32 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Chemistry *(SH453)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Define buffer capacity and buffer range. Calculate the concentration of sodium benzoate that must be present in 0.1 M benzoic acid to make a buffer solution of pH 3.7 (K_a for benzoic acid is 1.8×10^{-4}) [2+3]
2. What is electrode potential? How does it originate? What will be the reduction potential of Zn^{2+}/Zn electrode when zinc metal in contact with 0.1 M H_2SO_4 at 25°C. Given $E^0_{Zn/Zn^{2+}} = +0.768V$. [1+1+3]
3. Define heterogenous catalysis. Describe the absorption theory of catalysis with suitable example. Write any two criteria of choosing catalyst for industrial purpose. [1+3+1]
4. Global warming is one of the burning issues of the world. Point out major causes of global warming, its impacts and also control measures. [1+2+2]
5. What do you mean by water pollution? What are the major water pollutants, mention their adverse effects. [1+2+2]
6. Explain preparation and uses of polyphosphazines and polymeric sulfur nitride. [2.5+2.5]
7. What is biodegradable polymer? Mention preparation and uses of the following. [1+2+2]
   a) Epoxy resin b) Polyurethane
8. Give reasons for [2.5+2.5]
   a) Cu(I) is diamagnetic where as Cu(II) is paramagnetic.
   b) TiO_2 is white but $TiCl_3$ is violet.
9. Give reasons: [2.5x2]
   a) The components formed by symbol 'V' element in +5 oxidation state are colourless but those formed in +3 oxidation state are colourful.
   b) Transition elements are mostly paramagnetic.
10. What do you mean by effective atomic number? Give IUPAC name and calculate the effective atomic number of the following complexes. [1+4]
    a) $[Fe(CN)_6]^{3-}$
    b) $[Ag(NH_3)_4]^{+}$
    c) $[Ni(CN)_4]^{2-}$
    d) $[Cr(H_2O)_6]^{2+}$
11. What are the inner orbital and outer orbital complexes? Explain formation of $[Fe(CN)_6]^{4-}$ on the basis of valance bond theory and predict its magnetic behavior. [2+3]

12. Explain why SN^1 reaction gives both retension and invertion isomers but SN^2 gives only invertion isomer. Write the mechanism of given chemical reaction. [2+3]

$$(CH_3)_3C-Br + NaOH \rightarrow (CH_3)_3COH + NaBr$$

(aa)

13. Distinguish between enantiomers and diasteriomers. Show these isomers in 3-bromo-2-butanol. [2+3]

14. What is an explosive? Classify explosives with examples. What is the requirement of good explosives? [1+2+2]

15. What are elimination reactions? Write the differences between E_1 and E_2 reaction mechanism taking suitable example. [1+4]

16. a) What is lubricant? Write about the application of different types of lubricants. [1+2]

b) Write the characteristics of good paint. [2]

***

22 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Bhadra

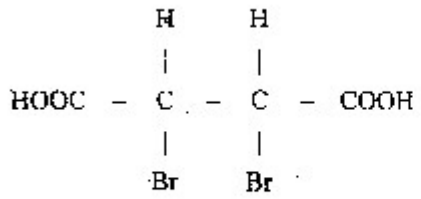
Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Chemistry *(SH453)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. How does electrode potential originate? Define standard electrode potential. Write the cell notation and cell reaction of Zn-Cu cell. [2+1+2]
2. What is meant by buffer solution? Calculate the concentration of sodium formate, HCOONa, that must be present in a 0.10M solution of formic acid to produce a pH of 3.80. [K_a for formic acid is 1.8×10^{-4}]. [1+4]
3. Explain the terms: (a) Homogeneous catalysis (b) Catalytic poisoning (c) Promoters. [2+1.5+1.5]
4. What are major gases responsible for causing green house effect and how are they released into the atmosphere? Give an account of the globel efforts to control the release of these gases. [1+2+2]
5. What are the main sources of water pollution? Write the effect of water pollution on mankind. Mention the measures to control water pollution. [1+2+2]
6. Write short notes on: (a) Sulphur based polymers (b) Polyphosphazines. [3+2]
7. a) What are monomers of: (i) Polyurethane (ii) Nylon 6,6 (iii) Bakelite (iv) Epoxy resin. [2]
   b) What are the engineering application of : (i) Polyvinyl chloride (ii) Conducting polymer.
8. Why do transition metals: (i) Form complex compound (ii) Exhibit variable oxidation states. [1+2+2]
9. Why are 3d-series elements called transition elements? Give their characteristic on the basis of valency. [2+3]
10. Differentiate between low spin and high spin complexes. Explain the geometry and magnetic behaviour of $[Ni(CO)_4]^o$ on the basis of valence bond theory. [2+3]
11. a) Differentiate between complex salts and double salts. Calculte EAN of the central metal atom in $Fe(CN)_6$ [2.5×2]
    b) Write the IUPAC name of the following co-ordination compounds. (i) $K[PtCl_5(NH_3)]$ (ii) $[CO(NH_3)_5SO_4]Br$
12. a) Mention the importance of primary and low explosives. Give the preparation and uses of TNT and TNG. [5]
13. a) What are lubricating greases? Give their functions. [1+2+2]
    b) Show your acquaintance with types of paints.

