalimide synthesis

OR

Complete the following:

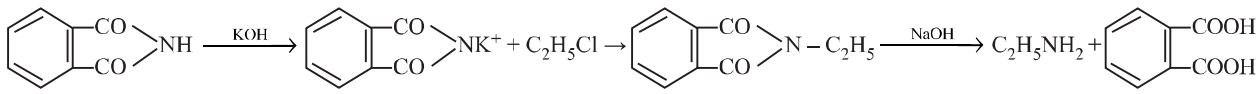
(*a*) $C_6H_5NO_2 \xrightarrow{Sn/HCl} X \xrightarrow[Pyridine]{C_6H_5COCl} Y$

(*b*) $C_2H_5C \equiv N \xrightarrow{LiAlH_4} X \xrightarrow{HNO_2} Y$

(*c*) $C_2H_5NO_2 \xrightarrow{Fe/HCl} X \xrightarrow{HCl} Y$

Ans. (*a*) $C_2H_5NH_2 + CHCl_3 + 3KOH \rightarrow C_2H_5N \equiv C + 3KCl + 3H_2O$

(*b*) $CH_3-\overset{\overset{O}{\|}}{C}-NH_2 + Br_2 + 4KOH \rightarrow CH_3NH_2 + 2KBr + K_2CO_3 + 2H_2O$

(*c*) 

OR

(*a*) $C_6H_5NH_2$, $C_6H_5NHCOC_6H_5$ (*b*) $C_2H_5CH_2NH_2$, $C_2H_5CH_2OH$

(*c*) $C_6H_5NH_2$, $C_6H_5-N^+H_3Cl^-$

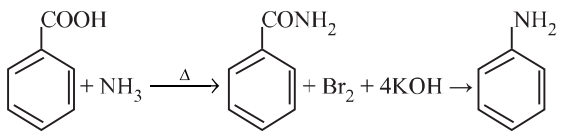
10. How will you carry out following conversions? **(3)**

(*a*) Methanamine to ethanamine (*b*) Propanoic acid to ethanoic acid

(*c*) Benzoic acid to aniline

Ans. (*a*) $CH_3NH_2 \xrightarrow{HNO_2} CH_3OH \xrightarrow{PCl_5} CH_3Cl \xrightarrow{KCN} CH_3C \equiv N \xrightarrow{LiAlH_4} CH_3CH_2NH_2$

(*b*) $CH_3CH_2COOH \xrightarrow{NH_3} CH_3CH_2CONH_2 \xrightarrow[KOH]{Br_2} CH_3CH_2NH_2 \xrightarrow{HNO_2} CH_3CH_2OH \xrightarrow[H_2SO_4]{KMnO_4} CH_3COOH$

(*c*) 

OR

Give reason.

(*a*) pK_b of aniline is more than that of methyl aniline.

(*b*) Methyl aniline in water reacts with ferric chloride to give reddish brown precipitate.

(*c*) Gabriel phthalimide synthesis cannot be used to prepare aniline.

Ans. (*a*) Become C_6H_5 is electron withdrawing, —CH_3 is electron releasing

(*b*) $CH_3NH_2 + H_2O \longrightarrow CH_3\,N^+H_3 + OH^-$, $FeCl_3 + 3OH^- \longrightarrow Fe(OH)_3 + 3Cl^-$ reddish brown ppt:

(*c*) It is because haloareres do not undergo nucleophelic substitution readily.

11. (*a*) Out of Ti^{3+}, V^{3+}, Cu^+, Sc^{3+}, Mn^{2+}, Fe^{3+} And Cu^{2+}, which ions are coloured in aqueous solution? **(3)**

[Ti = 22, V = 23, Cr = 24, Fe = 26, Mn = 25, Cu = 29]

(*b*) Out of Ti^{2+}, V^{2+}, Cr^{3+}, Mn^{2+} which ion has maximum number of unpaired electrons?

(*c*) Out of Fe^{2+} or Mn^{2+} which is more stable and why?

Ans. (*a*) Ti^{3+}, V^{3+}, Mn^{2+}, Fe^{3+}, Cu^{2+} are coloured due to presence of unpaired electrons.

(*b*) Mn^{2+} has 5 unpaired electrons.

(*c*) $Mn^{2+}(3d^5)$ is more stable than $Fe^{2+}(3d^6)$ due to half filled d-orbitals.

