Board Question Paper: March 2013
Chemistry

Time: 3 Hours **Total Marks: 70**

Note:

i. All questions are compulsory.
ii. Answer to the two sections are to be written in the same answer book.
iii. Figure to the right hand side indicate full marks.
iv. Write balanced chemical equations and draw neat and labelled diagrams wherever necessary.
v. Every new question must be started on a new page.
vi. Use of logarithmic table is allowed

SECTION – I

Q.1. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. In body centred cubic structure, the space occupied is about _____.
(A) 68 % (B) 53 %
(C) 38 % (D) 32 %

ii. For a gaseous reaction, the unit of rate of reaction is _____.
(A) L atm s^{-1} (B) atm mol^{-1} s^{-1}
(C) atm s^{-1} (D) mol s

iii. Which of the following compounds contains S = O as well as S = S bonds?
(A) Sulphuric acid (B) Thiosulphuric acid
(C) Sulphurous acid (D) Thiosulphurous acid

iv. Which of the following solutions shows maximum depression in freezing point?
(A) 0.5 M Li_2SO_4 (B) 1 M NaCl
(C) 0.5 M $Al_2(SO_4)_3$ (D) 0.5 M $BaCl_2$

v. For a chemical reaction, $\Delta S = -0.035$ kJ/K and $\Delta H = -20$ kJ. At what temperature does the reaction turn non-spontaneous?
(A) 5.14 K (B) 57.14 K
(C) 571.4 K (D) 5714.0 K

vi. The standard e.m.f of the following cell is 0.463 V
$Cu \mid Cu^{++}(1\ M) \parallel Ag^{+}(1M) \mid Ag$. If $E^{\circ}_{Ag} = 0.800$ V,
What is the standard potential of Cu electrode?
(A) 1.137 V (B) 0.337 V
(C) 0.463 V (D) –0.463 V

vii. Fe_2O_3 is reduced to spongy iron near the top of blast furnace by _____.
(A) H_2 (B) CaO
(C) SiO_2 (D) CO

Q. 2. Answer any SIX of the following: **[12]**

i. Distinguish between crystalline solid and amorphous solid.

ii. State Kohlrausch Law and write mathematical expression of molar conductivity of the given solution at infinite dilution.

iii. Write cell reactions in lead storage battery during discharge.

iv. Draw structures and write geometry of PCl_3 and PCl_5.

v. Prove that $\Delta H = \Delta U + \Delta nRT$. What is the condition under which $\Delta U = \Delta H$?

vi. Mention names and formulae of two ores of aluminium.

vii. Derive the relationship between relative lowering of vapour pressure and molar mass of non-volatile solute.

viii. What is pseudo first order reaction? Give one example of it.

Q.3. Answer any THREE of the following: **[9]**

i. Calculate the mole fraction and molality of HNO_3 in a solution containing 12.2 % HNO_3. (Given – atomic masses : H = 1, N = 14, O = 16)

ii. Consider the reaction,

$$3I^-_{(aq)} + S_2O_8^{2-} \longrightarrow I^-_{3(aq)} + 2SO^{2-}_{4(aq)}$$

At particular time t, $\frac{d\left[SO_4^{2-}\right]}{dt} = 2.2 \times 10^{-2}$ M/s.

What are the values of the following at the same time?

a. $-\frac{d\left[I^-\right]}{dt}$ b. $-\frac{d\left[S_2O_8^{2-}\right]}{dt}$ c. $-\frac{d\left[I_3^-\right]}{dt}$

iii. 300 M mol of perfect gas occupies 13 L at 320 K. Calculate the work done in joules when the gas expands –

a. isothermally against a constant external pressure of 0.20 atm.
b. isothermal and reversible process.
c. into vaccum until the volume of gas is increased by 3 L. ($R = 8.314$ J mol^{-1} K^{-1})

iv. What is the action of the following reagents on ammonia?

a. Excess of air
b. Excess of chlorine
c. Na metal

Q. 4. Answer any ONE of the following: **[7]**

i. a. Explain with reason sign conventions of ΔS in the following reactions :

1. $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$
2. $CO_{2(g)} \longrightarrow CO_{2(s)}$

b. Explain the following terms:

1. Smelting
2. Flux

c. Gold occurs as face centred cube and has a density of 19.30 kg dm^{-3}. Calculate atomic radius of gold. (Molar mass of Au = 197)

ii. a. Explain the trends in the following properties with reference to group 16:

1. Atomic radii and ionic radii
2. Density
3. ionisation enthalpy
4. Electronegativity

b. In the electrolysis of $AgNO_3$ solution 0.7g of Ag is deposited after a certain period of time. Calculate the quantity of electricity required in coulomb.
(Molar mass of Ag is 107.9 g mol^{-1}).

c. Define Osmosis.