14. What is optical activity? Give the stericisomers of tartaric acid. Would you expect the following compound to be optically active? Explain. [1+3+1]



15. How do SN1 and SN2 reactions differ in haloalkane? Mention the factors which regulates the reaction. [3+2]

16. What do you mean by Elimination reactions? Explain the reaction mechanism for the dehydrohalogenation of tertiary alkyl halide. [2+3]

***

22 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2068 Bhadra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BME, BIE	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Chemistry

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. How does a galvanic cell differ from an electrolytic cell? Calculate the emf of the following cell at 25°C giving electrode reactions and cell reaction. [1+4]

   $Cd(s)cd^{++}(0.01M)//Cu^{++}(0.5M)Cu(s)$
   $E^0Cd^{++}/cd = -0.140V$, $E^0Cu^{++}/cu = 0.34V$

2. What is a buffer solution? Discuss the mechanism of buffer action with suitable examples. [1+4]

3. What is meant by catalysis? Point out its importance. Discuss intermediate compound formation theory of catalysis with suitable examples. [1+1+3]

4. Brief discuss sources of organic and inorganic substances responsible for water pollution. Point out their adverse effects possible remedies. [3+2]

5. a) What is meant by global warming? Give its causes and consequences. [3]
   b) What is the photochemistry behind ozone layer depletion? [2]

6. a) What are chalcogenide glasses? Give their uses. [2.5]
   b) Give the preparation and applications of silicone rubbers. [2.5]

7. a) Give the preparation and applications of bakelite and polyurethanes. [4]
   b) What are the advantages of conducting polymers? [1]

8. a) What are transition elements? List the industrial application 3d transition elements. [1+2]
   b) Why do transition elements show variable oxidation states? [2]

9. Explain the following features of transition elements with reference to 3d transition series: [3+2]
   a) Formation of complex compounds
   b) Formation of colored compounds

10. Differentiate between complex salts and double salt. How does Werner's theory explain the bonding in complex salts? [1+4]

11. Write the formulae of following: [2]
    i) Potassium hexacyanoferrate (III)
    ii) Trioxalatoaluminate (III) ion
    iii) Trist (ethylenediamine) chromium (III) chloride
    iv) Bis (benzene) chromium(0)

b) How does valence bond theory explain the formation of $[Ni(NH_3)_6]^{2+}$? Predict its magnetic behaviour. [3]

12. What are low explosives? Write their uses. Give the preparation and applications glycerol trinitrate. [2+3]

13. a) What are lubricating oils? Indicate their importance in engineering. [2]

b) What are paints? Discuss any two types of paints indicating their applications in engineering works. [3]

14. a) What are geometrical isomers? Give an example specifying Z and E configuration. [2]

b) Show your familiarity with enantiomerism diastereomerism. [3]

15. Discuss the unimolecular nucleophilic substitution reaction mechanism in alkylhalide showing the stereochemistry. What type of solvent favors this type of mechanism? [4+1]

16. What is meant by elimination reaction? Discuss E^1 and E^2 reaction mechanisms. [1+4]

***

22 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2067 Mangsir

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Chemistry

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What is meant by standard electrode potential? Give the electrode reactions and calculate the emf of the following cell at 25°C. [1+4]

   $Fe^{++} = Fe^{+++} + e^-$, $E^\circ = -0.77V$
   $Ni^{++} + 2e^- = Ni$, $E^\circ = -0.25V$
   $[Ni^{++}] = 0.2M$, $[Fe^{++}] = 0.1M$; $[Fe^{+++}] = 1M$.