OR

(*a*) On what ground can you say Sc (21) is transition metal whereas is Zn(30) is not?

(*b*) Why do translation metals show variable oxidation states?

(*c*) Name one transition which forms irons in +4 oxidation state. Give reason.

Ans. (a) Sc, $[Ar]4s^23d^1$ has incompletely filled d-orbital and therefore it is transition metal. Zn $[Ar]\ 4s^23d^{10}$ and Zn^{2+} $(3d^{10})$ do not have incomplete d-orbitals, hence, it is not transition metal.

(b) It is because electrons from both (n – 1) d and ns take part in bond formation.

(c) Ce^{4+} because it has stable electronic configuration of xenon.

SECTION-C

12. Read the following passage and answer the questions that follow. **(5)**

Reductive alkylation is term applied to the process of introducing alkyl groups into ammonia or a primary or secondary amine by means of aldehyde and ketone in presence of reducing agent. The present discussion is limited to those reductive alkylations in which the reducing agent is hydrogen and a catalyst or "nascent" hydrogen usually from a metal acid combination; most of these reductive alkylations have been carried out with hydrogen and catalyst. The principal variation excluded is that in which the reducing agent in formic acid or its derivatives; this modification is known as Leuckart reaction. The process of reductive alkylation of ammonia consist in the addition of NH_3 to a carbonyl compound and reduction of addition compound or its dehydration product. The reduction is usually carried out in ethanol solution when the reduction is to be affected catalytically.

Since primary amine is formed in presence of aldehyde, it may react in same manner as ammonia, yielding an addition compound a schiff's base ($R-CH=N-CH_2-R$) and finally, secondary amine. Similarly primary amine may react with the imine, forming an addition product which also is reduced to a secondary amine. Finally, the secondary amine may react with either the aldehyde or the imine to give products which are reduced to tertiary amines. Similar reactions may occur when the carbonyl compound employed is a ketone.

(*Source: Emerson, W. S. (2011). The Preparation of Amines by Reductive Alkylation. Organic Reactions, 174–255. doi:10.1002/0471264181.or 004.03*)

(*a*) Complete the following reaction. (1)

$$CH_3CHO + NH_3 \longrightarrow \text{'A'} \xrightarrow{2[H]} \text{'B'}$$

(*b*) Identify 'X' and 'Y' in the following reaction. (1)

$$CH_3CH=NH + CH_3CH_2NH_2 \rightleftharpoons \text{'X'} \xrightarrow{2[H]} \text{'Y'}$$

(*c*) Convert $(CH_3CH_2)_2NH$ to $(C_2H_5)_3N$ using CH_3CHO (1)

(*d*) Convert acetone to 2-propanamine (2)

OR

Convert Actophenone to $C_6H_5-\underset{\displaystyle CH_3}{\underset{|}{CH}}-NH_2$

Ans. (*a*) $CH_3CHO + NH_3 \rightarrow \underset{\text{'A'}}{CH_3-CH=NH} \xrightarrow{2[H]} \underset{\text{'B'}}{CH_3CH_2NH_2}$

(*b*) $CH_3-CH=NH + CH_3CH_2NH_2 \rightleftharpoons CH_3-\underset{\displaystyle NH_2}{\underset{|}{CH}}-NHCH_2CH_3 \xrightarrow{2[H]} CH_3CH_2NHCH_2CH_3$

(*c*) $(CH_3CH_2)_2NH + CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-H \rightleftharpoons (CH_3CH_2)_2N\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3 \xrightarrow{2[H]} (CH_3CH_2)_3N + H_2O$

(*d*) $\underset{\text{Acetone}}{CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-CH_3} + NH_3 \longrightarrow CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=NH \xrightarrow[\text{or } H_2/Ni]{2[H]} \underset{\text{2-Propanamine}}{CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-NH_2}$

OR

$\underset{\text{Acetophenone}}{C_6H_5-\underset{\displaystyle CH_3}{\underset{|}{C}}=O} + NH_3 \longrightarrow C_6H_5-\underset{\displaystyle CH_3}{\underset{|}{C}}=NH \xrightarrow{H_2/Ni} \underset{\text{1-Phenyl ethanamine}}{C_6H_5-\underset{\displaystyle CH_3}{\underset{|}{CH}}-NH_2}$