SECTION – II

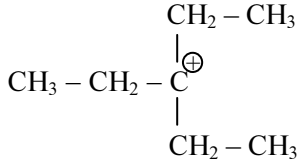
Q.5. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

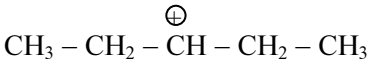
i. In which of the following pairs, highest oxidation states of transition metals are found?

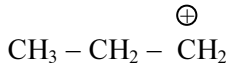
(A) nitriles and chlorides (B) fluorides and chlorides

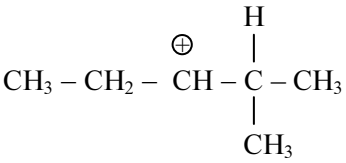
(C) fluorides and oxides (D) nitriles and oxides

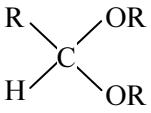
ii. Which of the following carbocations is least stable?

(A) 

(B) 

(C) 

(D) 

iii. Compound having general formula  is called _____.

(A) diester (B) acid anhydride

(C) hemiacetal (D) acetal

iv. The complex ion $[Co(H_2O)_5 (ONO)]^{2+}$ and $[Co(H_2O)_5NO_2)]^{2+}$ are called _____.

(A) linkage isomer (B) ionisation isomer

(C) co-ordination isomer (D) geometrical isomer

v. Inflammation of tongue is due to the deficiency of _____.

(A) vitamin B_1 (B) vitamin B_2

(C) vitamin B_5 (D) vitamin B_6

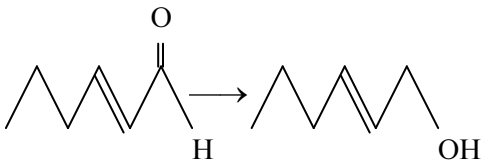
vi. Identify the compound 'B' in the following series of reaction:

propanenitrile $\xrightarrow{Na/alc}$ A $\xrightarrow[dil.HCl]{NaNO_2}$ B.

(A) n-propyl chloride (B) Propanamine

(C) n-propyl alcohol (D) Isopropyl alcohol

vii. Which of the following reagents is best for the following conversion?



(A) $LiAlH_4$ (B) H_3O^+

(C) H_2/ Ni, 453 K (D) $Zn - Hg + HCl_{(con)}$

Q.6. Answer any SIX of the following : **[12]**

i. Calculate magnetic moment of $Fe^{2+}_{(aq)}$ ion (Z = 26).

ii. How is ethanol prepared from methanal by using Grignard reagent?

iii. Write the chemical reaction to prepare novolac polymer.

iv. Why does p-nitrochlorobenzene undergo displacement reactions readily with attack of nucleophilic $HO^{\ominus}$ ion?

v. What is the action of bromine in alkaline medium on

a. $CH_3CH_2NO_2$ b. $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - NO_2$

vi. Define antioxidants and mention two examples.

vii. How is 4-methylpent-3-en-2-one obtained from propan-2-one?

viii. What are hormones? Write the structure of simple triglycerides.

Q.7. Answer any THREE of the following: **[9]**

i. Write the different oxidation states of manganese. Why +2 oxidation state of manganese is more stable?

ii. How are the following compounds prepared?

a. benzaldehyde from benzene
b. acetophenone from benzene
c. benzaldehyde from benzoyl chloride

iii. Define complex lipids and write the structures of nucleotide and nucleoside.

iv. Write the formulae of the following compounds:

a. Sodium hexanitrito – N – cobaltate (III)
b. Tetraaquodichlorochromium (III) chloride
c. Potassium tetracyanoaurate (III) ion

Q.8. Answer any ONE of the following: **[7]**

i. a. Explain the following terms:

1. Homopolymers
2. Elastomers

b. Explain the mechanism of cleansing action of soaps.

c. Write balanced chemical equations for the action of

1. phosphorus trichloride on propan-2-ol
2. hydrogen bromide on styrene in the presence of a peroxide
3. methyl bromide on silver propanoate

ii. a. Write a short note on Hoffmann bromamide degradation.

b. Explain the mechanism of action of hydroiodic acid on 3-methylbutan-2-ol.

c. Mention 'two' uses of propan-2-one.

Board Question Paper: March 2014
Chemistry

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SECTION – I

Q.1. Answer any ONE of the following: **[7]**

i. What is 'boiling point'?

Derive a relation between ΔH and ΔU for a chemical reaction.

Draw neat labelled diagram of calomel electrode.

Resistance and conductivity of a cell containing 0.001 M KCl solution at 298 K are 1500 Ω and 1.46×10^{-4} S. cm^{-1} respectively. What is the cell constant?

ii. Write molecularity of the following reaction:

$2NO_{(g)} + O_{2\,(g)} \longrightarrow 2NO_{2\,(g)}$

What is 'calcination'? How does it differ from 'roasting'?