2. What is a buffer? 1.64 g of anhydrous sodium acetate is added to 200ml of 0.2M acetic acid. What is the pH of buffer? Calculate the degree of ionization of the acid in the solution.(Ka of acid = 1.8×10^{-5}) [1+4]

3. Describe the adsorption theory of catalysis with an example. How does a poison paralyze the activity of a catalyst? Give any two industrial applications of catalysts. [3+1+1]

4. Write short notes on: [3+2]

   a) Global warming
   b) Acid rain

5. What is meant by soil pollution? Point out the major sources of soil pollution, their adverse effect and their possible remedies. [1+2+1+1]

6. a) What are polyphosphonitrilic compounds? Give one method for the preparation of polyphosphonitrilic compound and mention the uses. [3]

   b) What are silicones? Give any two uses of silicones. [2]

7. a) What is a thermosetting polymer? Write down the uses of epoxy resin. [2]

   b) What are conducting and biodegradable polymers? Point out the applications of conducting polymers in engineering. [3]

8. What are transition elements? Explain the variable oxidation states exhibited by 3d series. Why does the transition elements form alloy? [1+3+1]

9. Explain the followings: [3–2]

   a) Transition elements are good in forming complexes.

   b) TiO_2 is white but $TiCl_3$ is violet

10. What is complex salt? Give the main postulates of Werner's coordination theory. [1+4]

11. a) Explain the formation of $[Fe(CN)^6]^{4-}$ on the basis of valance bond approach and predict its magnetic behavior. [3]

b) Write the IUPAC name of the followings; [2]

i) $K_3[Fe\ (CN)_6]$
ii) $Na_3[Al\ C_2O_4)_3]$
iii) $[Co\ Cl.CN.NO_2.(NH_3)_3]$
iv) $[Cr\ (NO_3)_6]^{3-}$

12. What are characteristics of an explosive? Give the preparation of glycerol trinitrate (GTN) and trinitrotoluene (TNT). Point out the industrial applications of explosives. [1+1.5+1.5+1]

13. a) What is paint? Give the requisites of a good paint. [1+2]

b) What are lubricating greases? Give their functions. [1+1]

14. a) Define enantiomers, racemic mixture and meso compound giving one example of each. Also comment on their optical activity. [4]

b) Draw the structure and specify Z and E configuration of 1- Bromo-1 chloropropene. [1]

15. Explain the S_N2 reaction mechanism with reference to hydrolysis of alkylhalide. What type of solvent favors this type of path? How can you say that carbocation is not formed during S_N2 reaction? [3+1+1]

16. Write the mechanism of unimolecular elimination reaction. How does it differ from bimolecular elimination reaction? [3+2]

***

21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2067 Chaitra

Exam.	New Back (2066 Batch Only)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Chemistry

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What is normal hydrogen electrode? A galvanic cell consists of a metallic nickel plate immersed in 0.1M $Ni(NO_3)_2$ solution and a metallic plate of copper in 0.2M $CuSO_4$ solution. Calculate the emf of this cell. [2+3]

   $E^\circ_{Ni^{++}/Ni} = -0.25V$ $E^\circ_{Cu^{++}/Cu} = +0.34V$

2. What is corrosion? Calculate the pH of a resulted solution when 0.1 gm. of NaOH is added to 200ml of 0.1M acetic acid solution. ($pK_a = 4.74$). [1+4]