Write resonating structures of ozone.

The decomposition of $N_2O_{5(g)}$ at 320 K according to the following equation follows first order reaction:

$$N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2} O_{2(g)}$$

The initial concentration of $N_2O_{5(g)}$ is 1.24×10^{-2} mol. L^{-1} and after 60 minutes, 0.20×10^{-2} mol. L^{-1}. Calculate the rate constant of the reaction at 320 K.

Q.2. Answer any THREE of the following: **[9]**

i. One mole of a gas expands by 3 L against a constant pressure of 3 atmosphere. Calculate the work done in:
   a. L. atmosphere
   b. Joules
   c. Calories

ii. Calculate the amount of $CaCl_2$ (van't Hoff factor i = 2.47) dissolved in 2.5 L solution so that its osmotic pressure at 300 K is 0.75 atmosphere.
Given: Molar mass of $CaCl_2$ is 111 g. mol^{-1}.
R = 0.082 L. atm. K^{-1} mol^{-1}

iii. Describe anomalous behaviour of fluorine with the other elements of group 17 with reference to:
   a. Hydrogen bonding
   b. Oxidation state
   c. Polyhalide ions

iv. Face centred cubic crystal lattice of copper has density of 8.966 g. cm^{-3}. Calculate the volume of the unit cell.
Given: Molar mass of copper is 63.5 g. mol^{-1} and Avogadro number N_A is 6.022×10^{23} mol^{-1}.

Q.3. Answer any SIX of the following: **[12]**

i. What is the action of the following reagents on ammonia:
   a. Nessler's reagent
   b. Sodium metal

ii. State the first and second law of electrolysis.

iii. Draw neat and labelled diagram of Bessemer converter used in the extraction of copper.

iv. Derive the relation between half-life period and rate constant for first order reaction.

v. Derive the relation between $\Delta G°$ and equilibrium constant (K) for the reaction,
$aA + bB \quad cC + dD$.

vi. Explain brown ring test with the help of chemical equation.

vii. Explain, why do aquatic animals prefer to stay at lower level of water during summer?

viii. Distinguish between:
Crystalline solids and Amorphous solids.

Q.4. Select and write the most appropriate answer from the alternatives given below each sub-question: **[7]**

i. To prepare n-type semiconductor, the impurity to be added to silicon should have the following number of valence electrons _____.
(A) 2 (B) 3
(C) 4 (D) 5

ii. Number of faradays of electricity required to liberate 12 g of hydrogen is _____.
(A) 1 (B) 8
(C) 12 (D) 16

iii. What is molecular formula of oleum?
(A) H_2SO_3 (B) H_2SO_4
(C) $H_2S_2O_7$ (D) $H_2S_2O_8$

iv. Purification of aluminium by electrolytic refining is carried out by _____.
(A) Hoope process (B) Hall Process
(C) Baeyer process (D) Serperck process

v. The rate of reaction for certain reaction is expressed as:
$$\frac{1}{3}\frac{d[A]}{dt} = -\frac{1}{2}\frac{d[B]}{dt} = -\frac{d[C]}{dt}$$
The reaction is _____.
(A) $3A \longrightarrow 2B + C$ (B) $2B \longrightarrow 3A + C$
(C) $2B + C \longrightarrow 3A$ (D) $3A + 2B \longrightarrow C$

vi. A system absorbs 640 J heat and does work of 260 J, the change in internal energy of the system will be _____.
(A) + 380 J (B) – 380 J
(C) + 900 J (D) – 900 J

vii. Which of the following is 'not' a colligative property?
(A) Vapour pressure (B) Depression in freezing point
(C) Elevation in boiling point (D) Osmotic pressure

SECTION – II

Q.5. Answer any ONE: **[7]**

i. Write the structural formula and IUPAC names of all possible isomers of the compound with molecular formula C_3H_8O.
Write 'two' uses of phenol.
What happens when glucose is treated with:
a. Bromine water
b. Dilute nitric acid
c. Hydrogen cyanide (HCN)

ii. Write the molecular formula and structural formula of BHA and BHT.
What are thermoplastic polymers?
Write a note on aldol condensation.

Q.6. Answer any THREE: **[9]**

i. What is the action of the following reagents on aniline?
a. Bromine water
b. Acetic anhydride
c. Hot and conc. sulphuric acid

ii. Discuss the optical activity of lactic acid.

iii. Write balanced chemical equations for action of potassium permanganate on:
a. Hydrogen
b. Warm conc. sulphuric acid
Explain why Mn^{2+} ion is more stable than Mn^{3+}?
(Given: Mn $\rightarrow$ Z = 25)

iv. What is effective atomic number (EAN)?
Calculate EAN of cobalt (Z = 27) in $[Co(NH_3)_6]^{+3}$ and of zinc (Z = 30) in $[Zn(NH_3)_4]SO_4$.

Q.7. Answer any SIX: **[12]**

i. What is a 'soap'? How is it prepared?

ii. Identify the compounds 'A' and 'B' in the following equation:
$CH_3 - CH_3 + HNO_3 \xrightarrow{423-600\,K}$ 'A' $\xrightarrow{Sn/conc.HCl}$ 'B' + H_2O

iii. Write a note on self oxidation-reduction reaction of aldehyde with suitable example.

iv. Write names and chemical formulae of monomers used in preparing Buna–S.

v. Define complex lipids. Mention 'two' functions of lipids.

vi. Distinguish between S_N1 and S_N2 mechanisms.

vii. What are lanthanoids? What is the position of actinoids in periodic table?

viii. How is methoxyethane prepared from:
a. Methyl iodide
b. Diazomethane

Q.8. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. IUPAC name of $K_4[Fe(CN)_6]$ is _____.

(A) tetrapotassium ferrocyanide (B) potassium ferricyanide
(C) potassium ferrocyanide (D) potassium hexacyanoferrate

ii. Carbon atom in methyl carbocation contains how many pairs of electrons?

(A) 8 (B) 4
(C) 3 (D) 5

iii. How many moles of acetic anhydride will be required to form glucose pentaacetate from 2 M of glucose?

(A) 2 (B) 5
(C) 10 (D) 2.5

iv. Identify the weakest base amongst the following _____.

(A) p-methoxyaniline (B) o-toluidine
(C) benzene-1,4-diamine (D) 4-aminobenzoic acid

v. Bakelite is the polymer of _____.

(A) Benzaldehyde and phenol (B) Acetaldehyde and phenol
(C) Formaldehyde and phenol (D) Formaldehyde and benzyl alcohol

vi. Formalin is 40% aqueous solution of _____.

(A) Methanal (B) Methanoic acid
(C) Methanol (D) Methanamine

vii. Which among the following pairs of elements is 'not' an example of chemical twins?

(A) Zr and Hf (B) Nb and Ta
(C) Mo and W (D) Ta and Re

BOARD QUESTION PAPER : MARCH 2015
CHEMISTRY

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SECTION – I

Q.1. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. p-type semi-conductors are made by mixing silicon with impurities of _____.
(A) germanium (B) boron
(C) arsenic (D) antimony

ii. Amongst the following, identify the criterion for a process to be at equilibrium.
(A) $\Delta G < 0$ (B) $\Delta G > 0$
(C) $\Delta S_{total} = 0$ (D) $\Delta S < 0$

iii. Colligative property depends only on _____ in a solution.
(A) number of solute particles (B) number of solvent particles
(C) nature of solute particles (D) nature of solvent particles

iv. The charge of how many coulombs is required to deposit 1.0 g of sodium metal (molar mass 23.0 g mol^{-1}) from sodium ions?
(A) 2098 C (B) 96500 C
(C) 193000 C (D) 4196 C

v. What is the chemical composition of malachite?
(A) $CuO.CuCO_3$ (B) $Cu(OH)_2.CuCO_3$
(C) $CuO.Cu(OH)_2$ (D) $Cu_2O.Cu(OH)_2$

vi. The element that does NOT exhibit allotropy is _____.
(A) As (B) Sb
(C) Bi (D) N

vii. The integrated rate equation for first order reaction A $\rightarrow$ products is _____ .
(A) $k = 2.303\ t \log_{10} \frac{[A]_0}{[A]_t}$ (B) $k = -\frac{1}{t} \ln \frac{[A]_t}{[A]_0}$
(C) $k = \frac{2.303}{t} \log_{10} \frac{[A]_t}{[A]_0}$ (D) $k = \frac{1}{t} \ln \frac{[A]_t}{[A]_0}$

Q.2. Answer any SIX of the following: **[12]**

i. Define the following terms:
   a. Enthalpy of fusion
   b. Enthalpy of atomization

ii. Derive van't Hoff general solution equation.

iii. Explain impurity defect in stainless steel with diagram.

iv. Derive the relation between half life and rate constant for a first order reaction.

v. Draw neat and labelled diagram of dry cell.

vi. Explain the structure of sulphur dioxide.

vii. What is calcination? Explain it with reactions.

viii. Arrange the following reducing agents in the order of increasing strength under standard state conditions. Justify the answer.