3. What is catalyst? Explain positive and negative catalysis with two examples for each. [1+2+2]

4. Define heterogeneous catalysis. Give a brief account on theory of Heterogeneous catalysis. [1+4]

5. Give an account of acid rain? What are the sources of CO and SO_2 pollutants in air? How are they controlled? [1+2+2]

6. What is ozone depletion? Explain its causes. Mention the major pollutants of water? [1+2+2]

7. Differentiate thermosetting and thermoplastics polymers. Write the name and the preparation of the organic polymers that are used for (i) Preparing ropes and socks (ii) Preparing non stick cooking utensils. [2+3]

8. What is linear chain polymer? Write the preparation and uses of different types of sulphur bases inorganic polymers. [1+4]

9. What are d-block elements? Give the electronic configuration of 3d series. Mention which d block metals are not considered as transition as transition metals and why? [1+2+2]

10. Explain the following: [2+3]

    a) Transition metals exhibit variable valency.
    b) Transition elements are very good in forming complexes.

11. How does the valence bond theory account for the following facts? [5]

    a) $[Fe(CN)_6]^{-4}$ ion is diamagnetic but $[Fe(CN)_6]^{-3}$ is paramagnetic
    b) $[Ni(CO)_4]^0$ is diamagnetic and tetrahedral.

12. Identify the complex ion and legends in the compound $[Co(NH_3)_6]Cl_3$. Write the formulae of the following co-ordination compounds. [2+3]

a) Dichloro tetra-aquo chromium (III) cation
b) Tris (ethylene diamine) chromium(III) chloride
c) Dicyano argentate (I) ion
d) Bromo penta-ammine cobalt (III) sulfate
e) Sod. hexa nitrito cobaltate(III)
f) Hexa-cyanoferrate (III) ion

13. Define Dynamite and plastic explosive. Write the preparation, properties and uses of Nitro cellulose. [2+3]

14. What are greases? Mention their specific uses. Write short note on varnish. [2+1+2]

15. What is optical isomerism? Comment why presence of chiral centre is not sufficient for the molecule to be optically active. [1+4]

16. Explain the reaction mechanism involved when primary alkyl halide react with alcoholic alkali and aqueous alkali. [5]

***

22 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2066 Magh

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BME, BIE	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Chemistry

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

Group A

1. a) Derive Schrodinger wave equation for the wave mechanical model of an atom and write the significance of ψ and ψ^2. [5]
   b) State Heisenberg uncertainty principle. How this principle goes against Bohr's theory? Explain. [1+3]
2. a) What is de Broglie's equation? Derive a relation between wave length (λ) associated with particle of mass m moving with a velocity V. [1+2]
   b) Calculate the de Broglie wavelength for a ball of 200 gm mass moving with a velocity of 3×10^{10} cm/sec and an electron moving with the same velocity. What these values indicate? [4]
3. a) What is buffer action? Explain clearly why a solution of weak acid and its salt with a strong base behaves as a buffer solution. [1+3]
   b) 100 mℓ of 1M H_2SO_4 and 50 mℓ of 2M NaOH are mixed together. Calculate the pH of the resulting solution. [4]
4. a) What is electrochemical series? Write its applications. [4]
   b) Calculate the emf of the cell: $Ni/Ni^{++}(1M)$ // Pb^{++} (1M) / Pb at 25°C [4]
   Write down its cell reaction. Standard electrode potential of Ni and Pb are –0.24V and –0.13V respectively at 25°C.

Group B

5. a) Explain why transition metals (i) show variable oxidation states and (ii) form large number of complexes. [6]
   b) Write down the uses of silicones. [2]
6. a) Write down the conditions necessary for hybridization. Discuss the types of hybridization in SF_6 molecule. [2+4]
   b) Explain the formation of N_2 molecule on the basis of VBT. [2]
7. a) $[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$, both are octahedral complexes. What is the difference between the two? Explain on the basis of VBT. [3+3]
   b) Write down the IUPAC names of the following co-ordination compounds (i) $K_3[Co(CN)_5C\ell]$ (ii) $[Pt\ C\ell\ (NO_2)(NH_3)_3]$ (iii) $[Pt\ (OH)_4]^{2-}$ (iv) $K_2[HgI_4]$. [2]

OR

   a) Write down the main postulates of Werner's co-ordination theory. [5]
   b) The formation of inner orbital complexes of Ni^{+2} (CN=6) is not possible. Explain with example. [3]