Element	$Al_{(s)}$	$Cu_{(s)}$	$Cl^-_{(aq)}$	$Ni_{(s)}$
E^o	–1.66 V	0.34 V	1.36 V	–0.26 V

Q.3. Answer any THREE of the following: **[9]**

i. Determine whether the reactions with the following ΔH and ΔS values are spontaneous or non-spontaneous. State whether the reactions are exothermic or endothermic.
   a. $\Delta H = -110$ kJ, $\Delta S = +40$ J K^{-1} at 400 K
   b. $\Delta H = +40$ kJ, $\Delta S = -120$ J K^{-1} at 250 K

ii. 1.0×10^{-3} kg of urea when dissolved in 0.0985 kg of a solvent, decreases freezing point of the solvent by 0.211 K. 1.6×10^{-3} kg of another non-electrolyte solute when dissolved in 0.086 kg of the same solvent depresses the freezing point by 0.34 K. Calculate the molar mass of the another solute.
   (Given molar mass of urea = 60)

iii. Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law with $t_{1/2} = 3$ hours. What fraction of the sample of sucrose remains after 8 hours?

iv. Explain how does nitrogen exhibit anomalous behaviour amongst group 15 elements.

Q.4. Answer any ONE of the following: **[7]**

i. Niobium crystallises as body centred cube (BCC) and has density of 8.55 kg dm^{-3}. Calculate the atomic radius of niobium.
   (Given: Atomic mass of niobium = 93)
   Write one statement of first law of thermodynamics and its mathematical expression.
   Write the reactions involved in the zone of reduction in blast furnace during extraction of iron.

ii. Write molecular formulae and structures of the following compounds:
   a. Dithionic acid
   b. Peroxymonosulphuric acid
   c. Pyrosulphuric acid
   d. Dithionous acid

   Calculate E_{cell} and ΔG for the following at 28 °C:
   $Mg_{(s)} + Sn^{2+}$ (0.04 M) $\rightarrow Mg^{2+}$ (0.06 M) + $Sn_{(s)}$
   $E^o_{cell} = 2.23$ V
   Is the reaction spontaneous?

SECTION – II

Q. 5. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. Identify the product 'D' in the following sequence of reactions:

$H_3C - CH_2 - CH_2 - Cl \xrightarrow[\Delta]{Alc.KOH}$ 'B' $\xrightarrow{HBr}$ 'C' $\xrightarrow[Ether]{Na}$ 'D'

(A) 2,2-dimethylbutane (B) 2,3-dimethylbutane
(C) hexane (D) 2,4-dimethylpentane

ii. Which of the following complexes will give a white precipitate on treatment with a solution of barium nitrate?

(A) $[Cr(NH_3)_4SO_4]Cl$ (B) $[Co(NH_3)_4Cl_2]NO_2$
(C) $[Cr(NH_3)_4Cl_2]SO_4$ (D) $[CrCl_2(H_2O)_4]Cl$

iii. What is the geometry of chromate ion?

(A) Tetrahedral (B) Octahedral
(C) Trigonal planar (D) Linear

iv. Primary and secondary nitroalkanes containing α-H atom show property of _____.

(A) chain isomerism (B) tautomerism
(C) optical isomerism (D) geometrical isomerism

v. In phenol carbon atom attached to –OH group undergoes _____.

(A) sp^3 hybridisation (B) sp hybridisation
(C) sp^2 hybridisation (D) no hybridisation

vi. Identify the strongest acid amongst the following.

(A) Chloroacetic acid (B) Acetic acid
(C) Trichloroacetic acid (D) Dichloroacetic acid

vii. Which of the following vitamins is water soluble?

(A) A (B) D
(C) E (D) B

Q.6. Answer any SIX of the following : **[12]**

i. Write a note on Friedel Craft's acylation.
ii. How is ethylamine prepared from methyl iodide?
iii. What are antibiotics? Give 'two' examples.
iv. Explain, why are boiling points of carboxylic acids higher than corresponding alcohols.
v. How are proteins classified on the basis of molecular shapes?
vi. What are interstitial compounds? Why do these compounds have higher melting points than corresponding pure metals?
vii. Write the structures and IUPAC names of the following compounds:
   a. Adipic acid
   b. α-methyl butyraldehyde
viii. Explain with examples, branched and linear polymers.

Q.7. Answer any THREE of the following: **[9]**

i. On the basis of valence bond theory explain the nature of bonding in $[CoF_6]^{3-}$ ion.
Write the IUPAC name of $[Co(NO_2)_3(NH_3)_3]$.
ii. Define lanthanoid contraction. Explain its effects.
iii. Write mechanism of Aldol addition reaction.
iv. Define carbohydrates. What are reducing and non-reducing sugars?

Q.8. Answer any ONE of the following: **[7]**

i. Write a note on Gabriel phthalimide synthesis.
What are biodegradable polymers and non-biodegradable polymers? Write 'one example' of each.
Explain cationic detergents.

ii. How is carbolic acid prepared from the following compounds:
   a. Aniline
   b. Chlorobenzene and steam at 698 K?
Draw structure of DDT. Write its environmental effects.
Mention 'two' physical properties of carbolic acid.

BOARD QUESTION PAPER : MARCH 2016
CHEMISTRY

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SECTION – I

Q.1. Answer any SIX of the following: **[12]**

i. What is ferromagnetism? Iron (Z = 26) is strongly ferromagnetic. Explain.
ii. Define boiling point. Write the formula to determine molar mass of a solute using freezing point depression method.
iii. Write mathematical equations of first law of thermodynamics for the following processes:
   a. Adiabatic process
   b. Isochoric process
iv. Explain graphical method to determine activation energy of a reaction.
v. Write the names and chemical formulae of any one ore of iron and zinc each.
vi. What is the action of
   a. Sodium on arsenic?
   b. Magnesium on bismuth?
vii. Define enthalpy of sublimation. How is it related to enthalpy of fusion and enthalpy of vaporization?
viii. What are Ellingham diagrams? Write any two features of it.

Q.2. Answer any THREE of the following: **[9]**

i. Silver crystallises in fcc structure. If density of silver is 10.51 g cm^{-3}, calculate the volume of unit cell.
   [Atomic mass of silver (Ag) = 108 g mol^{-1}]
ii. The vapour pressure of pure benzene is 640 mm of Hg. 2.175×10^{-3} kg of non-volatile solute is added to 39 g of benzene, the vapour pressure of solution is 600 mm of Hg. Calculate molar mass of solute (C = 12, H = 1).
iii. Calculate C–Cl bond enthalpy from the following reaction:
   $CH_3Cl_{(g)} + Cl_{2(g)} \longrightarrow CH_2Cl_{2(g)} + HCl_{(g)}$; $\Delta H° = -104$ kJ
   If C–H, Cl–Cl and H–Cl bond enthalpies are 414, 243 and 431 kJ mol^{-1} respectively.
iv. Define cell constant. Draw a neat and well labelled diagram of primary reference electrode.

Q.3. Answer any ONE of the following: **[7]**

i. Write four points of differences between properties of nitrogen and other elements of group 15.
   Explain the structure of ClF_3.
   Conductivity of a solution is 6.23×10^{-5} $\Omega^{-1}cm^{-1}$ and its resistance is 13710 Ω. If the electrodes are 0.7 cm apart, calculate the cross-sectional area of the electrode.
   Why is molality of a solution independent of the temperature?

ii. What are neutral oxides? Explain the nature of zinc oxide with the help of the reactions.
Define 'molar conductivity' and 'zero order reaction'.
In a first order reaction x $\rightarrow$ y, 40% of the given sample of compound remains unreacted in 45 minutes. Calculate rate constant of the reaction.

Q.4. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. The molecular formula $H_2S_2O_2$ represents which oxoacid among the following?
(A) Hydrosulphurous acid (B) Thiosulphurous acid
(C) Sulphuric acid (D) Pyrosulphurous acid

ii. Iodine exists as _____.
(A) polar molecular solid (B) ionic solid
(C) non-polar molecular solid (D) hydrogen bonded molecular solid

iii. Absolute entropies of solids, liquids and gases can be determined by _____.
(A) measuring heat capacity of substance at various temperatures
(B) subtracting standard entropy of reactants from products
(C) measuring vibrational motion of molecules
(D) using formula $\Delta S° = S^{\circ}_{T} - S^{\circ}_{0}$

iv. The determination of molar mass from elevation in boiling point is called as _____.
(A) cryoscopy (B) colorimetry
(C) ebullioscopy (D) spectroscopy

v. The process of leaching alumina, using sodium carbonate is called _____.
(A) Baeyer's process (B) decomposition
(C) cyanide process (D) Hall's process

vi. On calculating the strength of current in amperes if a charge of 840 C (coulomb) passes through an electrolyte in 7 minutes, it will be _____.
(A) 1 (B) 2
(C) 3 (D) 4

vii. A $\rightarrow$ B is a first order reaction with rate 6.6×10^{-5} M s^{-1}. When [A] is 0.6 M, rate constant of the reaction is _____.
(A) $1.1 \times 10^{-5}\ s^{-1}$ (B) $1.1 \times 10^{-4}\ s^{-1}$
(C) $9 \times 10^{-5}\ s^{-1}$ (D) $9 \times 10^{-4}\ s^{-1}$

SECTION – II

Q.5. Answer any SIX of the following: **[12]**

i. Why is Sc^{3+} colourless while Ti^{3+} coloured? (Atomic number Sc = 21, Ti = 22)
ii. Illustrate with example, the difference between a double salt and a coordination compound.
iii. How is chlorobenzene prepared from aniline? How is chlorobenzene converted into diphenyl?
iv. What is metamerism? Explain metamerism with suitable examples of ethers.
v. What are ketones? How are ketones classified?
vi. How are
a. 1-nitropropane and b. 2-nitropropane
prepared from suitable oxime?
vii. Define antioxidants. Draw structure of BHT.
viii. What are carbohydrates? Write the reaction for the preparation of nylon-6.