Group C

8. a) Explain the reaction mechanism of unimolecular elimination reaction with a suitable example. [4]
   b) What does SN^1 and E_2 represents? Write one example of each. [2+2]

OR

   a) Explain the reaction mechanism of bimolecular nucleophilic substitution reaction with a suitable example. [4]
   b) Write E_1 and pinacol pinacolone rearrangement reactions. [2+2]
9. a) Define geometrical and optical isomerisms with suitable examples and write the differences between enantiomers and diastereomers. [3+3]
   b) What happens when toluene is treated with chlorine in different conditions? [2]
10. a) Describe the preparation and uses of Teflon and Nylon 6,6. [3]
    b) What are explosives? Describe the preparation and uses of nitroglycerol. [3]
    c) How can you obtain carboxylic acid and ethanol from Grignard's reagent? [2]

***

22 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2065 Kartik

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BME, BIE	Pass Marks	32
Year / Part	I/ II	Time	3 hrs.

Subject: - Chemistry

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions selecting at least **Two** from **Group A**, **One** from **Group B** and **One** from **Group C**.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

Group A

1. a) What is meant by 'buffer solution' and 'buffer action'? Explain clearly, why a solution of weak acid and its salt with a strong base behaves as a buffer solution.

   b) Explain Sommerfeld's extension of Bohr's atomic model. Calculate the uncertainty in the position of an electron moving with velocity 600 m/s if error in the measurement of velocity is 0.005%. Comment on the result. [8+4+4]

2. a) What is electrochemical corrosion? Explain the mechanism of corrosion and methods of its prevention.

   b) 1.64 gm of anhydrous sodium acetate is added to 400 ml of 0.2M acetic acid. What is the pH of buffer? Also calculate the degree of ionization of the acid in the solution. [8+8]

3. a) What do you understand by the terms c_p and c_v? How are they related with each other? Derive the relationship.

   b) What is normal hydrogen electrode? Calculate the emf of the following cell at 25°C. [8+2+6]

   Zn/Zn^{++} (0.1M) // Ag^{+} (1.2M)/Ag

   $E°\ Zn/Zn^{++} = +0.76V$

   $E°\ Ag/Ag^{-} = -0.80V$

4. a) What is Aufbau principle? State and explain (n + l) rule. Write down the configurations of Cu and Cr. Why don't these elements follow Aufbau principle?

   b) Define the terms internal energy change and enthalpy change. How are they related? Calculate the work done when one mole of a gas at 25°C and 5 atm. pressure is allowed to expand isothermally but irreversibly against a constant external pressure of 1 atm. until the internal pressure is reduced to 1 atm. [8+4+4]

Group B

5. a) What are the conditions for hybridization? Discuss the type of hybridization that exists in the octahedral shape of molecule with an example.

   b) Describe the formation of outer and inner orbital complexes on the basis of valence bond theory. [4+4+8]

6. a) Why one d-block elements known as transition elements? Explain, why transition metals (i) form coloured compounds (ii) show variable oxidation state.

   b) What are cyclic silicones? How are they formed?

7. Explain following giving appropriate reasons. [4×4

   a) Aqueous solution of $[CO(NH_3)_5Cl]Cl_2$ gives white ppt with $AgNO_3$ solution but $[CO(NH_3)_3Cl_3]$ does not.
   b) CH_4 and H_2O molecules have tetrahedral geometry but their bond angles are different.
   c) PCl_5 exists in nature but NCl_5 does not.
   d) σ bond is stronger than π bond.

Group C

8. Explain the mechanism involved in the following reactions (a) hydrolysis of methyl bromide by aqueous sodium hydroxide. (b) Dehydrohalogination of tertiary butyl bromide by alcoholic sodium hydroxide. Give reasons. Why (i) Tertiary butyl bromide undergoes SN^1 reaction but methyl bromide undergoes SN^2 reaction. (ii) SN^1 reaction gives both retention and inversion products but SN^2 reaction gives inversion product only. [4+4+4+4

9. a) Describe the following with examples.