Q.6. Answer any THREE of the following: **[9]**

i. What are f-block elements? Distinguish between lanthanoids and actinoids.

ii. Explain the terms
   a. Optical activity
   b. Ligand
   c. Interstitial compounds

iii. Write the formula of Tetraamminedichloroplatinum(IV) chloride. How is propene converted into 1-bromopropane and 2-bromopropane?

iv. What are broad-spectrum antibiotics?
How are polythene and neoprene prepared?

Q.7. Answer any ONE of the following: **[7]**

i. Explain the mechanism of esterification. Write the reactions involved in dehydration of 1°, 2° and 3° alcohols.

ii. What are vitamins? Name any two diseases caused by deficiency of vitamin A. Write the structures of:
   a. nucleoside b. nucleotide
How are 1-nitropropane, 2-nitropropane and 2-methyl-2-nitropropane are distinguished from each other using nitrous acid?

Q.8. Select and write the most appropriate answers from the given alternatives: **[7]**

i. The preparation of alkyl fluoride from alkyl chloride, in presence of metallic fluorides is known as _____.
   (A) Williamson's reaction (B) Finkelstein reaction
   (C) Swarts reaction (D) Wurtz reaction

ii. Identify the weakest acidic compound amongst the following:
   (A) p-Nitrophenol (B) p-Chlorophenol
   (C) p-Cresol (D) p-Aminophenol

iii. On acid hydrolysis, propanenitrile gives _____.
   (A) propanal (B) acetic acid
   (C) propionamide (D) propanoic acid

iv. Which of the following amines yield foul smelling product with haloform and alcoholic KOH?
   (A) Ethylamine (B) Diethylamine
   (C) Triethylamine (D) Ethylmethylamine

v. Which of the following is NOT present in DNA?
   (A) Adenine (B) Guanine
   (C) Thymine (D) Uracil

vi. Amongst the following, identify a copolymer.
   (A) Orlon (B) PVC
   (C) PHBV (D) Teflon

vii. Phenelzine is used as an _____.
   (A) analgesic (B) antiseptic
   (C) antipyretic (D) antidepressant

BOARD QUESTION PAPER : MARCH 2017
CHEMISTRY

Note:

i. All questions are compulsory.
ii. Answers of both the sections should be written in same answer book.
iii. Draw well labelled diagrams and write balanced equations wherever necessary.
iv. Figures to the right indicate full marks.
v. Use of logarithmic table is allowed.
vi. Every new question must be started on a new page.

SECTION – I

Q.1. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. An antifriction alloy made up of antimony with tin and copper, which is extensively used in machine bearings is called _____.

(A) Duralumin (B) Babbitt metal
(C) Spiegeleisen (D) Amalgam

ii. Which of the following pairs is an intensive property?

(A) Density, viscosity (B) Surface tension, mass
(C) Viscosity, internal energy (D) Heat capacity, volume

iii. Fe^{2+} ions react with nitric oxide formed from reduction of nitrate and yields a brown coloured complex _____.

(A) $[Fe(CO)_5NO]^{2+}$ (B) $[Fe(NH_3)_5NO]^{2+}$
(C) $[Fe(CH_3NH_2)_5NO]^{2+}$ (D) $[Fe(H_2O)_5NO]^{2+}$

iv. MnO_2 and $Ca_3(PO_4)_2$ present in iron ore get reduced to Mn and P in the zone of _____.

(A) combustion (B) reduction
(C) fusion (D) slag formation

v. An ionic compound crystallises in FCC type structure with 'A' ions at the centre of each face and 'B' ions occupying corners of the cube. The formula of compound is _____.

(A) AB_4 (B) A_3B
(C) AB (D) AB_3

vi. On passing 1.5 F charge, the number of moles of aluminium deposited at cathode are _____.
[Molar mass of Al = 27 gram mol^{-1}]

(A) 1.0 (B) 13.5
(C) 0.50 (D) 0.75

vii. For a chemical reaction, A$\rightarrow$ products, the rate of reaction doubles when the concentration of 'A' is increased by a factor of 4, the order of reaction is _____.

(A) 2 (B) 0.5
(C) 4 (D) 1

Q.2. Answer any SIX of the following: **[12]**

i. What are 'fuel cells'? Write cathode and anode reaction in a fuel cell.

ii. Derive the relationship between half life and rate constant for first order reaction.

iii. Explain magnetic separation process of ores with the help of a neat, labelled diagram.

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

v. Define the term 'enthalpy'.

What will happen to the internal energy if work is done by the system?

vi. Nitrogen does not form pentahalides. Give reason.

vii. Calculate the percentage efficiency of packing in case of simple cubic cell.

viii. Write the electronic configuration of the following elements:

a. Sulphur (Z = 16) b. Krypton (Z = 36)

Q.3. Answer any THREE of the following: **[9]**

i. How is phosphine prepared using the following reagents?

a. HCl

b. H_2SO_4

c. Caustic soda

ii. 0.05 M NaOH solution offered a resistance of 31.6 Ω in a conductivity cell at 298 K. If the cell constant of the cell is 0.367 cm^{-1}, calculate the molar conductivity of NaOH solution.

iii. Calculate $\Delta H°$ for the reaction between ethene and water to form ethyl alcohol from the following data:

$\Delta_c H° \ C_2H_5OH_{(l)} = -1368$ kJ

$\Delta_c H° \ C_2H_{4(g)} = -1410$ kJ

Does the calculated $\Delta H°$ represent the enthalpy of formation of liquid ethanol?

iv. In the Arrhenius equation for a first order reaction, the values of 'A' of 'E_a' are 4×10^{13} sec^{-1} and 98.6 kJ mol^{-1} respectively. At what temperature will its half life period be 10 minutes?

[R = 8.314 J K^{-1} mol^{-1}]

Q.4. Answer any ONE of the following: **[7]**

i. State Faraday's first law of electrolysis.

Write any 'two' uses of each of the following:

a. H_2SO_4 b. Chlorine

Distinguish between crystalline solids and amorphous solids.

A solution of a substance having mass 1.8×10^{-3} kg has the osmotic pressure of 0.52 atm at 280 K. Calculate the molar mass of the substance used.

[Volume = 1 dm^3, R = 8.314 J K^{-1} mol^{-1}]

ii. Define the following:

a. Leaching

b. Metallurgy

c. Anisotropy

Derive an expression for maximum work.

The boiling point of benzene is 353.23 K. When 1.80 gram of non-volatile solute was dissolved in 90 gram of benzene, the boiling point is raised to 354.11 K. Calculate the molar mass of solute.

[K_b for benzene = 2.53 K kg mol^{-1}]

SECTION – II

Q.5. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. When primary amine reacts with $CHCl_3$ in alcoholic KOH, the product is _____.

(A) aldehyde (B) alcohol

(C) cyanide (D) an isocyanide

ii. $CH_3–CH_2–Br \xrightarrow[\Delta]{\text{Alcoholic KOH}} B \xrightarrow{HBr} C \xrightarrow{Na/\text{ether}} D$, the compound D is _____.

(A) ethane (B) propane

(C) n-butane (D) n-pentane

iii. Cisplatin compound is used in the treatment of _____.

(A) malaria (B) cancer

(C) AIDS (D) yellow fever

iv. A gas when passed through $K_2Cr_2O_7$ and dil. H_2SO_4 solution turns it green, the gas is _____.

(A) CO_2 (B) NH_3

(C) SO_2 (D) Cl_2

v. The alcohol used in thermometers is _____.

(A) methanol (B) ethanol

(C) propanol (D) butanol

vi. Which of the following vitamins is the vitamin of alicyclic series?

(A) Vitamin C (B) Vitamin K

(C) Vitamin B (D) Vitamin A

vii. Which of the following is the first oxidation product of secondary alcohol?

(A) Alkene (B) Aldehyde

(C) Ketone (D) Carboxylic acid

Q.6. Answer any SIX of the following: **[12]**

i. How is diethyl ether prepared by continuous etherification process?
ii. Write a note on Hoffmann bromamide degradation.
iii. How is ethanoic acid prepared from dry ice?
iv. Write the molecular and structural formula of BHA and BHT.
v. Explain the preparation of glucose from cane sugar.
vi. Write the factors which are related to the colour of transition metal ions.
vii. Explain the following terms:
   a. Homopolymers b. Elastomers
viii. Define racemic mixture.

Give IUPAC name of $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CHO$.

Q.7. Answer any THREE of the following: **[9]**

i. What is 'effective atomic number' (EAN)?
Calculate the effective atomic number of the central metal atom in the following compounds:
   a. $K_4Fe(CN)_6$ b. $Cr(CO)_6$
   Fe (Z = 26) Cr (Z = 24)
ii. Write the different oxidation states of iron. Why +2 oxidation state of manganese is more stable? (Z of Mn = 25).
iii. Write a note on 'aldol condensation'.
iv. What are 'nucleic acids'?
Define complex lipids. Mention any 'two' functions of lipids.

Q.8. Answer any ONE of the following: **[7]**

i. What is the action of mixture of $NaNO_2$ and dil. HCl on:
   a. Ethylamine b. Aniline c. Diethylamine
How is nylon 6,6 prepared?
What are 'antacids'?
Write any 'two' side effects of tranquilizers.

ii. Explain the mechanism of alkaline hydrolysis of tert-butyl bromide with energy profile diagram.
Define carbolic acid.
How carbolic acid is prepared from benzene sulphonic acid?