   (i) Enantiomers (ii) Diastereomers (iii) Racemic mixture (iv) Meso compound. Justify the statement "All the diastereoisomers are stereoisomers but all the stereoisomers are not diastereoisomers".

   b) What happens when (i) Glycerol undergoes nitration (ii) Chlorine is passed boiling toluene in presence of uv light. [8+4+4

10. Write short notes on: [8+8

    a) Addition polymerization giving preparation of (i) Teflon (ii) Polyster.

    b) Starting from Grignard's reagent, how would you obtain (i) 1° alcohol (ii) 2° alcohol (iii) 3° alcohol (iv) higher alkane. [8+8]

***

22 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2065 Chaitra

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BME, BIE	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Chemistry

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

Group A

1. a) Write down the limitation of Bohr's atomic theory. [4]
   b) What is energy rule? Calculate of wave length of matter wave of electron. [2+2]
2. a) What is pH scale? Write down the limitation of pH meter. [2+1]
   b) Calculate teh pH change of buffer solution 100 C.C of semimolar NH_4OH and 400 C.C of N/10 $NH_4C\ell$ in which 20 mℓ of 0.5 N HCℓ is added ($K_b = 1.8 \times 10^{-5}$) [5]
3. Give the electro chemical mechanism of corrosion. Calculate the molarity of Fe^{++} ion in the cell when iron electrode is combined with standard AgCℓ/Ag, $C\ell^-$ electrode having emf 0.57V of cell. [4+4]

   Given, $E^{\circ}_{AgCl, C\ell^-} = +0.22V$

   $E^{\circ}_{Fe/Fe^{++}} = +0.44V$

4. Derive Kirchhoff's equation. Calculate the heat of formation of CH_4 gas if enthalpy of cobustion of CH_4 gas is –890 KJ, the amount of heat evolved by burning of coke is 394 KJ and standard enthalpy of formation of water is –286 KJ. [4+4]

OR

Write short notes on: [4+4]

a) Enthalpy
b) Calorific value of food

Group B

5. a) What are co-ordination compounds? Write down the main postulates of Werner's theory. [1+4]
   b) How does the valence bond theory explain the formation of tetrahedral complexes? [3]

OR

a) What are the differences between inner orbital and outer orbital complexes? Explain on the basis of valence bond theory the structure of $[FeF_6]^{3-}$. [2+4]

b) Write down the IUPAC names of the following compounds. [2]

i) $[Co(NH_3)_4SO_4]NO_3$
ii) $Na_3\{Co(NO_2)_6\}$
iii) $Na3[A\ell(C2O4)3]$
iv) $[Pb(OH)_4]^{2+}$

6. a) What are transition elements? What do these elements [1+2=3]
   i) form large number of complexes
   ii) form coloured compounds
   b) Give the four important properties and uses of silicons. [2]
7. a) What are the postulates of valence bond theory of covalent bond? [3]
   b) What is hybridization? How does the shape of octahedral molecules better explained on the basis of hybridization. [1+4]

Group C

8. a) Give an account of stereoisomerism shown by but – 2 – ene – 1, 4 – dioic acid and 2 – hydroxypropanic acid. [3]
   b) Differentiate between racemic mixture and meso compound. [2]
   c) Write the possible isomers of 2, 3 – dichloropentane and mention enantiomers and diastereomers. [3]
9. a) Explain the SN reaction mechanism. Which occurs both by retention and inversion of configuration. [4]
   b) Describe the mechanism involved in the reaction between tertiary butyl bromide and alcoholic KOH. [4]

OR

   a) Why do SN_1 mechanism occur in two steps? [2]
   b) Why does the attack of nucleophile on tertiary butyl carbonium ion mostly prefer from back side? [2]
   c) Give an account of Pinacol – pinacolone rearrangement and dehydro halogenation of 3 – alkyl halide. [4]
10. a) Write the preparation and uses of polymers formed by the polymerization of tetrafluoroe thylene and vinyl chloride. [4]
   b) What happens when [4]
   i) Grignard reagent reacts with ethanol
   ii) Methyl benzene is oxidised by acidic chromyl chloride
   iii) Toluene is treated with fuming nitric acid
   iv) n-heptane undergoes aromatisation

***